DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, REDSTONE
4488 MARTIN ROAD
REDSTONE ARSENAL, ALABAMA 35898-5000

REPLY TO ATTENTION OF

Environmental Management Division January 31, 2025

Mr. Stephen A. Cobb
Chief, Land Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

SUBJECT: Revision 2, Review Corrective Measure Implementation Plan, RSA-311 Exterior Pumps and Interior Concrete Pits at Building 7352, Operable Unit 9, US Army Garrison – Redstone, Madison County, Alabama

Reference:

a. The Installation Restoration Program at Redstone Arsenal, Alabama, AMIM-REP-ER (EPA ID AL7 210 020 742).

b. Resource Conservation and Recovery Act Corrective Action Program at Redstone Arsenal, Alabama (EPA ID AL7 210 020 742).

c. Redstone Arsenal's Alabama Hazardous Wastes Management and Minimization Act Hazardous Waste Storage Facility/Thermal Treatment/Solid Waste Management Unit Corrective Action (AHWMMA) Permit dated July 19, 2021.

d. ADEM Review and Comment: Revision 1, Corrective Measure Implementation Plan, RSA-311 Exterior Pumps and Interior Concrete Pits at Building 7352, Operable Unit 9, US Army Garrison – Redstone, Madison County, Alabama, dated November 13, 2024.

Dear Mr. Cobb:

This letter transmits the response to ADEM comments on the subject report and Revision 2, Corrective Measure Implementation Plan, RSA-311 Exterior Pumps and Interior Concrete Pits at Building 7352, Operable Unit 9, US Army Garrison – Redstone, Madison County, Alabama.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based

on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Copies of this correspondence are being furnished to Mr. Joseph Palk and Mr. Rich Jannett with Alabama Department of Environmental Management. Copies are also provided to Mr. Robert Pope, Superfund and Emergency Management Division USEPA Region 4, and Mr. Cesar Zapata, Land, Chemicals and Redevelopment Division USEPA Region 4.

My point of contact for this request is Mr. Nick Campanella, Environmental Management Division, 410-812-3730 or email Nick.Campanella@sse-anc.com.

Sincerely,

Clint Howard

Clint Howard
Chief, Installation Restoration Branch

Enclosure

Responses to ADEM Review Comments
***Revision 1 Corrective Measure Implementation Plan RSA-311, Exterior Sumps and Interior Concrete Pits at Building 7352, Operable Unit 9*, dated July 19, 2024**
Redstone Arsenal

1. Page 3-3, Section 3.3, Corrective Measures Evaluation and Selection: ADEM recognizes the two (2) alternative remedies proposed in this CMIP. However, a third alternative proposing an active remedy should also be included and discussed in detail. This discussion should also contain rationale as to the dismissal or acceptance of that alternative. Please revise.

   Response: A third alternative (In Situ Enhanced Bioremediation, MNA, LTM, and LUCs) has been added in Section 3.3.1.3. Changes have been made globally in the CMIP to accommodate the addition of this third alternative.

2. Page 3-4, Section 3.3.2, Selection of Corrective Measures for RSA-311: The CMIP should be revised to reflect the following schedule for groundwater monitoring: quarterly monitoring should be conducted for the first year, followed by three (3) years of semi- annual monitoring. After the three (3) full years of semi-annual monitoring, the Army may request a permit modification to change to annual monitoring. ADEM will evaluate the request based on the sampling results presented in Annual Effectiveness Report. Please revise.

   Response: Section 3.3.2 has been revised as suggested. Changes have been made globally in the CMIP to accommodate the revised groundwater monitoring schedule.

3. Page 3-4, Section 3.3.2.2, Baseline Groundwater Sampling Event in Year 0: Additional information should be provided to support the flow of site groundwater to the northwest. A potentiometric map of RSA-311 demonstrating groundwater flow to the northwest should be included in the CMIP with the surface water flow map that has been provided. In addition, please cite the exact location within the RSA-146 RFI being referenced.
   Due to the statement in Section 1.5.3 that groundwater flow is to the northwest, additional wells will still be needed downgradient of the exceedances detected in well 311-RS2854 for monitoring.

   Response: As illustrated in the left panel of Figure 3 (adapted from Figure 1-6 of the Rev 4 RSA-311 RFI Report [Aptim 2020]), groundwater flows northwest towards Huntsville Spring Branch across a larger scale RSA-146 area where RSA-311 is part of. Dye trace studies at RSA-146 also demonstrate an overall northwesterly groundwater flow as illustrated in right panel of Figure 3 (adapted from Figure 1-6 of the Rev 4 RSA-311 RFI Report [Aptim 2020]). Additional discussion has been added to Section 1.5.3.

   Given that downgradient of well 311-RS2854 is a wooded/wetland area (Figure 7), installation of additional wells there would encounter site access issues and thus would be difficult to implement. Because of the karstic nature of the site, constant exchange of surface water and groundwater would be expected at RSA-311. This was confirmed by a groundwater-wetland interaction investigation at a large scale at RSA-146 (CB&I, 2015). Analytical results from the springs and surface water samples thus would be indicative of the contaminants concentrations of the local shallow groundwater. Therefore, we recommend collecting samples from springs and surface water bodies in the northwestern area, as a more practicable alternative to installing new monitoring wells. In addition, although overall groundwater flow at a larger scale RSA-146 area where RSA-311 is part of is toward northwest, localized groundwater flow may vary

at different times. For example, the interpreted groundwater flow direction based on the May 2014 and January 2016 potentiometric surface maps for the RSA-311 (Figures 4 and 5, respectively) varied from northwest to southwest over this time, with an overall westerly flow south of the site and southwesterly flow north of the site. Based on this consideration, we propose to add RSP-1802, a spring location in the vicinity of well 311-RS2854, to the existing groundwater monitoring network, to monitor downgradient of the groundwater exceedances detected in this well.

Rev 2

CORRECTIVE MEASURE IMPLEMENTATION PLAN RSA-311, EXTERIOR SUMPS AND INTERIOR CONCRETE PITS AT BUILDING 7352, OPERABLE UNIT 9

U.S. ARMY GARRISON-REDSTONE MADISON COUNTY, ALABAMA

CONTRACT NUMBER W9124J-18-D-004
DELIVERY ORDER W9124J22F0045

Prepared for:

U.S. ARMY ENVIRONMENTAL COMMAND
Southeast-Environmental Service and Support Division
2450 Connell Road, Building 2264
Fort Sam Houston, TX 78234-7664

Prepared by:

January 2025

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Corrective Measures Implementation Work Plan
RSA-311, Exterior Sumps and Interior Concrete Pits at Building 7352,
Operable Unit 9

U.S Army Garrison-Redstone
Madison County, Alabama
USEPA ID No. AL7 210 020 742

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Approvals

Matthew B. Vest



01/30/2025

Matt Vest, PG
Alabama P.G. No. 1026

Date

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per Liter
AAC	Alabama Administrative Code
ADEM	Alabama Department of Environmental Management
AEIRG	Alabama Environmental Investigation and Remediation Guidance
AHWMMA	Alabama Hazardous Wastes Management and Minimization Act
ARBCA	Alabama Risk-Based Corrective Action
Army	U.S. Army
bgs	Below Ground Surface
BSV	Background Screening Value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CG	Cleanup Goal
CMI	Corrective Measures Implementation
CMI-O	Corrective Measures Implementation-Operations
CMIP	Corrective Measures Implementation Plan
CMO	Corrective Measures Objective
CMS	Corrective Measures Study
COC	Contaminant of Concern
COPC	Contaminants of Potential Concern
COPEC	Contaminants of Potential Ecological Concern
CSM	Conceptual Site Model
DAF	Dilution-Attenuation Factor
DIA	Defense Intelligence Agency
DNAPL	Dense Nonaqueous-Phase Liquid
DNB	Dinitrobenzene
DNT	Dinitrotoluene
DO	Dissolved Oxygen
DPT	Direct-Push Technology
ECC	Environmental Chemical Corporation
EVO	Emulsified Vegetable Oil
FS	Feasibility Study
HAL	Health Advisory Level
HI	Hazard Index
IDW	Investigation-Derived Waste
IELCR	Individual Excess Lifetime Cancer Risk
IROD	Interim Record of Decision
ISEB	In Situ Enhanced Bioremediation
IW-QAPP	Installation Wide-Quality Assurance Program Plan
IWGW	Installation-Wide Groundwater
LTM	Long-Term Monitoring
LUC	Land Use Control
MAG	Monitoring Acceptance Goal
MCL	Maximum Contaminant Level
MDC	Maximum Detected Concentration
mg/kg	Milligrams per Kilogram
MICC	Mission and Installation Contracting Command
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

NDPA	N-Nitroso-di-n-Propylamine
NEUR	Notice of Environmental Use Restriction
ORP	Oxidation-Reduction Potential
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PETN	Pentaerythritol Tetranitrate
PMP	Project Management Plan
PSA	Potential Source Area
PSL	Preliminary Screening Level
PSV	Preliminary Screening Value
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RDX	1,3,5-Trinitro-1,3,5-Triazine
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RM	Risk Management
RSA	Redstone Arsenal
RSL	Regional Screening Level
SAC	Site Access Control
SLERA	Screening-Level Ecological Risk Assessment
SPLP	Synthetic Precipitation Leaching Procedure
SSHP	Site Safety and Health Plan
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leachate Procedure
USAEC	U.S. Army Environmental Command
USEPA	U.S. Environmental Protection Agency
VC	Vinyl Chloride
VOC	Volatile Organic Compound

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EXECUTIVE SUMMARY

Environmental Chemical Corporation (ECC), on behalf of the U.S. Army Garrison-Redstone, has prepared this Redstone Arsenal (RSA)-311 Corrective Measures Implementation (CMI) Work Plan for RSA, Madison County, Alabama, under the management of the U.S. Army Environmental Command (USAEC). The Mission and Installation Contracting Command (MICC) has contracted ECC under Contract Number W9124J-18-D-0004, Delivery Order W9124J22F0045 to perform environmental remediation and restoration and program management services at RSA under the Resource Conservation and Recovery Act (RCRA) Corrective Action program in accordance with RSA's hazardous waste permit (U.S. Environmental Protection Agency [USEPA] ID # AL7 210 020 742). This CMI Work Plan has been developed to provide technical guidance for implementing the corrective measures selected for groundwater at RSA-311, Exterior Sumps and Interior Concrete Pits at Building 7352, Operable Unit (OU) 9.

The area occupied by RSA-311 lies within groundwater site RSA-146, located in the southeastern portion of Redstone Arsenal, northwest of the intersection of Flicker Road and Swallow Road. The site occupies approximately 3,490 ft^2. RSA-311 consists of three exterior covered sumps and two interior concrete pits associated with Building 7352. Building 7352 was originally used as a bowl and wastewater cleanup facility for equipment and tools used in propellant mixing and casting operations at nearby facilities. Beginning in 2009, the southern bays were used for a missile recycling program Feasibility Study (FS). On May 10, 2010, an explosion occurred at Building 7352.

Topography at the site is flat, with little relief, and lies at 566 feet above mean sea level. The native soils beneath RSA-311 predominantly consist of medium- to high-plasticity clay with trace to small amounts of silt and fine-grained sand. The thickness of the overburden ranges from approximately 8 to 28 feet below ground surface (bgs). The average depth to bedrock is approximately 14 feet bgs. Stormwater drainage at the site is controlled by ephemeral unlined ditches. No perennial surface water features are associated with the site. The site is within the 100-year floodplain. Groundwater beneath RSA-311 occurs in the unconsolidated overburden and the upper portion of the carbonate bedrock. The overburden and upper bedrock comprise a single interconnected, unconfined water table aquifer.

This CMI Work Plan details the tasks to complete the corrective measures for RSA-311. Exposure to groundwater was found to pose unacceptable risks if groundwater were used as a source of potable drinking water. Groundwater beneath RSA-311 contains two volatile organic compounds (VOCs) (trichloroethene [TCE] and vinyl chloride [VC]), three explosive compounds (2-nitrotoluene, 2,6-dinitrotoluene [DNT], 1,3,5 trinitro-1,3,5-triazine [RDX]), and perchlorate at concentrations exceeding cleanup goals. Exposure to surface media was not found to pose unacceptable health risks to human health or ecological receptors. Corrective measures are therefore needed at RSA-311 to address unacceptable risks to potential receptors from exposure to TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate in groundwater.

Alternatives to address the contaminants of concern (COCs) were developed to meet the corrective measures objectives for groundwater at RSA-311 and include:

- Alternative 1 – No Action
- Alternative 2 – Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs)
- Alternative 3 – In Situ Enhanced Bioremediation (ISEB), MNA, Long-Term Monitoring (LTM), and LUCs.

Alternative 2, MNA and LUCs, is recommended for addressing the groundwater contamination at this site. Through groundwater MNA, natural processes will act to reduce the TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate groundwater contamination to below the cleanup goal (CG). LUCs will prevent or minimize exposure to contaminated groundwater. Periodic groundwater monitoring will be conducted to track the progress of the groundwater MNA. Closure for groundwater will be achieved when the concentrations in groundwater reach the CG.

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1.0 INTRODUCTION

Environmental Chemical Corporation (ECC), on behalf of the U.S. Army Garrison-Redstone (hereinafter referred to as the Army), has prepared this RSA-311 Corrective Measures Implementation (CMI) Work Plan for Redstone Arsenal (RSA), Madison County, Alabama, under the management of the United States Army Environmental Command (USAEC). The Mission and Installation Contracting Command (MICC) has contracted ECC under Contract Number W9124J-18-D-0004, Delivery Order W9124J22F0045 to perform environmental remediation and restoration and program management services at RSA under the Resource Conservation and Recovery Act (RCRA) Corrective Action program in accordance with RSA's Alabama Hazardous Wastes Management and Minimization Act (AHWMMA) Hazardous Waste Storage Facility/Thermal Treatment/Solid Waste Management Unit (SWMU) Corrective Action Permit, dated July 19, 2021 (hereinafter referred to as the Permit) (U.S. Environmental Protection Agency [USEPA] ID # AL7 210 020 742) (ADEM 2021), and the Permit Modification #1, dated August 12, 2022 (ADEM 2022). This CMI Work Plan has been developed to provide technical guidance for implementing the remaining corrective measures selected for RSA-311, Exterior Sumps and Interior Concrete Pits at Building 7352, Operable Unit (OU) 9.

This CMI Work Plan incorporates applicable elements of the RSA RCRA Permit (ADEM 2021); the Permit Modification #1, dated August 12, 2022 (ADEM 2022); and the most recent edition of the Alabama Environmental Investigation and Remediation Guidance (AEIRG) (ADEM 2017). This CMI Work Plan is submitted to fulfill in part the requirements listed in Section VI.E of the Permit. This CMI Work Plan protects human health and the environment from hazardous constituents at concentrations exceeding applicable limits.

This CMI Work Plan presents the corrective measures for groundwater. The nature and extent of contamination was presented in the RSA-311 RCRA Facility Investigation (RFI) Report (APTIM 2020). No chemicals were present in soil at concentrations that could cause a groundwater impact due to leaching and migration to the water table. An Alabama Risk-Based Corrective Action (ARBCA) evaluation for human health and a screening-level ecological risk assessment (SLERA) was also prepared for RSA-311 as part of the RFI. The ARBCA evaluation concluded that:

- Exposure to soil alone does not pose an unacceptable health threat to the commercial worker, construction worker, or hypothetical residential receptor by direct exposure pathways.
- Exposure to groundwater poses a health threat to the commercial worker, construction worker, and hypothetical residential receptor by direct exposure pathways if groundwater is developed as a potable source.
- A screening-level vapor intrusion evaluation showed that volatile organic compounds (VOCs) in soil and groundwater do not pose an unacceptable health threat to occupants in the event that buildings are erected onsite in the future.

The RFI Report (APTIM 2020) recommended that corrective measures be implemented at RSA-311 to address the potential for trichloroethene (TCE), vinyl chloride (VC), 2-nitrotoluene, dinitrotoluene (DNT), 1,3,5-trinitro-1,3,5-triazine (RDX), and perchlorate in groundwater to pose a future threat to human health if the groundwater is developed for potable use.

This CMI Work Plan was prepared to describe the technical approach and rationale for conducting the field activities that will be performed prior to and during implementation of the groundwater corrective measures at RSA-311.

1.1 REDSTONE ARSENAL LOCATION AND DESCRIPTION

RSA occupies approximately 38,300 acres in Madison County, Alabama. The RSA is bounded on the north and east by the city of Huntsville, on the west by the city of Madison, on the west and southwest by Wheeler National Wildlife Refuge, and on the south by the Tennessee River. Huntsville has a population of nearly 217,000; Madison County's population is approximately 399,000. Approximately 330 military families reside in government quarters on RSA and approximately 40,000 government employees and contractors work at the facility. The primary mission of RSA is the development, acquisition, testing, fielding, and sustainment of aviation and missile weapon systems. Most of the installation tenants support this effort; however, RSA is also home to such diverse activities as training for handling explosives and ordnance devices, Defense Intelligence Agency (DIA) activities, and the production of iron carbonyl. The RSA is home to more than 70 different tenant organizations.

1.2 RSA-311 SITE DESCRIPTION AND HISTORY

RSA-311 is located in Test Area 10 in the southeastern portion of RSA **(Figure 1**). RSA-311 consists of three non-contiguous areas (two interior concrete pits within the former Building 7352, exterior Sump 1, and exterior Sumps 2 and 3). The sumps drain two southern bays in Building 7352 (**Figure 2**). The administrative site boundary for RSA-311 is approximately 3,490 ft^2.

The former Building 7352, built in 1989, was 5,464 ft^2 and consisted of the northern portion, southern portion, and exterior process units.

Northern portion:

- A northern bay (Truck Ramp Bay) with an interior concrete pit (Pit 1) that was 8 ft^2 and 8 feet deep with a 1- ft^2 by 1-foot-deep recessed sump. Mixing and casting equipment and tools were received from nearby propellant and mixing facilities at the truck ramp. Smaller equipment stayed in this room for cleaning above the grate-covered containment pit.
- A center bay with an interior concrete pit (Impoundment Tank [Pit 2]) that measured 36 by 16 feet and was 3.5 feet deep. Large equipment was transferred from the Pit 1 area into the Pit 2 area for high-pressure washing above the steel grate-covered containment pit. Two recessed sumps (approximately 2- ft^2 by 1-foot-deep sumps) were located on the eastern side of the impoundment tank where wastewater was pumped to the wastewater treatment system located above the pit on the steel-grate floor. The wastewater treatment system had two influent tanks and six carbon columns positioned on the metal grate floor.

The pits in the northern and center bay were connected by a 6-inch-deep pipe trench used for pumping water between pits.

Southern portion:

- Three smaller bays (Bay 1, Bay 2, and Bay 3) with Bays 1 and 2 having a floor trench drain that flowed to exterior sumps. Bays 1 and 2 were used as the final cleaning stage for large components and for small equipment and parts. Bay 3 was used as a storage room.

Exterior process units:

- Three exterior sumps
  - Two sumps (Sump 2 and Sump 3), located on the eastern side of the building, received drainage from southern Bay 1.
  - One sump (Sump 1), located on the western side of the building, received drainage from southern Bay 2.

The sumps measured approximately 5 by 10 feet and were 4 feet deep. The sumps were built to contain water and did not have drains or outlets to the soil.

Building 7352 was originally constructed for use as a bowl and wastewater cleanup facility for equipment and tools used in propellant mixing and casting operations at nearby facilities. The three bays in the southern portion of the building were used for large component cleaning, small parts cleaning, and equipment storage between 1989 and 1995. The two interior trench drains in the southern portion of Building 7352 were designed to capture floor washings and spills from Bays 1 and 2. The trench drains are recessed into the floor and connected to the exterior captive sumps located on the eastern and western sides of the building (**Figure 2**).

Decontamination of Building 7352 began in 1995, and acceptance inspection was signed in April 1996. The building was inspected during the Alabama Department of Environmental Management (ADEM) visual site inspection in 2008.

Beginning in 2009, the southern bays were used for a missile recycling program Feasibility Study (FS). The process used anhydrous ammonia to dissolve explosives, energetics, and propellants and to remove the materials from the missile housings. Wastes from operations were stored at RSA-136b. It is unknown if any releases of hazardous constituents from the trench or sump occurred.

On May 10, 2010, an explosion occurred at Building 7352 when workers were working on a new process to separate ammonium perchlorate from other components in the missile fuel. The explosion killed two workers and injured a third. The accident resulted in damage to Bay 1.

The RSA-136b treatment, storage, and disposal facility is located east of Building 7352 (**Figure 2**) and was used to store propellant wastes. ADEM recommended no further action in 2008.

Building 7352 and the associated sumps and pits were demolished from July to September 2019. Based on information provided by RSA personnel on April 14, 2020 (U.S. Army Garrison-Redstone 2020), operating equipment used in processes conducted in the former Building 7352 that were determined to have residual energetics were taken to the Open Burn/Open Detonation area for thermal treatment. Following removal of operating equipment, the building structure was reflashed to remove any potentially remaining energetics prior to demolition. Water in pits/sumps was pumped to the industrial sewer after sample results were non-detect for energetics and lead. Steel removed during demolition was taken to metal recyclers, and concrete (including sumps and pits) was taken to the Construction and Demolition Landfill for disposition.

1.3 ECOLOGY

RSA-311 covers approximately 3,490 ft^2. The area immediately surrounding the former Building 7352 is either paved, graveled, or grass. The area surrounding RSA-311 is wooded. Topography at the site is flat, with little relief. A wetlands area lies north and northwest of the site; however, surface water does not exist within the boundaries of the site (**Figure 2**).

1.4 CLIMATE

Climate is a primary component in the hydrologic cycle and water budget and an integral element of the hydrogeologic framework of a site. Seasonal and storm-related trends in temperature and rainfall influence surface water and groundwater flow conditions. Average annual rainfall at RSA is 52 inches, and rainfall is the principal source of groundwater recharge, either directly through infiltration and percolation through the vadose zone (unsaturated overburden) or as runoff to streams, which may also recharge groundwater. On an annual basis, 75 to 90 percent of rainfall at RSA is lost to evapotranspiration (Shaw 2003). Discounting runoff to surface water, 5 to 13 inches of rainfall remain available to recharge groundwater. Rainfall contributes to groundwater recharge primarily during the winter, when deciduous

trees are leafless, reducing overall transpiration. With the onset of the growing season in April, temperatures increase dramatically, and most potential recharge is lost through evaporation and transpiration.

1.5 GEOLOGY

A generalized installation-wide environmental setting is presented in Section 2.0 of the Installation-Wide Work Plan (IT 2002) and includes discussions on the regional stratigraphic and structural geology, surface and subsurface hydrology, and other physiographic and geographic topics. Logs of soil borings advanced at the site were used to interpret the site-specific geology, which consists of a low-permeability, clay-rich soil cover overlying limestone bedrock.

1.5.1 Soil

Based on direct-push technology (DPT) and auger refusal depths, thickness of the overburden at RSA-311 ranges from approximately 8 to 28 feet below ground surface (bgs). The average depth to bedrock is approximately 14 feet bgs. The lithological logs from soil and well borings indicate native soils consisting predominantly of medium- to high-plasticity clay with trace to small amounts of silt and fine-grained sand. Weathered limestone fragments were also observed in the soil borings together with traces of chert and manganese nodules.

The overburden or unconsolidated soil layer across most of RSA is called residuum because it formed from in situ chemical weathering of the underlying karstic limestone bedrock. This overburden layer primarily consists of clay and silty clay and includes varying amounts of residual chert fragments, which were present within the parent limestone and have resisted chemical weathering because of their siliceous composition. The chert can be found scattered within the clay matrix as nodules or concentrated locally as near-horizontal layers within the soil. Although little compositional variation is found within the overburden, the residuum does not transmit groundwater uniformly. Groundwater infiltration follows preferred pathways because zones of higher hydraulic conductivity developed during soil-forming processes. Preferred pathways within the overburden directly affect contaminant migration and distribution within the soil column.

Residual clay generally has low horizontal and vertical hydraulic conductivities. At a given location, a layer of chert within the clay may decrease vertical hydraulic conductivity and increase horizontal conductivity, while isolated nodules of chert may increase the vertical conductivity.

In addition, microfractures may be created within the clay during raveling, a process in which the clay slowly subsides as it is eroded and carried away by groundwater in bedrock fractures and conduits. Vertical movement of the soil caused by raveling or sloughing into fractures and conduits results in the development of microfractures in the overlying material. The microfractured clay soils have higher hydraulic conductivities than undisturbed clay and act as preferred groundwater flow pathways.

1.5.2 Bedrock

Depth to bedrock across this portion of RSA is variable over short distances due to solution weathering of the upper bedrock surface (epikarst). Lithologic data from bedrock wells installed across this portion of RSA indicate that the shallow bedrock first encountered correlates with middle to upper Tuscumbia Limestone and exhibits well-developed karst features. The Tuscumbia Formation beneath this area is characterized by thinly bedded to massive, fine to medium crystalline, stylolitic limestone with numerous chert nodules and chert lenses. The Tuscumbia is underlain by the Fort Payne Chert, which consists of thinly bedded, fossiliferous limestones interbedded with chert. The Fort Payne is underlain by the Chattanooga Shale, a dark gray to black, fissile shale.

1.5.3 Hydrogeology

Surface Water. Wetlands are located north and northwest of RSA-311. Site drainage is controlled by ephemeral unlined ditches. No perennial surface water features are associated with the site. The site is within the 100-year floodplain of Huntsville Spring Branch.

Groundwater. Groundwater beneath RSA-311 occurs in the unconsolidated overburden and the upper portion of the limestone bedrock. The overburden and upper bedrock comprise a single interconnected aquifer. At depth, groundwater occurs under semi-confined conditions, flowing along discrete joints and bedding-plane partings. As discussed in the Rev 4 RFI Report (APTIM 2020), the average depth to groundwater at the site is approximately 4.4 feet bgs. The groundwater surface elevation varies from approximately 557.95 to 563.84 feet above mean sea level. As illustrated in the left panel of **Figure 3** (adapted from Figure 1-6 of the Rev 4 RSA-311 RFI Report [Aptim 2020]), groundwater flows northwest toward Huntsville Spring Branch across a larger-scale RSA-146 area that includes RSA-311. Dye trace studies at RSA-146 also demonstrate an overall northwesterly groundwater flow, as illustrated in the right panel of **Figure 3** (adapted from Figure 1-6 of the Rev 4 RSA-311 RFI Report [Aptim 2020]). However, localized groundwater flow underneath RSA-311 may vary at different times. For example, the interpreted groundwater flow direction based on the May 2014 and January 2016 potentiometric surface maps for RSA-311 (**Figures 4 and 5**, respectively) varied from northwest to southwest over this time, with an overall westerly flow south of the site and southwesterly flow north of the site. Because of the karstic nature of the site, constant exchange of surface water and groundwater would be expected at RSA-311. This was confirmed by a groundwater-wetland interaction investigation at a large scale at RSA-146 (CB&I 2015). Analytical results from the springs and surface water samples thus would be indicative of the contaminant concentrations of the local shallow groundwater.

1.6 DOCUMENT ORGANIZATION

This CMI Work Plan is organized into the following five sections:

- Section 1.0 presents the purpose and overview of the document and includes brief site history and descriptions and environmental setting, including the topography, geology, and hydrogeology associated with the site.
- Section 2.0 presents additional background information about the site, including investigations and reporting history, nature and extent of contamination, fate and transport, site risks, and the final conceptual site model (CSM).
- Section 3.0 describes the basis for the action, including the corrective measures objectives (CMOs), cleanup goals (CGs), and the selected corrective measures.
- Section 4.0 presents the planned CMI activities necessary to complete the corrective measures at RSA-311.
- Section 5.0 describes the potential for contingencies that could arise during execution of the corrective measures described herein.
- Section 6.0 provides the references that contributed to the preparation of this CMI Work Plan.

The following plans and supporting documentation are included as appendices to this CMI Work Plan:

- Appendix A. Regulatory Concurrence Letter
- Appendix B. Redstone Arsenal RCRA Permit Modification Request
- Appendix C. Corrective Measures Implementation Schedule
- Appendix D. Quality Control Plan
- Appendix E. Site Safety and Health Plan
- Appendix F. Groundwater Monitoring Plan
- Appendix G. Building 7352 Demolition Report
- Appendix H. Notice of Environmental Use Restriction.

As the Army implements the corrective measures using support contractors, variations from this CMI Work Plan may be proposed prior to or during field activities. Proposed changes will be submitted by the construction contractor to the Army as field variances for approval prior to implementation as part of the corrective measures process. As part of their approval process, the Army will discuss applicable field variances with ADEM to determine if the variance process is suitable for documenting the proposed changes, or whether revisions to the CMI Work Plan along with a permit modification may be needed. Any variances will be documented and included with the CMI Report for the site.

2.0 INVESTIGATION RESULTS

This section presents additional background information for RSA-311, including the investigation history, nature and extent of contamination, fate and transport summary, human health and ecological risks, and the final CSM.

2.1 INVESTIGATION HISTORY

Environmental investigations were formally initiated at RSA-311 in 1996. This section describes the data collection performed under previous studies at RSA-311 and those efforts conducted in support of the current RFI (APTIM 2020). The following investigations were conducted at RSA-311:

- Phase I Environmental Baseline Study (Conestoga-Rovers & Associates 1996)
- RARE North Plant Phase II Environmental Baseline Survey (CH2M Hill 1998)
- OU 10 Phase II Field Investigations (IT 2002)
- Potential Source Area Investigation (Shaw 2005)
- ADEM RCRA Facility Assessment (RFA) (ADEM 2008)
- SWMU Assessment (Shaw 2009a)
- Rev 1 RFI for RSA-146 Groundwater Site (CB&I 2015)
- Rev 1 RFI for RSA-206, Propellent Mixing Facility #2 and Casting Facility (CB&I 2016)
- Rev 2 RFI for RSA-311 (CB&I 2017)
- Rev 4 RFI for RSA-311 (APTIM 2020).

In 1996, a Phase I environmental survey was conducted at Building 7352 (Conestoga-Rovers & Associates 1996). Three surface soil samples were collected in 1997 as part of the Phase II environmental baseline survey (CH2M Hill 1998). Sample NPSS046 was analyzed for RCRA 8 metals and polynuclear aromatic hydrocarbons (PAHs). Sample NPSS047 was analyzed for semivolatile organic compounds (SVOCs), metals, and explosives. Sample NPSS048 was analyzed for PAHs, metals and explosives. The Phase II environmental baseline survey concluded that there was no evidence of release or disposal of hazardous substances or petroleum products detected.

Sampling activities completed in 2002 as part of the OU-10 Phase II field investigations included soil sampling from four soil borings (K7352-SB01 through K7352-SB04) and groundwater sampling from three Hydropunch borings (K136b-HP01 through K136b-HP03). RSA-311 is within the boundary of OU-10. One surface soil and three subsurface soil samples were collected from each soil boring, and one groundwater sample was collected from each Hydropunch boring. The soil samples were analyzed for volatile organic compounds (VOCs), SVOCs, metals, explosives, and perchlorate. Hydropunch groundwater samples were analyzed for VOCs and perchlorate.

Building 7352 was assigned as a potential source area (PSA) 146-PS-07H in the PSA report conducted for the RSA-146 groundwater unit (Shaw 2005). Background information was obtained and evaluated, including historical aerial photographs, building use indices, and historical documents and maps. A visual site inspection and sampling was not conducted since the facility was still considered active, and the report concluded that further evaluation was needed to determine its regulatory status under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In 2008, ADEM conducted a visual inspection of Building 7352 during an RFA at RSA (ADEM 2008).

In 2009, A SWMU assessment was conducted at RSA-311 (Shaw 2009a) following the PSA evaluation and ADEM visual inspection. The assessment indicated that past use of the building for wastewater treatment suggested the potential for releases to occur from the interior concrete pits and the exterior captive sumps. Further assessment of potential site releases was recommended as part of a release

assessment report; however, in a June 26, 2012, comment letter on the SWMU assessment report, ADEM requested that additional sampling to determine if releases occurred be conducted in an RFI. RSA-311 was then added to Table VI.2 of the RSA RCRA Permit.

The Phase I investigations to support the RFI at RSA-311 were initiated in January 2014, including soil boring installation, monitoring well installation, and groundwater sampling. Phase II investigations were completed in January 2016 following ADEM comments on the RFI Report submitted in February 2015. The objective of the sampling was to determine the extent of VOC, explosive, and perchlorate occurrence in groundwater and potential influences from offsite upgradient sources. The Phase III investigation was completed in December 2016 in response to ADEM comments on the Revision 1 RFI Report requesting additional delineation of TCE, explosives, and perchlorate in groundwater. In response to the comments, two new monitoring wells were installed. In response to ADEM comments on the Revision 2 RFI report for RSA-311 (CB&I 2017) requesting additional delineation of explosive compounds, one additional overburden monitoring well was installed in April 2019.

The following subsections summarize the findings for surface media and groundwater of the Rev 4 RFI Report (APTIM 2020); the RFI Report presents a more detailed discussion. Surface media and groundwater samples were analyzed for metals, VOCs, SVOCs with low-level PAHs, perchlorate, and explosives. No background screening value (BSV) or regional screening level (RSL) exceedances were observed for any contaminants of concern (COCs) in surface and subsurface soil samples. The Rev 4 RFI Report (APTIM 2020) concluded that the vertical and horizontal delineation of contamination at RSA-311 has been achieved.

2.2 NATURE AND EXTENT OF CONTAMINATION

The RFI (APTIM 2020) evaluated available data for usability and defined an appropriate data set for evaluating the nature and extent of contamination for RSA-311, which consists of analytical results from 23 discrete and 2 multiple incremental surface soil samples, 25 subsurface soil samples, 26 groundwater samples from site overburden monitoring wells, and 2 groundwater samples from springs. The RFI concluded that this data set is adequate for evaluating the nature and extent of contamination for RSA-311. A summary of COC analytical groundwater results is presented in **Table 1** and **Figures 6** through **9**.

2.2.1 Metals

Per the Rev 4 RFI (APTIM 2020), all metals detected in soil and groundwater were determined to be background related. Therefore, no metals were determined to represent COCs requiring additional consideration within the Corrective Measures Study (CMS) Report (ECC 2022).

2.2.2 VOCs

No VOCs were detected at concentrations above the RSLs or RSA-specific dilution-attenuation factor (DAF)4 soil screening levels (SSLs) or TCE leachate test-based SSL in any surface or subsurface soil sample collected from RSA-311. However, TCE and VC were detected in shallow groundwater at concentrations exceeding the maximum contaminant levels (MCLs):

- In the most recent groundwater data set, TCE exceeded the RSL (5 micrograms per liter [µg/L]) in well 311-RS2789 at a concentration of 22 µg/L (January 21, 2016). TCE was not detected in any of the other eight wells sampled in January 2016. Previous sampling results showed TCE concentrations above the RSL in well 311-RS2398 (8.33 µg/L in April 2014) and in well K136b-RS673 (5.83 and 159 µg/L in April and May 2014, respectively).
- VC exceeded the RSL (2 µg/L) in well 311-RS2854 at a concentration of 4.39 µg/L in the initial sample collected from this well (December 14, 2016). No confirmation sampling results are available.

2.2.3 SVOCs

SVOCs were not detected in surface soil, and concentrations of SVOCs in subsurface soil were below the RSLs. One concentration of dibenz(a,h)anthracene in one groundwater sample was above the RSL during the May 2014 sampling event, but dibenz(a,h)anthracene was not detected during the previous sampling event in April 2014.

2.2.4 Perchlorate

No perchlorate health advisory level (HAL) exceedances were reported in surface and subsurface soil samples analyzed from the RSA-311 site. In the most recent groundwater data (December 2016), perchlorate was detected in three sample locations (RSP-1802, RSP-1802a, and 311-RS2636) above the HAL. The groundwater exceedances at RSP-1802 and RSP-1802a are believed to be from historical propellant processing plant activities conducted throughout this region of RSA. The perchlorate concentrations in 311-RS2636 have been declining since April 2014. The most recent data from December 2016 demonstrate that the occurrence of perchlorate greater than the HAL is bounded in all directions.

2.2.5 Explosives

Explosives compounds were not detected in surface or subsurface soil samples. Only one explosive compound, nitroglycerin, in well 311-RS2399 was detected above the Residential CG based on achievement of target risk (risk screening levels) once in January 2016. This lone risk screening level exceedance is delineated by wells located in all compass directions away from 311-RS2399. Explosives compounds were also detected at concentrations exceeding risk screening levels in sample location 311-RS2902 and RSP-1802 that do not directly monitor the RSA-311 site and would be representative of explosives originating from other locations associated with the historical propellent processing operations in this area of RSA, including RSA-206N to the northeast and RSA-206S to the southeast. Spring location RSP-1802 integrates groundwater from a wide area that includes sites surrounding RSA-311. Due to its cross-gradient location, the explosives compounds in 311-RS2902 are likely unrelated to contaminants associated with RSA-311.

Prior to 2016, 1,3-dinitrobenzene (DNB), 2-6-DNT, 2-nitrotoluene, 3-nitrotoluene, nitrobenzene nitroglycerin, and RDX were detected at concentrations above their risk screening levels in monitoring wells 311-RS2636, 311-RS2396, 311-RS2397, 311-RS2398, 311-RS2399, and 311-RS2853 (APTIM 2020).

2.2.6 Sump and Pit Liquid Waste

Liquid waste samples collected from two interior concrete pits and three external sumps at RSA-311 contained concentrations of metals (antimony, arsenic, and lead) that exceeded groundwater BSVs and leachate screening values derived from corresponding screening levels. RDX and perchlorate were detected at concentrations above their leachate screening values in one waste sample from one pit. No VOCs or SVOCs were detected at concentrations that exceeded their leachate screening values. No results exceeded associated toxicity characteristic leaching procedure (TCLP) values; therefore, this liquid does not have the characteristics of a hazardous waste. Sumps were cleaned out frequently as part of the maintenance performed by the site landlord. The sump and sump contents were removed as part of the Building 7352 demolition completed in 2019 (Appendix G).

2.3 CONTAMINANT FATE AND TRANSPORT SUMMARY

Contaminant fate and transport are dictated by the physical and chemical characteristics of site-related contaminants. The effects of physical, chemical, and biological processes on the constituents control the potential fate (degradation) and transport (movement). The fate and transport evaluation provides key input to the human health risk assessment by identifying all transport mechanisms working at the site and subsequently determining which exposure pathways are relevant to the risk evaluation.

The most significant potential contaminant migration pathway at RSA-311 is the dissolution of site-related chemicals from soil to form leachate and subsequent transport to the groundwater table resulting from the downward percolation of infiltrating rainfall. A contaminant migration assessment was conducted for RSA-311. Because chemical of potential concern (COPC) concentrations (individual sample or average borehole) in surface and subsurface soil are below DAF4 SSLs or leachate-based SSLs, and in the case of perchlorate, synthetic precipitation leaching procedures (SPLP) results are below the leachate threshold value, COPCs in soil do not represent a leaching threat from soil to groundwater.

2.3.1 Migration Mechanisms

Potential routes of contaminant migration among surface media at RSA-311 include the following:

- Migration of contaminants from soils to groundwater via leaching
- Transport of contaminants in surface soil by wind or water
- Migration of free-phase nonaqueous liquids
- Transport of contaminants in subsurface soil vapors.

At RSA-311, the major potential contaminant migration pathway is the dissolution of site-related chemicals from soil to form leachate and subsequent transport to groundwater resulting from downward percolation of infiltrating rainfall. Overland transport of soil contaminants by wind or water is unlikely at RSA-311 because the site is flat, with very little relief, and vegetated with mowed grass. Migration of free-phase nonaqueous liquids is not a viable mechanism at this site, as demonstrated by VOCs not being detected in soil.

In addition, facilitated transport mechanisms in groundwater beneath RSA-311 are not applicable for the following reasons:

- Bulk transport with dense nonaqueous-phase liquid (DNAPL) is not active, because DNAPL has not been observed at RSA-311 and VOC and SVOC concentrations in soil and groundwater do not suggest the presence of DNAPL.
- Colloidal transport is not applicable because the use, disposal, or release of colloid-producing materials, such as heavy metals and radionuclides, is not included in the CSM for RSA-311.
- Cosolvency, in which more water-soluble solvents like acetone or 2-butanone may dissolve and mobilize other contaminants (e.g., pesticides), is not relevant to RSA-311.

VOCs, including acetone and 2-butanone, are not present at elevated concentrations above RSLs in surface or subsurface soil.

2.3.2 Soil-to-Groundwater Migrations

The soil-to-groundwater migration evaluation for RSA-311 was conducted as described in Section 4.2.1 in the Rev 4 RFI Report (APTIM 2020).

Metals with concentrations greater than their respective DAF4 SSLs were determined to be background related and were not evaluated in the leaching assessment. Perchlorate is the only detected constituent in surface and subsurface soil with concentrations that are greater than its DAF4 SSL. Perchlorate concentrations in both surface and subsurface soil were greater than the RSA-specific DAF4 SSL. Comparison of perchlorate concentrations in surface and subsurface soil with the leachate-based DAF4 SSLs suggests that perchlorate in surface soil is not a leaching threat to groundwater. Two subsurface soil samples (samples from locations 311-SB005 [3 to 5 feet bgs] and 311-SB008 [7 to 9 feet bgs]) exhibited concentrations greater than the leachate-based DAF4 SSL of 1.7 milligrams per kilogram (mg/kg). SPLP analyses were conducted on samples from where the DAF4 SSL exceedances were detected. The SPLP analytical results from these locations were well below the threshold concentration of 60 µg/L, and thus, leaching of perchlorate from subsurface soil is not likely to result in adverse impacts to groundwater quality.

Based on the results of soil-to-groundwater migration evaluation, no further evaluation of any chemical detected in soil is warranted. These results indicate that chemicals in soil at RSA-311 do not pose a current leaching threat to groundwater and will not adversely impact groundwater quality in the future.

2.4 SITE RISK

An ARBCA evaluation for human health and an ecological risk evaluation were performed for RSA-311 in accordance with the ARBCA Guidance Manual – Revision 2 (ADEM 2008) as part of the Rev 4 RFI Report (APTIM 2020). The complete ARBCA evaluation for human health and the ecological risk evaluation are provided in the Rev 4 RFI Report (APTIM 2020).

2.4.1 Current and Potential Future Land and Resources Use

RSA-311 is located in the southeastern portion of RSA in an area designated as Industrial in the RSA Master Plan. Current land use is designated as Manufacturing and Production and future land use has been designated as Research, Development, Testing, Evaluation, and Training.

It is not anticipated that RSA-311 will be developed for residential use. Although risk regulations, policy, and guidance are to only evaluate those receptors that are at a site or that could reasonably be anticipated to occur, the risk assessment includes a residential use scenario to comply with Alabama Environmental Investigation and Remediation Guidance and ARBCA guidance. RSA is legally mandated to comply with the AHWMMA. In RSA's AHWMMA permit, ADEM requires that these guidance documents including approved risk assessment work plans (IT 2002, Shaw 2010) be adhered to during environmental investigations and evaluations. At RSA, the residential scenario is included in the risk assessment only to determine if a site is eligible for unrestricted use as defined in Alabama Administrative Code (AAC) 335-5-1-.03(r), or to support the use of land use controls (LUCs) as a component of the selected remedy. Therefore, risks to a residential receptor were assessed in the Rev 4 RFI Report (APTIM 2020).

There is no current potable use of groundwater at RSA-311, and development of groundwater as a potable source is precluded by the terms of the Installation-Wide Groundwater (IWGW) Interim Record of Decision (IROD) (Shaw 2007). Nevertheless, the exposure to groundwater hypothetically developed as a potable source was evaluated in the Rev 4 RFI Report (APTIM 2020).

2.4.2 Human Health ARBCA

The human health risk assessment for RSA-311 was prepared and presented in the Rev 4 RFI Report (APTIM 2020) in accordance with the ARBCA guidance (ADEM 2008). It consists of a three-tiered process: the preliminary screening level (PSL) evaluation (Tier 1); the Risk Management (RM)-1 evaluation (Tier 2); and the RM-2 evaluation (Tier 3). In the case of RSA-311, the RM-1 evaluation was not performed; instead, the evaluation proceeded directly from the PSL evaluation to the cumulative risk assessment in the RM-2 evaluation.

The PSL evaluation consists of a simple comparison of site concentrations with RSLs. In the case of soil, the RSLs generally were the USEPA (2018) RSLs for residential soil, based on the lower of an individual excess lifetime cancer risk (IELCR) of 1E-6 and a non-cancer hazard index (HI) of 0.1. In the case of groundwater, MCLs were used as the RSLs, if available (USEPA 2018). Otherwise, tap water RSLs (USEPA 2018) were used. Residential RSLs were selected for the evaluation of this site to consider alternatives to attain unrestricted land use.

The PSL evaluation is conducted for all chemicals that are determined to be site related. Inorganics with maximum detected concentrations (MDCs) that do not exceed their BSVs or are shown in a site-to-background evaluation to be naturally occurring are judged not to be site related and are not evaluated further. All other detected chemicals are initially identified as COPCs, and site concentrations

are compared to RSLs in the PSL evaluation. A COPC is identified as a COC if the MDC is greater than the RSL.

A screening-level vapor intrusion evaluation was conducted for this site. It was concluded that VOCs in soil and groundwater at RSA-311 do not represent a source that would pose an unacceptable health threat to occupants of current or future buildings at the site.

The soil and groundwater COCs identified in the PSL evaluation were brought forward for evaluation in the cumulative risk assessment (RM-2 evaluation). Receptor scenarios evaluated in the cumulative risk assessment included a commercial worker, a construction worker, and a hypothetical residential receptor. A hypothetical future residential receptor was evaluated as required by ADEM (ADEM 2017) to evaluate future use without restrictions and determine whether remedial measures and/or LUCs are warranted to achieve no further action status.

Groundwater was evaluated as if it were developed as a source of potable water in the future. Risks from exposure to groundwater were assessed even though groundwater use at this site is precluded now and in the future, and non-potable uses are managed because of RSA's site access control (SAC) program (U.S. Army Garrison-Redstone 2012) and because of the terms of the IWGW IROD (Shaw 2007).

The ARBCA guidance considers an IELCR of 1E-05 to be the target cumulative risk. The target cumulative non-cancer hazard is an HI of 1.0. Estimated cumulative risks/hazards at or below these targets do not require additional action.

Cumulative IELCR and HI estimates for all receptor scenarios are summarized in **Table 2**. No risk or hazard estimates were completed for soil exposures, as no COCs were identified in soil in the PSL evaluation. For groundwater, the cumulative IELCR estimate for the construction worker is less than 1E-05; however, the IELCR is greater than 1E-05 for the hypothetical resident and the commercial worker. The cumulative HI for groundwater exceeded 1.0 for all receptors.

Table 3 summarizes the RM-2 evaluation of human health for RSA-311. It shows the relevant COCs identified through the ARBCA evaluation that require action. As shown in **Table 3**, no relevant COCs were identified in soil. Perchlorate, 2,6-DNT, 2-nitrotoluene, RDX, TCE, and VC were identified as relevant groundwater COCs for the residential receptor.

2.4.3 Preliminary Screening-Level Ecological Risk Assessment

A screening-level ecological risk assessment was completed for RSA-311 as part of the Rev 4 RFI report (APTIM 2020). The surface soil data for this site was compared to relevant BSVs and ecological screening values. A weight-of-evidence evaluation was completed to further evaluate the constituents identified in the initial screening and examined numerous lines of evidence to draw conclusions as to whether site-related constituents have the potential to pose hazards to ecological receptors.

The chemicals of potential ecological concern (COPECs) refinement process concluded that no further evaluation was warranted for the perchlorate, calcium, chromium, magnesium, manganese, mercury, and selenium in surface soil at RSA-311. The weight-of-evidence evaluation concluded that all metals detected in the RSA-311 samples were likely to be naturally occurring or essential nutrients. It was also concluded that perchlorate does not require further evaluation because it is not bioaccumulative.

Based on the results of the screening evaluation and COPEC refinement, the RFI concluded COPECs in surface soil are unlikely to pose hazards to ecological receptors, communities, and/or populations, and further evaluation of ecological hazards at RSA-311 is not warranted.

2.5 CONCEPTUAL SITE MODEL

A CSM was developed for RSA-311 based on historical operations, available site information, and available soil and groundwater data. **Figure 10** presents a visual representation of the CSM listing potential contaminants, their likely sources, possible migration pathways, potential impacted media, and hypothetical receptors. The potential release locations and potential contaminants for soil and groundwater include releases from the cleaning of casting bowls and other equipment as well as materials (primarily ammonium perchlorate) released as a result of the 2010 explosion. Potential contaminants include VOCs, such as solvents; SVOCs, such as petroleum, oil, and lubricants; metals; explosive compounds; and perchlorate. There is the potential for the pits and sumps to have received hazardous constituents from historical operations and released to the environment from leaks or overflows.

The following chemicals are not in the CSM: 2,4,6-trichlorophenol, 2,4-dinitrophenol, 3,3′-dichlorobenzidine, 4,6-dinitro-2-methylphenol, 4-chloroaniline, bis(2-chloroethyl)ether, bromomethane, cis-1,3-dichloropropene, dibenzofuran, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, n-nitroso-di-n-propylamine (NDPA), pentachlorophenol, and trans-1,3-dichloropropene.

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3.0 DECISION SUMMARY

The Rev 4 RFI Report (APTIM 2020) concluded that the Army's historical operations at this site have resulted in releases to groundwater of hazardous substances that pose an unacceptable threat to human health via direct exposure pathways. This section identifies the CMOs based on the results of the RFI and provides CGs that can be used in evaluating alternatives that rely on reduction in concentrations to achieve the CMOs.

3.1 BASIS FOR THE ACTION

The Rev 4 RFI Report (APTIM 2020) defined the nature and extent of contamination and evaluated potential risks to current and future receptors. The RFI concluded that exposure to groundwater potentially used for potable purposes would pose unacceptable risks/hazards due to the presence of perchlorate; 2,6-DNT, 2-nitrotoluene, RDX, TCE, and VC. No unacceptable risks/hazards were associated with 1,3-DNB, 3-nitrotoluene, nitrobenzene, nitroglycerin, and pentaerythritol tetranitrate (PETN); however, the historical concentrations of these chemicals exceeded their corresponding screening levels. Therefore, these chemicals are also included in the CMS evaluation only for monitoring purposes (ECC 2022).

Corrective actions are necessary at RSA-311 to address the unacceptable risks/hazards posed by future potable use of groundwater. Potable groundwater use at this site is precluded now and in the future, and non-potable uses are managed by RSA's SAC program according to the terms of the IWGW IROD (Shaw 2007).

3.1.1 Corrective Measure Objectives

Based on the results of the RFI, the CMO for RSA-311 is as follows:

- Reduce or prevent human exposure to groundwater used for potable purposes that is contaminated with COCs requiring action such that regulatory limits are achieved, or no unacceptable hazard or risk is present.

3.1.2 Applicable Regulations

In considering corrective measures, various laws and regulations (state and Federal) may apply. Consideration of applicable laws and regulations may affect the alternative evaluation and selection. The primary laws and regulations relevant to groundwater and its potential for potable use are:

- Safe Drinking Water Act of 1974 non-zero MCL goals and MCLs (40 Code of Federal Regulations [CFR] Part 141)
- Alabama MCLs (ADEM Administrative Code r. 335-7-2).

Federal MCLs have generally been adopted by Alabama. As a result, Federal MCLs are used as CGs for groundwater unless superseded by a state MCL.

Other laws and regulations may affect alternative evaluation and section. **Table 4** lists the laws and regulations that may be relevant to RSA-311.

3.1.3 Cleanup Goals for the Corrective Measures

CGs are relevant to alternatives that reduce concentrations. The USEPA National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR §300.430[3][B] and [C]) identifies 1E-06 as a level at or below which cancer risk is considered to be minimal. Levels from 1E-06 to 1E-04 represent a risk management range within which cancer risks may or may not be subjected to further action. Cancer risk levels above 1E-04 are generally considered to be unacceptable and require further action. The Army has adopted the USEPA perspective on cancer risk as expressed in the NCP. ADEM, however, considers a total

(cumulative) IELCR of 1E-05 as the trigger level at which risk-based target levels must be developed to guide site management (ADEM 2017).

For RSA-311, perchlorate, 2,6-DNT, 2-nitrotoluene, RDX, TCE, and VC are identified as groundwater COCs requiring action. As noted above, for relevant COCs in groundwater with MCLs, the MCLs are selected as the CGs (TCE and VC). In the case of perchlorate, the HAL of 15 µg/L (DoD 2009) is used as the CG. For the other groundwater COCs requiring action, the CGs are based on risk, with the objective of achieving a cumulative cancer risk of 1E-05 and a cumulative HI of 1.0 or less (**Table 5**).

Current guidance from ADEM indicates that a site's groundwater corrective action must consider all of the COCs that were detected at concentrations greater than the RSLs. Five explosive compounds (1,3-DNB, 3-nitrotoluene, nitroglycerin, nitrobenzene, and PETN) were historically detected in groundwater above their RSLs.

The Rev 4 RFI Report (APTIM 2020) concluded that these chemicals are not COCs requiring remedial action, However, based on the results of the risk assessment, the Rev 4 RFI Report (APTIM 2020) concluded that five non-COCs would be included in the Corrective Measures Implementation Plan (CMIP) for monitoring purposes only. Therefore, 1,3-DNB, 3-nitrotoluene, nitroglycerin, nitrobenzene, and PETN would be included in the site's groundwater monitoring program and monitoring results compared to the monitoring acceptance goals (MAGs). The USEPA (2022) RSLs for these compounds were used to develop the MAGs. The CGs and MAGs for RSA-311 are summarized in **Table 6**.

3.1.4 Identification of the Area and Volume of Contaminated Media Requiring Corrective Measures

COCs in groundwater requiring action at RSA-311 fall into two subclasses. The three explosives compounds (RDX, 2-nitrotoluene, and 2,6-DNT) are present above their risk screening levels either locally or infrequently or both locally and infrequently, indicating that a mappable plume is not present at the site. The latest groundwater sampling results indicate perchlorate, TCE, and VC concentrations are above the CGs at one sample location each, are relatively low, and do not reflect the presence of a mappable plume beneath the site. In addition, the overall concentrations of the site COCs are declining.

3.2 SCOPE AND ROLE OF THE RESPONSE ACTION

The environmental concerns at RSA are extremely complex. Work is underway at more than 300 sites in the Installation Restoration Program at RSA. To ensure protection from exposure to potentially contaminated groundwater under these sites and elsewhere on RSA, an IWGW IROD has been approved for LUCs (Shaw 2007 and 2009b). This IROD selected LUCs for groundwater as the interim remedy. LUCs have been implemented to prevent potable use of groundwater and manage nonpotable uses such that exposure to contaminated groundwater is minimized (Shaw 2009b). This interim remedy will remain in place for the groundwater under RSA-311 until a final remedy has been selected in the decision document for the RSA-146 groundwater unit. In accordance with the provisions of the IWGW IROD, as implemented via the Army's SAC program, the installation of wells for drinking water is prevented on sites without a final remedy, and all requests for the installation of wells for industrial processes or agricultural purposes on RSA are subject to Army review and approval.

3.2.1 Overall Remedial Strategy for Redstone Arsenal and RSA-311

The overall strategy for cleanup at RSA has been presented to the regulators in two cleanup strategy documents, the IWGW Cleanup Strategy (Shaw 2009c) and the Installation-Wide Strategy for Cleanup of Impacted Wetlands (Shaw 2010). The overall RSA cleanup strategy includes the following elements:

- Expedite evaluation and release of surface media sites to allow for efficient, mission-related property reuse.

- Expedite cleanup of sources area at surface media sites and secondary sources of ongoing groundwater contamination, including DNAPL.
- At SWMUs without approved decision documents, exposures to surface media will be managed through the use of the Army's SAC program, and exposure to groundwater that may result in unacceptable risks will be prevented or managed as required by RSA's IWGW IROD.
- Coordinate the evaluation of groundwater units and their associated surface sites so that approval of groundwater RFIs is not delayed by unresolved surface media site issues.
- Design and implement an installation-wide monitoring network to monitor remedial progress and ensure that the selected remedies are protective of human health and the environment on a long-term basis.

The corrective measure for RSA-311 is consistent with this strategy. The selected remedy will provide protection of human and ecological receptors and reduction of continued sourcing from soil to groundwater.

3.2.2 Scope of Problems Addressed by RSA-311 Response Action

The corrective measures already conducted at RSA-311 provide protection to potential receptors from TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate in groundwater. The groundwater monitoring program will evaluate the effectiveness of monitored natural attenuation (MNA) to protect human health and the environment and verify groundwater COCs remain below CGs.

3.3 CORRECTIVE MEASURES EVALUATION AND SELECTION

Multiple technologies and alternatives were evaluated in the initial screening for the corrective measures for groundwater at RSA-311, including no action; MNA and LUCs; and In Situ Enhanced Bioremediation (ISEB), MNA, Long Term Monitoring (LTM), and LUCs.

3.3.1 Groundwater

The following three alternatives were evaluated for groundwater: 1) no action; 2) MNA and LUCs; and 3) ISEB, MNA, LTM, and LUCs, as summarized below:

3.3.1.1 Alternative 1 – No Action

Evaluation of the no-action alternative will serve as a baseline for evaluating other corrective measures.

3.3.1.2 Alternative 2 – MNA and LUCs

Alternative 2 involves documenting the passive reduction in the COC concentrations via natural attenuation. MNA would be implemented to track COC trends in groundwater until CGs were attained. The CMS Report for RSA-311 used a first-order degradation rate evaluation approach to estimate the time frame to achieve CGs for the site (ECC 2022). In brief, using available literature half-life values for COCs and historical groundwater monitoring data collected from the site, an approximate time frame of 6 years is estimated to attain CGs. Given the limited groundwater monitoring data at RSA-311 and the uncertainties in the half-life values, a conservative groundwater sampling program consisting of 8 years of monitoring is proposed instead of 6 years. However, it should be noted that once the CGs have been reached and maintained for a period of 3 consecutive years in all the monitoring wells, the Army can petition ADEM to discontinue the monitoring program in accordance with the Permit. Groundwater monitoring and reporting would be conducted for 8 consecutive years to verify that concentrations remain below CGs (Years 0 through 3).

Alternative 2 would protect human health by implementing LUCs to prevent exposure to groundwater until the concentrations of COCs were reduced to the groundwater CGs. Available data indicate that the present groundwater concentrations do not pose an unacceptable risk to current receptors. The monitoring program implemented under the MNA component of the alternative would track the progress of natural attenuation processes in reducing COC concentrations until CGs are attained.

3.3.1.3 Alternative 3 – ISEB, MNA, LTM, and LUCs

Alternative 3 involves the injection via DPT of a food-grade emulsified vegetable oil (EVO) carbon source and nutrient amendments (EVO solution) into groundwater to produce an ISEB treatment zone that stimulates microbial degradation of the COCs. MNA (including LTM) would be conducted to track the progress of the ISEB treatment of groundwater as well as the concentrations of perchlorate, TCE, VC, and explosives in groundwater on the periphery of the treatment area. Alternative 3 would protect human health by implementing LUCs to prevent exposure to groundwater until the concentrations of COCs were reduced to the groundwater CGs.

This active remedy was not retained because it is considered inefficient and costly compared to other inactive remedy counterparts. In addition, this active remedy was not retained based on the nature and extent of TCE and VC, the most prominent exceedances in groundwater at RSA-311. TCE and VC do not have a widespread presence at RSA-311, and their concentrations are not elevated:

- TCE exceeded the RSL (5 µg/L) in 311-RS2789 at a concentration of 22 µg/L.
- VC exceeded the RSL (2 µg/L) in 311-RS2854 at a concentration of 4.39 µg/L.

Considering the limited area of the site and the relatively low COC concentrations detected in groundwater, Alternative 3 was not retained.

3.3.2 Selection of Corrective Measures for RSA-311

Alternative 2, MNA and LUCs, most appropriately addresses the contaminated groundwater at RSA-311.

Alternative 2 involves documenting the passive reduction in the COC concentrations via natural attenuation. MNA would be implemented to track COC trends in groundwater until CGs were attained.

The major components of the corrective measures in Alternative 2 include the following:

- Development of a CMIP
- Procurement
- Establishment of LUCs
- Baseline groundwater sampling and reporting of 10 onsite overburden monitoring wells, which are part of the proposed MNA monitoring plan at RSA-311 (**Figure 11**)
- Quarterly groundwater sampling of 10 wells and 1 spring location and annual reporting in Year 1
- Semiannual groundwater sampling of 10 wells and 1 spring location and annual reporting in Years 2 through 4
- Annual groundwater sampling of 10 wells and 1 spring location and annual reporting in Years 5 through 8. RSA may request a permit modification to reduce monitoring frequency to annually after Year 4 based on the sampling results presented in annual effectiveness reports.
- Closure of 10 overburden monitoring wells, following the monitoring period and after ADEM's acceptance that site remediation goals have been met.

LUCs would be implemented under this corrective measure alternative in accordance with ADEM Land Divisions – Uniform Environmental Covenants Program Administrative Code, Chapter 335-5 (ADEM 2013) to prevent the potable use of groundwater and manage non-potable uses such that exposure to contaminated groundwater is minimized. The RSA SAC Program would be used to implement the LUCs. Via the RSA SAC Program, the installation of wells for drinking water would be prevented, and all requests for the installation of wells for industrial processes or agricultural purposes for RSA-311 would be subject to Army review and approval. LUC measures would be implemented at the site in accordance with ADEM Land Divisions – Uniform Environmental Covenants Program Administrative Code, Chapter 335-5. A Notice of Environmental Use Restriction (NEUR) will be implemented in accordance with ADEM regulations to restrict groundwater use at RSA-311. The NEUR will be incorporated into the RSA facility Master Plan as required by ADEM. The NEUR will be recorded in the land records for the property, as required by Chapter 335-5-1- 0.2(3).

3.3.2.1 MNA Sampling and Analysis Program

Under Alternative 2, sampling would be performed quarterly in Year 1 after initial baseline sampling (Year 0), semiannually for Years 2 through 4 , then annually for Years 5 through 8. The change of sampling frequency from semi-annual to annual would be based on a review of data trends and approval by ADEM, prior to the implementation of this change. Groundwater samples would be collected from an estimated 10 monitoring wells at the RSA-311 site. Groundwater samples would be analyzed for COCs (VOCs, perchlorate, and explosives). A complete set of water quality parameters, which could be used to evaluate attenuation and destruction of the COCs, will also be collected. These parameters include common anions (chloride, nitrate, and sulfate), ferrous iron, total organic carbon, alkalinity, gases (methane, ethane, and ethene), dissolved oxygen (DO), pH, and oxidation-reduction potential (ORP).

3.3.2.2 Baseline Groundwater Sampling Event in Year 0

One baseline groundwater monitoring event would be conducted at the beginning of the monitoring program. Groundwater samples would be collected from 10 existing monitoring wells (311-RS2854, 311-RS2789, 311-RS2790, 311-RS2398, 311-RS2399, 311-RS2396, 311-RS2397, 311-RS2636, 311-RS2853, and 311-RS2795) and 1 spring location (RSP-1802) to analyze for the 6 COCs requiring action (2,6-DNT, 2-nitrotoluene, RDX, TCE, VC, and perchlorate) and five additional chemicals in groundwater requiring monitoring (1,3-DNB, 3-nitrotoluene, nitroglycerin, nitrobenzene, and PETN). The location of the 10 wells and 1 spring to be monitored is presented in **Figure 11**. The water quality parameters identified in Section 3.3.2.1 of this CMI Work Plan will also be collected.

3.3.2.3 Groundwater Sampling in Years 1 through 8

Quarterly sampling and analysis would be conducted in Year 1, and semiannual sampling and analysis would be conducted in Years 2 through 4 . Annual sampling and analysis will begin in Year 5 and continue through Year 8, if approved by ADEM, based on review of data results and trends. Groundwater samples will be collected and analyzed from the same 10 monitoring wells sampled during the baseline event. The water quality parameters identified in Section 3.3.2.1 of this CMI Work Plan will also be collected.

Once the CGs have been met and ADEM concurs with the results, the program can be discontinued, and the 10 monitoring wells will be abandoned. In the Rev 4 RFI Report (APTIM 2020), it was concluded that explosives compounds exceedances in monitoring well 311-RS2902 are likely unrelated to RSA-311. Therefore, final closure of this well would defer to the RSA-146 groundwater unit.

Baseline sampling data will be submitted following the completion of the baseline sampling event. Reports will be submitted annually and will document all groundwater monitoring activities. The results of quarterly and semiannual sampling events will be documented in memorandum form and summarized in the annual reports.

3.4 REQUEST FOR PERMIT MODIFICATION

The Rev 4 RFI Report (APTIM 2020) received ADEM concurrence on February 2, 2021. A copy of the ADEM concurrence letter for the RFI Report is included in **Appendix A**. The request for permit modification (**Appendix B**) presents the supporting information, including all procedures necessary to implement and monitor the final corrective measures for RSA-311 in accordance with AAC R. 335-14-8-04 (2). The inclusion of this request for permit modification meets requirements specified in Section VI.E.3 of the Permit.

4.0 CORRECTIVE MEASURES IMPLEMENTATION FOR RSA-311

The CMI plan for RSA-311 is as follows.

4.1 GENERAL SCOPE

The general scope of work for RSA-311 activities is expected to include the following:

- Procurement and subcontracting
- Mobilization/demobilization
- Baseline groundwater sampling and gauging
- Groundwater monitoring
- Implementation of LUCs
- Submission of a CMI Report.

The general schedule for implementation of corrective measures at RSA-311 is provided in **Appendix C**. The actual start date is pending approval of this CMI Work Plan, incorporation of the site corrective measures into the revised Permit, and availability of funding.

Stakeholder communication and coordination during the CMI will follow the procedures outlined in the IW-QAPP (HGL 2019) and the Project Management Plan (PMP) (ECC 2021a).

4.1.1 Procurement and Subcontracting

The following subcontracted service will be required for the completion of the project:

- Analytical laboratory services
- Remediation-derived waste transportation and disposal (e.g., sampling purge and decontamination water)

Support materials will be procured through equipment vendors and shipped directly to the site. Support materials and equipment include sampling supplies and equipment, health and safety supplies and equipment (i.e., personal protective equipment, air monitoring equipment [e.g., photoionization detector]), equipment for sample collection and field parameter monitoring [e.g., submersible pump, tubing, and multiparameter meter], and other miscellaneous supplies [e.g., wooden stakes and pin flags]). Copiers and a fax machine at the contractor's office will also be used to support the work at RSA-311.

4.1.2 Field Personnel

The following field personnel may be used to complete field corrective measure activities:

- Site supervisor
- Site safety officer
- Field quality control site manager
- Groundwater sampling technicians.

The same field personnel may satisfy multiple roles simultaneously. Groundwater sampling may be performed in house or subcontracted. The number and schedule of personnel will be adjusted during the project as required for completion.

4.1.3 Quality Control Inspections for Field Activities

Inspections will be performed to determine compliance with this CMI Work Plan. The inspection criteria are discussed further in the Quality Control Plan (QCP) presented in **Appendix D**. Inspections may

be performed and verified through visual observation, measurement of materials or equipment, examination of documentation/certification, evaluation of performance, or testing.

Inspections will be performed using a three-phase inspection method. Participants in the inspections typically include, but are not limited to, the field personnel, the project quality control manager, the regulatory representative, and the project health and safety representative. The preparatory inspection(s) are performed prior to start-up and will examine training, procedures, equipment and materials, work plans and documents, and overall readiness to perform work. Initial inspection(s) are performed upon beginning a particular phase of work and include an examination of the quality of workmanship and a review of control testing for compliance with work plan requirements. Follow-up inspection(s) are then performed to verify compliance with procedures. Follow-up inspections will ensure a continuation of quality and safety standards established during preparatory and initial inspections until completion of the definable work feature. Final follow-up inspection(s) will be conducted at the completion of the activity. The final follow-up inspection will be performed to ensure that the completed feature of work meets the work plan requirements. Any deficiencies noted during this inspection will be documented and a determination will be made as to the corrective actions necessary to mitigate the deficiency. All significant deficiencies will be corrected prior to completion of the activity.

Records of inspections will be maintained in the project files. At a minimum, inspection files will include inspection reports/checklists, inspection responses, any supporting documents, and applicable comments.

4.1.4 Daily Reports

The requirements for preparation and submittal of daily project documentation are outlined in the QCP (**Appendix D**). As indicated, the daily reports (including daily construction logs, etc.) will be provided to the Project Manager or designee during CMI activities.

4.1.5 Safety and Health Requirements

All personnel involved in the corrective measures will follow this CMI Work Plan and abide by the health and safety requirements presented in the Site Safety and Health Plan (SSHP) (**Appendix E**).

4.2 PRELIMINARY ACTIVITIES

Preliminary activities are summarized below. All field personnel will follow this work plan and abide by the health and safety requirements presented in the SSHP.

4.2.1 Mobilization

Upon notice to proceed, the contractor will begin mobilization, including the deployment of personnel, equipment, subcontractors, and materials necessary to commence CMI activities at RSA-311. After field mobilization, contractor personnel will attend a safety tailgate meeting and safety orientation to review the tasks and the sequencing of work to ensure safe work activities and a clear line of communication is established. All necessary site-specific safety training will be conducted at this time and in accordance with the SSHP.

4.2.2 Access to Redstone Arsenal

RSA is a secure facility; visitors gain access through badging at the visitor control center at Gate 9. Badge requests for access to RSA should be submitted at least 2 weeks ahead of the date needed to allow for approval and processing by the RSA host organization. On the approved pickup date, new contractor personnel and subcontractor personnel will register at the RSA Visitor's Center at Gate 9 and receive a security badge. Personnel with prior approval from a host RSA organization will be issued a personnel badge upon presentation of proper identification. All personnel requesting access to RSA must be United States citizens in good standing (i.e., no convictions or outstanding warrants).

Military and government personnel will present current military (active, retired, or family) or Federal government identification cards and do not require a host RSA organization. Further information may be obtained by contacting the RSA Visitor's Center located at Gate 9 at (256) 876-1122.

Registered personnel may access RSA-311 using Gate 1 at Martin Road. Directions from Gate 1 are east on Martin Road to Patton Road SW, south on Patton Road to Redstone Road SW, and east on Redstone Road. The site will be on the north side of Redstone Road past Oriole Circle. Gate 1 is open 5 days a week (Monday through Friday) from 0530 to 2100. Gate hours and conditions are subject to change; therefore, operational hours should be verified.

4.3 MONITORING TO EVALUATE MONITORED NATURAL ATTENUATION

A groundwater monitoring program will be implemented in order to evaluate the effectiveness of MNA to protect human health and the environment.

One baseline groundwater sampling event would be conducted in Year 0. Groundwater samples would be collected from the 10 existing monitoring wells (311-RS2854, 311 RS2789, 311-RS2790, 311-RS2398, 311-RS2399, 311-RS2396, 311-RS2397, 311-RS2636, 311 RS2853, and 311-RS2795) and analyzed for the 6 COCs requiring action (2,6-DNT, 2-nitrotoluene, RDX, TCE, VC, and perchlorate) and five additional chemicals in groundwater requiring monitoring (1,3 DNB, 3-nitrotoluene, nitroglycerin, nitrobenzene, and PETN). The water quality parameters identified in Section 3.3.2.1 of this CMI Work Plan will also be collected.

Quarterly sampling and analysis would be conducted in Year 1, and semiannual sampling and analysis would be conducted in Years 2 and 3. Annual sampling and analysis will begin in Year 4 and continue through Year 8, if supported by data trends and ADEM approval. Groundwater samples will be collected and analyzed from the same 10 monitoring wells sampled during the baseline event. The water quality parameters identified in Section 3.3.2.1 of this CMI Work Plan will also be collected.

Once the CGs have been met and ADEM concurs with the results, the program can be discontinued, and the 10 monitoring wells will be abandoned.

Appendix F provides the plan for the implementation of the groundwater monitoring program. This plan includes the wells scheduled for monitoring, sampling worksheets, analysis methods, and data management. The Groundwater Monitoring Plan is intended to be used in conjunction with the IW-QAPP (HGL 2019).

4.4 DECONTAMINATION/INVESTIGATION-DERIVED WASTE

Non-disposable sampling equipment will be decontaminated prior to beginning work at the site and prior to the collection of individual samples to prevent cross-contamination and maintain the integrity of the environmental samples collected. All sampling equipment will be decontaminated in accordance with procedures specified in the IW-QAPP (HGL 2019).

All solid and liquid investigation-derived waste (IDW) generated during CMI activities will be handled in accordance with the most recent versions of AEIRG and AAC 335-14, as well as in accordance with the IW-QAPP (HGL 2019).

4.5 RECORDKEEPING

Daily safety tailgate meetings will be recorded, and field sample collection logs will be prepared during the corrective measures activities at RSA-311 and will be provided in the CMI Report and subsequent Monitoring Reports. Variance and inspection forms will be included in the project reporting in accordance with the IW-QAPP (HGL 2019) and the PMP (ECC 2021a).

4.6 DEMOBILIZATION

Personnel, equipment, and subcontractors will be demobilized from the project site after completion of remedial activities.

4.7 IMPLEMENTATION OF LUCs

LUCs at RSA-311 will be implemented to prevent or minimize exposure to contaminated groundwater. The LUCs will be implemented to prevent potable use of groundwater and manage non-potable uses so that exposure to contaminated groundwater is minimized. The LUCs previously implemented for IWGW in the IROD (Shaw 2007) will remain in place until CGs are attained for COCs in groundwater at RSA-311. The Army-regulated SAC program will be used to implement LUCs (U.S. Army Garrison-Redstone 2012). Via the SAC program, the installation of wells for drinking water will be prevented, and all requests for the installation of wells for industrial processes or agricultural purposes at RSA-311 will be subject to Army review and approval. Annual inspection and repairs (if needed) for signage will be performed with groundwater sampling activities.

4.7.1 Survey Plat

In accordance with the RCRA Permit (ADEM 2022), where residual contaminants remain in place at concentrations greater than those appropriate for unrestricted land use, RSA will submit a survey plat indicating the locations and dimensions of the contaminated areas within RSA-311 and the concentrations of hazardous constituents. This survey plat will be submitted to the Madison County Probate Judge's Office and to ADEM as part of the NEUR in the CMI Report. This plat will be prepared and certified by a professional land surveyor registered in the State of Alabama and contain a prominently displayed note stating RSA's obligations to limit property to the specified restricted uses. The survey plat will be maintained as described in the RCRA Permit until RSA can demonstrate to ADEM that the concentrations of hazardous constituents in all contaminated media are within limits appropriate for unrestricted land uses.

4.7.2 Notice of Environmental Use Restriction

An NEUR is required when an approved CMI Work Plan includes corrective measures that will not result in remediation of the property or portions of the property to unrestricted use. The purpose of an NEUR is to ensure that risks to human health and/or the environment are properly managed by imposing activity and use restrictions on the applicable portions of the property and making these restrictions a legal obligation until the NEUR is removed.

ADEM will be notified within 10 days after uses inconsistent with the NEUR are identified. In addition, notice regarding any observed changes in use, identified proposed changes in use, applications for building permit, or proposals for site work inconsistent with the NEUR will be provided to ADEM as part of the annual monitoring report. Once the NEUR is approved, ADEM will execute and return the original document to RSA to be filed in the appropriate land records (Madison County Probate Judge's Office) within 30 days of receipt. Certification that the NEUR was recorded with the Madison County Probate Judge's Office will be submitted to ADEM within 30 days of recording per AAC 335-1-05(3). This certification will include a copy of the NEUR and the document in which the notation was placed. RSA will maintain the NEUR until demonstrating to the satisfaction of ADEM that hazardous constituents in all contaminated media at RSA-311 are within limits appropriate for unrestricted land use.

If the property is transferred to an owner that is not the Federal Government, an environmental covenant will be executed and filed at that time in accordance with AAC 335-5-1-.02(3)(a)(1)(i) (ADEM 2013). The Draft NEUR is provided in Appendix H.

4.8 CORRECTIVE MEASURE IMPLEMENTATION REPORTING

CMI reporting will be conducted in accordance with Section VIII.D of the Permit and AEIRG (ADEM 2017) as follows:

- ***CMI Report*** – Prepared following the baseline groundwater sampling event (Year 0).
- ***CMI Effectiveness Report*** – Prepared annually to present the results of groundwater monitoring data and progress toward the CGs for groundwater.
- ***Final Report of Corrective Measures*** – Prepared upon attainment of CGs for constituents in groundwater.

Field documentation (e.g., daily reports, daily field logs, calibration logs) will be provided to the Project Manager or designee during CMI activities. The requirements for preparation and submittal of daily project documentation are outlined in the IW-QAPP (HGL 2019) and the PMP (ECC 2021a).

4.9 ONGOING CORRECTIVE MEASURES ACTIVITIES

4.9.1 Groundwater Monitoring and Evaluation

RSA will achieve compliance with the conditions of the RCRA Permit for corrective measures at RSA-311 (ADEM 2021). Conduct of the ongoing corrective measures activities includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory controls, including appropriate quality assurance procedures.

The groundwater concentrations for arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE will be monitored and compared to the health-based standards.

RSA will monitor the groundwater concentrations as described in the Groundwater Monitoring Plan (**Appendix F**).

Prior to reducing the frequency of inspections, the Army will submit a request to ADEM for review and approval.

4.9.2 Corrective Measures Effectiveness Reporting

A corrective measures effectiveness report must be prepared annually to document the MNA Alternative remedy and effectiveness of the LUCs. Part VIII.D of the Permit presents the required components of the report.

4.10 GROUNDWATER MONITORING PROGRAMS

A groundwater Corrective Measures Implementation – Operations (CMI-O) program will be implemented in order to evaluate the effectiveness of MNA to protect human health and the environment. **Figure 11** shows the monitoring wells in the CMI-O program.

4.10.1 Corrective Measures Implementation – Operations Plan

Appendix F provides the plan for the implementation of the groundwater CMI-O program. This CMI-O plan includes the wells scheduled for monitoring, sampling worksheets, analysis methods, and data management. The CMI-O plan is intended to be used in conjunction with the IW-QAPP (HGL 2019) and includes QAPP Worksheet No. 17 (Appendix F, Table F-3), Worksheet No. 18 (Appendix F, Table F-4), and Worksheet No. 20 (Appendix F, Table F-6). Several QAPP worksheets (No. 1, No. 2, No. 3, No. 4, and No. 26) specific to the future CMI-O contractor for site RSA-311 and their subcontracted laboratory will be submitted to ADEM for review and approval prior to implementing the CMI-O program.

4.10.2 Corrective Measures Implementation – Plan Reporting

The CMI-O report is prepared annually to present the groundwater monitoring results to evaluate the effectiveness of MNA to protect human health and the environment. Part VII.B of the Permit (ADEM 2021) presents the required components of the report.

5.0 CONTINGENCIES

The implementation of corrective measures is based on the best information currently available for RSA-311. The following sections include contingency plans to address different situations that could occur as part of this implementation. Any contingencies implemented will be documented and included with the CMI report for the sites.

5.1 ELEVATED CONCENTRATIONS OF COCs

Historical and current data supports the corrective measure alternative that was selected for RSA-311; (Alternative 2: MNA and LUCs). If COC concentrations do not remain below the CG for 3 consecutive years, the contingency corrective measure will include additional years of MNA monitoring, as appropriate based on the annual effectiveness evaluation of contaminant trends.

5.2 VARIANCES

The Army recognizes that variations from this CMI Work Plan in addition to the contingencies included above may be required during the execution phase of the work in order to fully address actual site conditions in a timely manner that is protective of human health and the environment. The Army may grant variances from this CMI Work Plan submitted by the contractor during the corrective measures process. As part of their approval process, the Army will discuss applicable field variances with ADEM to determine if the variance process is suitable for documenting the proposed changes, or whether revisions to the CMI Work Plan along with a permit modification may be needed. Any variance will be documented and included with the CMI report for the sites.

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TABLES

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Table 1. Summary of COC Analytical Groundwater Results
Redstone Arsenal, Madison County, Alabama

Chemical of Concern	Detection Frequency	Percent Detection	Maximum Detected Concentration	VQ	Location of MDC	Arithmetic Mean Concentration	Representative Concentration	Method of Estimation
GROUNDWATER (µg/L)								
Perchlorate								
Perchlorate	12 / 23	52	6.46E+02		311-RS2636	8.17E+01	**6.46E+02**	MDC
Explosives								
1,3-Dinitrobenzene	3 / 25	12	2.53E-01	J	311-RS2399	1.61E-01	**2.53E-01**	MDC
2,6-Dinitrotoluene	1 / 25	4	1.37E-01	J	311-RS2398	1.46E-01	**1.37E-01**	MDC
2-Nitrotoluene	14 / 25	56	5.00E+00	J	311-RS2902	8.71E-01	**5.00E+00**	MDC
3-Nitrotoluene	1 / 24	4	1.73E-01	J	311-RS2398	1.52E-01	**1.73E-01**	MDC
Nitrobenzene	4 / 25	16	6.24E-01	J	311-RS2853	1.76E-01	**6.24E-01**	MDC
Nitroglycerin	3 / 25	12	4.60E-01	J	311-RS2398	3.65E-01	**4.60E-01**	MDC
PETN	1 / 25	4	5.90E+00	J	311-RS2902	6.08E-01	**5.90E+00**	MDC
RDX	8 / 24	33	2.31E+00	J	311-RS2853	3.00E-01	**2.31E+00**	MDC
Semivolatile Organics								
bis(2-Ethylhexyl)phthalate	1 / 7	14	3.52E+00	J	311-RS2396	2.58E+00	**3.52E+00**	MDC
Volatile Organics								
1,1-Dichloroethene	1 / 22	5	4.61E-01	J	311-RS2789	5.21E-01	**4.61E-01**	MDC
cis-1,2-Dichloroethene	4 / 22	18	1.83E+01		311-RS2789	1.68E+00	**1.83E+01**	MDC
Tetrachloroethene	1 / 22	5	1.02E+00		311-RS2636	5.46E-01	**1.02E+00**	MDC
Toluene	1 / 22	5	1.43E+00		311-RS2398	5.65E-01	**1.43E+00**	MDC
Trichloroethene	11 / 22	50	1.59E+02		K136b-RS673	9.53E+00	**1.59E+02**	MDC
Vinyl chloride	2 / 22	9	4.39E+00		311-RS2854	7.43E-01	**4.39E+00**	MDC

µg/L = Micrograms per Liter
J = Estimated Concentration
MDC = Maximum Detected Concentration
NA = Not Applicable
VQ = Validation Qualifier

Table 2. Summary of Receptor Cancer Risk and Noncancer Hazard for Chemicals of Concern
Reasonable Maximum Exposure
Redstone Arsenal, Madison County, Alabama

CANCER RISK				
Receptors	**Total Soil IELCR**	**Groundwater IELCR**	**Cumulative Risk Soil**	**Cumulative Risk Soil and Groundwater**
Industrial Receptors:				
Commercial Worker	NA	6.9E-05	NA	6.9E-05
Construction Worker	NA	3.1E-06	NA	3.1E-06
Hypothetical Residential Receptors:				
Child Resident*	NA	3.9E-04	NA	3.9E-04
Adult Resident*	NA	2.1E-04	NA	2.1E-04
Lifetime Resident*	NA	6.0E-04	NA	6.0E-04

NON-CANCER HAZARD				
Receptors	**Total Soil HI**	**Groundwater HI**	**Cumulative Soil HI**	**Cumulative Soil and Groundwater HI**
***Industrial Receptors*:**				
Commercial Worker	NA	19.8	NA	19.8
Construction Worker	NA	22.0	NA	22.0
Hypothetical Residential Receptors:				
Child Resident*	NA	65.8	NA	65.8

Notes:

*Risk associated with the hypothetical residential receptor; child and adult resident risk are summed to estimate the cancer risk for the lifetime resident. Non-cancer hazard estimates are based on the hypothetical child resident only.

HI = Hazard Index
IELCR = Individual Excess Lifetime Cancer Risk
NA = Not Applicable

Table 3. Conclusions of the ARBCA RM-2 Evaluation
Redstone Arsenal, Madison County, Alabama

Receptors	Exposure to Soil[a]	Relevant COCs in Soil[b]	Exposure to Soil and Groundwater[a]	COCs for Exposure to Groundwater[c]
Commercial Worker	√	(None)	X	Perchlorate 2,6-DNT 2-Nitrotoluene RDX TCE VC
Construction Worker	√	(None)	X	Perchlorate TCE VC
Hypothetical Resident	√	(None)	X	Perchlorate 2,6-DNT 2-Nitrotoluene RDX TCE VC

Notes:

√ Cumulative cancer risk and non-cancer hazard were found to be acceptable.

X Cumulative cancer risk and/or non-cancer hazard were found to be unacceptable.

[a]Risk conclusions exclude inorganics found to be naturally occurring.
[b]Conclusions regarding risk and identification of relevant COCs in soil exclude consideration of contribution of risk from exposure to groundwater.
[c]Chemicals with maximum detected concentrations below their maximum contaminant levels are not included as COCs from exposure to groundwater.

COC = Chemical of Concern
DNT = Dinitrotoluene
RDX = 1,3,5-Trinitro-1,3,5-triazine
RM-2 = Risk Management-2
TCE = Trichloroethene
VC = Vinyl Chloride

Table 4. Potential Federal and State Regulations Applicable to Corrective Measures
Redstone Arsenal, Madison County, Alabama

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
	Federal		
Safe Drinking Water Act – 40 CFR 149	Sole-source drinking water aquifer designation.	Not applicable	This site is not located over a sole-source aquifer.
Safe Drinking Water Act, 40 USC Section 300 – National Primary Drinking Water Standards – 40 CFR Part 141	Applicable to the use of public water systems. Establishes MCLs, monitoring requirements, and treatment techniques.	Applicable	Federal drinking water standards are used by ADEM to establish cleanup standards.
Safe Drinking Water Act, 40 USC Section 300 – MCLGs, 40 CFR 143	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects.	Applicable	Federal drinking water goals are used by ADEM to establish cleanup standards.
Floodplain Management – 44 CFR Part 9, Executive Order 11988	Federal agencies proposing actions to be located in a floodplain must first evaluate the potential adverse effects those actions might have on the natural and beneficial values served by the floodplain.	Potentially applicable	Portions of the site are located within the 100-year floodplain, although expected remedy is unlikely to include components that would have adverse effects on the beneficial attributes of the floodplain.
Floodplain Management – RCRA; RCRA Location Standards, 42 USC Section 6901, 40 CFR 264.18(b)	Requires treatment, storage, or disposal facilities to be designated, constructed, operated, and maintained to avoid washout on a 100-year floodplain.	Not applicable	No new regulated units will be developed as part of the expected remedy.
Protection of Wetlands – 44 CFR Part 9, Executive Order 11990	Federal agencies are directed to avoid construction located in wetlands unless the agency head finds: 1) no practical alternative to such construction, and 2) the proposed action includes all practical measures to minimize harm to wetlands that might result from such use.	Not applicable	There are wetlands north and northwest of RSA-311 but none within the site boundary.
Protection of Wetlands – 40 CFR 230	Sets forth guidelines for fill material in wetlands.	Not applicable	There are wetlands north and northwest of RSA-311 but none within the site boundary.
Wetlands Permitting – 32 CFR 650.68	Identifies permitting requirements for excavation activities in wetlands.	Not applicable	There are wetlands north and northwest of RSA-311 but none within the site boundary.
Endangered Species Act; 16 USC 1531; 50 CFR 200 & 402	Requires Federal agencies to ensure that actions are not likely to threaten the continued existence of endangered/threatened species or adversely modify or destroy the critical habitats of such species.	Not applicable	Actions are not anticipated that will modify or destroy critical habitats as part of the expected remedy.

Table 4. Potential Federal and State Regulations Applicable to Corrective Measures Redstone Arsenal, Madison County, Alabama (Continued)

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
	Federal		
Fish and Wildlife Coordination Act – 16 USC 661-666; 33 CFR 320-330	Sets forth procedures for consultation between regulatory agencies to consider wildlife conservation. Requires any Federal agency proposing to modify a body of water to consult with USFWS.	Not applicable	Discharge to surface water is not a component of the expected remedy.
Wild and Scenic Rivers Act, 16 USC 1274, 40 CFR 6.302I	Restricts activities within areas affecting national wild, scenic, or recreational rivers.	Not applicable	No such areas present.
Presence of archaeological resources, 43 CFR 7.4(a), 40 CFR 7.5(b)(1), 43 CFR 10.4(c), 43 CFR 10.4(d)	Restricts excavating, removing, damaging, or otherwise altering or defacing such resources unless by permit or exception. Protects any such archaeological resources, if discovered. Restricts activities in the area of discovery and requires a reasonable effort be made to protect the objects discovered. Requires consultation with the Indian tribe likely to be affiliated with the objects to determine further disposition per 40 CFR 10.5(b).	Potentially applicable but unlikely	This regulation would apply if archaeological or historic resources are discovered at the site. This is unlikely, since the site was previously developed.
National Archaeological and Historical Preservation Act (16 USC Section 469-470); 35 CFR Part 65	Requires action be taken to recover and preserve artifacts.	Potentially applicable but unlikely	This regulation would apply if archaeological or historic resources are discovered at the site. This is unlikely, since the site was previously developed.
Department of the Army, Environmental Protection and Enhancement; Historic Preservation, 32 CFR 650.181 – 650.193	Requires preservation, restoration, or rehabilitation of all sites, structures, and objects of historical, architectural, archaeological, or cultural significance located on Army-controlled property.	Potentially applicable but unlikely	This regulation would apply if archaeological or historic resources are discovered at the site. This is unlikely, since the site was previously developed.
Native American Graves Protection and Repatriation Act, 25 USC 3001-3013 and 43 CFR 10	Requires protection of Native American graves discovered during excavation activities.	Potentially applicable but unlikely	This regulation would apply if Native American burial sites or cultural items are discovered at the site. This is unlikely, since the site was previously developed.
American Indian Religious Freedom Act, 42 USC 1996	Requires activities in the area of discovery to be stopped and affected work to be suspended until a compliance strategy is approved.	Potentially applicable but unlikely	This regulation would apply if archaeological or historic resources are discovered at the site. This is unlikely, since the site was previously developed.
Standards Applicable to Generators of Hazardous Waste, 40 CFR Part 262	Establishes standards for generators of hazardous waste under RCRA. Specifies requirements for hazardous waste packaging, labeling, manifesting, recordkeeping, and accumulation time.	Not applicable	Generation of hazardous waste not anticipated as part of the expected remedy.

Table 4. Potential Federal and State Regulations Applicable to Corrective Measures Redstone Arsenal, Madison County, Alabama (Continued)

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
	Federal		
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 CFR Part 264.13(a)(1)	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s).	Not applicable	Generation of hazardous waste not anticipated as part of the expected remedy.
Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 CFR Part 265.171-173(b)	Management of hazardous waste in containers.	Not applicable	Generation of hazardous waste not anticipated as part of the expected remedy.
Land Disposal Restrictions, 40 CFR 268	Identifies hazardous wastes that are restricted from land disposal.	Not applicable	Generation of hazardous waste not anticipated as part of the expected remedy.
Discharge to Offsite Surface Water, 40 CFR 122.26, 122.41, and 122.48	Requires that the selected remedial action must establish a standard of control to maintain surface water quality.	Not applicable	Discharge to surface water not anticipated as part of the expected remedy.
Superfund Amendments and Reauthorization Act, 42 USC Section 9801 et seq.	Identifies Water Quality Criteria established under Section 304 or 303 of the Clean Water Act as a required level of control, where such controls are relevant and appropriate.	Not applicable	RSA is regulated under RCRA.
Clean Water Act, 33 USC Sections 1351-1376 – Best Available Treatment Technology, 40 CFR 122	Requires use of best available technology economically achievable to control discharge of toxic pollutants to a POTW.	Not applicable	There is no POTW. Sewer at RSA is private.
Clean Water Act, 33 USC Sections 1351-1376 –NPDES Permit Regulations, 40 CFR 122 Subpart C	Requires use of best available technology economically achievable for toxic pollutants discharged to surface waters. Mandates that the discharge must comply with the USEPA-approved Water Quality Management Plan.	Not applicable	No discharge to surface water is planned for this site.
Discharge to a POTW, 33 USC Section 1317, 40 CFR 403	Establishes list of toxic pollutants and promulgates pretreatment standards for discharge to POTWs.	Not applicable	There is no POTW. Sewer at RSA is private.
Clean Air Act, codified under 40 CFR Part 60, part 61, or part 63. Prerequisite for this action: 40 CFR 264,1030(e)	Process vents associated with air or stream stripping operations that manage hazardous wastes with organic concentrations of at least 10 parts per million weight.	Not applicable	No treatment is anticipated for this site.

Table 4. Potential Federal and State Regulations Applicable to Corrective Measures Redstone Arsenal, Madison County, Alabama (Continued)

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
	State		
Alabama Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, ADEM 335-14-5-.01, Hazardous Waste Program	Establishes location standards for facilities located in 100-year floodplains. Forbids placement of any non-containerized or bulk liquid hazardous waste within any salt dome/salt bed, underground mine, or cave.	Not applicable	Generation of hazardous waste not anticipated as part of the expected remedy.
Alabama Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, ADEM 335-14-6, Hazardous Waste Program	Prohibits placement of any hazardous waste in a salt dome, salt bed formation, underground mine, or cave.	Not applicable	Placement of waste is not relevant for this site.
Alabama Identification and Listing of Hazardous Waste, ADEM 335-14-3	Establishes standards for generators of hazardous waste, including identification, accumulation, transport, and reporting.	Not applicable	Generation of hazardous waste not anticipated as part of the expected remedy.
Alabama Drinking Water Standards, ADEM 335-7-2	Applicable to the use of public water systems. Establishes MCL, monitoring requirements, and treatment techniques.	Applicable	Drinking water standards established by ADEM based on Federal drinking water goals.
Alabama Water Quality Criteria, ADEM 335-610, Water Quality Program	Requires any Federal agency proposing to modify a body of water to consult with USFWS. Establishes an antidegradation policy based on water use classifications and potentially impacted wildlife, fish, and aquatic life	Not applicable	Discharge to surface water is not included as a component of the expected remedy for this site.
UST Requirements – ADEM 335-6-15	Technical standards, corrective action requirements, and financial responsibility for owners and operators of USTs.	Not applicable	USTs are not present at this site.
Wetlands Protection – ADEM 335-8-2.02/2.03 AAC 220-2.92	Defines requirements for dredging or filling and mitigation of impacts to wetlands.	Not applicable	Dredging and/or filling are not components of the anticipated remedy for this site.
Alabama Non-Game Species Regulation,	Identifies state-protected species.	Potentially applicable but unlikely	Applicable if state-protected species are encountered. This is unlikely due to the developed nature of the site.
Phase I Organic Air Emission Standards: AAC 335-14-5-.27 and 335-15-5-.28	For TSDFs. Emission standards for process vents and emission standards for leaks from specific equipment containing hazardous waste with a total organic concentration of at least 10 percent by weight.	Not applicable	No TSDFs are planned as part of the expected remedy.

Table 4. Potential Federal and State Regulations Applicable to Corrective Measures Redstone Arsenal, Madison County, Alabama (Continued)

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
	State		
Phase II Organic Air Emission Standards: AAC 335-14-5-.29	For TSDFs. Emission standards tanks, surface impoundments, containers, and miscellaneous units that contact hazardous waste containing an average organic concentration greater than 500 parts per million weight.	Not applicable	No regulated units will be developed as part of the expected remedy.
Alabama Solid Waste Act, Code of Alabama, Title 22, Chapter 27	Establishes sitewide program to provide for the safe management of non-hazardous wastes.	Applicable	Non-hazardous waste may be generated during groundwater monitoring or well installation/abandonment.
Alabama Solid Waste Management Regulations, ADEM 335-13-1 through 335-13-8	Establishes minimum criteria for the processing, recycling, transportation, and disposal of solid wastes and the design, location, and operation of solid waste disposal facilities.	Applicable	Non-hazardous waste may be generated, transported, or disposed of as part of monitoring or corrective measure activities.
Alabama Stormwater Discharge Regulations, ADEM 335-6-12	Establishes requirements for a stormwater discharge permit for construction activities that disturb greater than 1 acre of land.	Not applicable	Disturbance of greater than 1 acre of land is not anticipated as part of the remedy.
Alabama Water Quality Criteria and Use Classifications Regulations, ADEM 335-6-10	Establishes water quality criteria and uses for lakes and rivers based on toxicity to aquatic organisms and human health and water use classifications and antidegradation policy.	Not applicable	No discharge to surface water is planned as part of the expected remedy for this site.
Indirect Discharge Permits and Pretreatment Rules, ADEM 335-6-5	Establishes list of toxic pollutants and promulgates pretreatment standards for discharge to POTWs and defines the requirements for State Indirect Discharge permits for discharge to POTWs.	Not applicable	There is no POTW. Sewer at RSA is private.
Alabama Wellhead Protection Program, ADEM 335-7-12	Establishes requirements for the closure or abandonment of groundwater monitoring or extraction wells.	Potentially applicable	Applicable if any monitoring wells are abandoned or constructed.
Alabama Uniform Environmental Covenants Program, ADEM 335-5	Establishes the requirements for environmental use restrictions on Federal facility property.	Applicable	LUCs will be used for this site until the cleanup goals are obtained.

AAC = Alabama Administrative Code
ADEM = Alabama Department of Environmental Management
CFR = Code of Federal Regulations
LUC = Land Use Control
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
NPDES = National Pollutant Discharge Elimination System
POTW = Publicly Owned Treatment Works
RCRA = Resource Conservation and Recovery Act
RSA = Redstone Arsenal
TSDF = Treatment, Storage, and Disposal Facility
USC = United States Code
USEPA = U.S. Environmental Protection Agency
USFWS = U.S. Fish and Wildlife Service
UST = Underground Storage Tank

Table 5. Derivation of Groundwater Cleanup Goals – Hypothetical Resident
Redstone Arsenal, Madison County, Alabama

COC Requiring Action	RC (µg/L)	Sum of IELCR[f] (mg/L)	Target Cancer Risk	Sum of HI Resident[f]	Target HI	Residential CG – Cancer[a] (µg/L)	Residential CG – Non-Cancer[a] (µg/L)
Perchlorate[b]	646	NC	NC	4.3E+01	1[c]	NC	15
2,6-DNT	0.137	2.83E-06	2.00E-06	2.43E-02	NC	0.10	NC
2-Nitrotoluene	5.00	1.60E-05	2.00E-06	3.10E-01	NC	0.63	NC
RDX	2.31	2.39E-06	2.00E-06	2.90E-02	NC	1.93	NC
TCE[d]	159	3.55E-04	2.00E-06	1.82E+01	1[e]	5.0	5.0
VC[d]	4.39	2.18E-04	2.00E-06	7.80E-03	NC	2.0	NC
			SUM = 1.00E-05				

Notes:

[a]Residential CG based on achievement of target risk.
[b]COC included only for the purpose of accounting the COC contribution toward HI calculations. The CG defaults to the USEPA HAL for this COC.
[c]Target HI for non-cancer (Thyroid effects).
[d]COC included only for the purpose of accounting the COC contribution toward cumulative risk and/or HI calculations. The CG defaults to the USEPA MCL for this COC.
[e]Target HI for non-cancer (Immune System effects).
[f]Sum of IELCR and HI taken from Table D-18 in the RFI for the hypothetical resident (APTIM 2020).

µg/L = Micrograms per Liter
CG = Cleanup Goal
COC = Contaminant of Concern
DNT = Dinitrotoluene
HAL = Health Advisory Level
HI = Hazard Index
IELCR = Incremental Excess Lifetime Cancer Risk
MCL = Maximum Contaminant Level
mg/L = Milligrams per Liter
NC = Not a relevant COC for either cancer or non-cancer effects
RC = Representative concentration obtained from Table D-18 in the RFI (APTIM 2020)
RDX = 1,3,5-Trinitro-1,3,5-Triazine
RFI = RCRA Facility Investigation
TCE = Trichloroethene
USEPA = U.S. Environmental Protection Agency
VC = Vinyl Chloride

Table 6. Summary of Cleanup Goals – RSA-311
Redstone Arsenal, Madison County, Alabama

COC Requiring Action	Groundwater CG (µg/L)	Basis
Perchlorate	15	HAL[a]
2,6-DNT	0.10	Risk[b]
2-Nitrotoluene	0.63	Risk[b]
RDX	1.93	Risk[b]
TCE	5.0	MCL
VC	2.0	MCL
Chemicals Requiring Monitoring Only	**MAG**	**Basis**
1,3-DNB	2.0	RSL[c]
3-Nitrotoluene	1.7	RSL
Nitrobenzene	0.14	RSL
Nitroglycerin	4.6	RSL
PETN	18	RSL

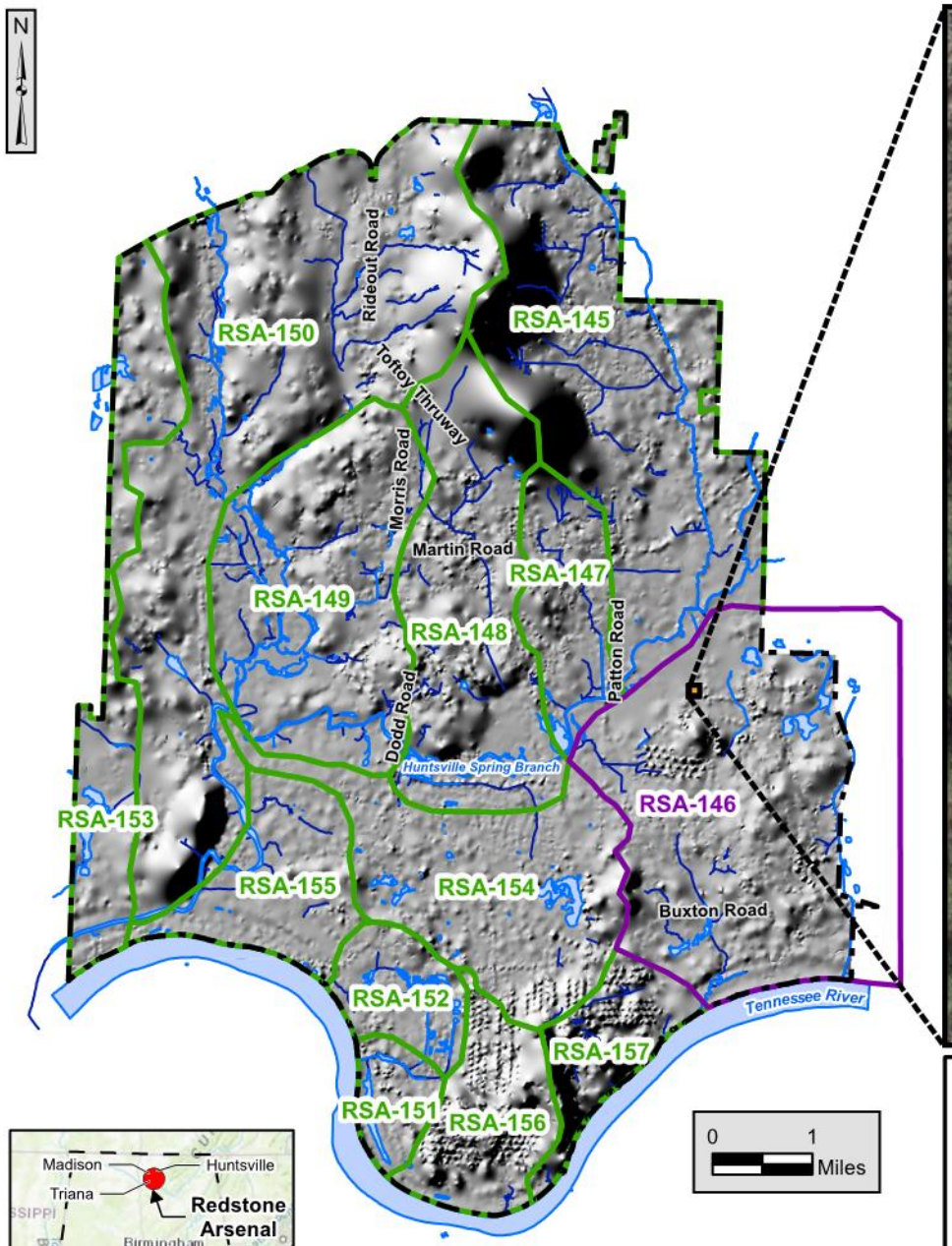
Notes:

[a]Health Advisory Level – Perchlorate Release Management Policy," Memorandum from Wayne Army to Deputy Assistant Secretaries of the Army, Navy and Air Force, April 4 (DoD 2009).
[b]Residential CG based on achievement of target risk.
[c]Monitoring acceptance goal is based on the May 2022 USEPA RSLs.

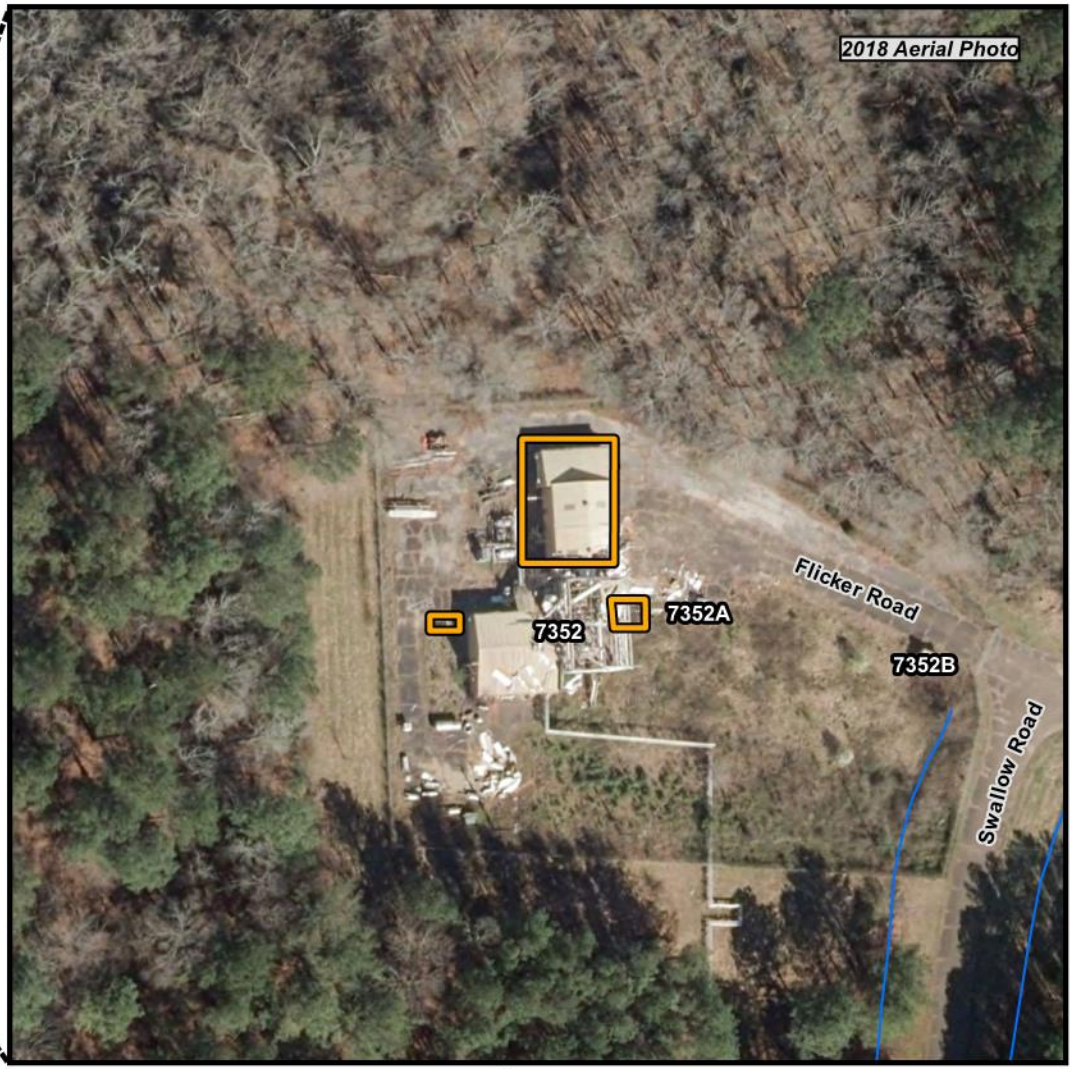
µg/L = Micrograms per Liter
ADEM = Alabama Department of Environmental Management
CG = Cleanup Goal
COC = Contaminant of Concern
DNB = Dinitrobenzene
DNT = Dinitrotoluene
HAL = Health Advisory Level
MAG = Monitoring Acceptance Goal
MCL = Maximum Contaminant Limit
PETN = Pentaerythritol Tetranitrate
RDX = 1,3,5-Trinitro-1,3,5-Triazine
RSL = Regional Screening Level
TCE = Trichloroethene
USEPA = U.S. Environmental Protection Agency
VC = Vinyl Chloride

FIGURES

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Legend

- RSA-311 Site Boundary
- RSA-146 Groundwater Unit Boundary
- Groundwater Unit Boundary
- RSA Installation Boundary
- Surface Water Body
- Surface Drainage Features (Some Ephemeral)

NOTES
1. Basemap data from IGI&S Office at Redstone Arsenal
2. Map Size: A-size (11"x8.5")
3. Revision Date: 7/14/2023

Figure 1
RSA-311
Site Location Map

Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004

1 inch = 100 feet
0 100 200 Feet
NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

ECC GIS Server: E:\Projects\Redstone\MapDocument\CMIP\RSA311\Fig01_RSA311_SiteLoc.mxd

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2018 Aerial Photo

Pit 1

Truck Ramp Bay

Impoundment Tank (Pit 2)

RSA-311

Floor Trench Drains

Sump 1

RSA-311

Sump 2

Sump 3

RSA-136B

Bay 3

Bay 2

Bay 1 (Area of 2010 Expansion)

Swallow Road

Flicker Road

LEGEND

- RSA-311 Site Boundary
- No Further Action Site (NFA)
- Topographic Contour - 2 ft. Interval
- Wetland
- Surface Drainage Features (Some Ephemeral)

Figure 2
RSA-311
Site Layout

Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004

1 in = 30 ft

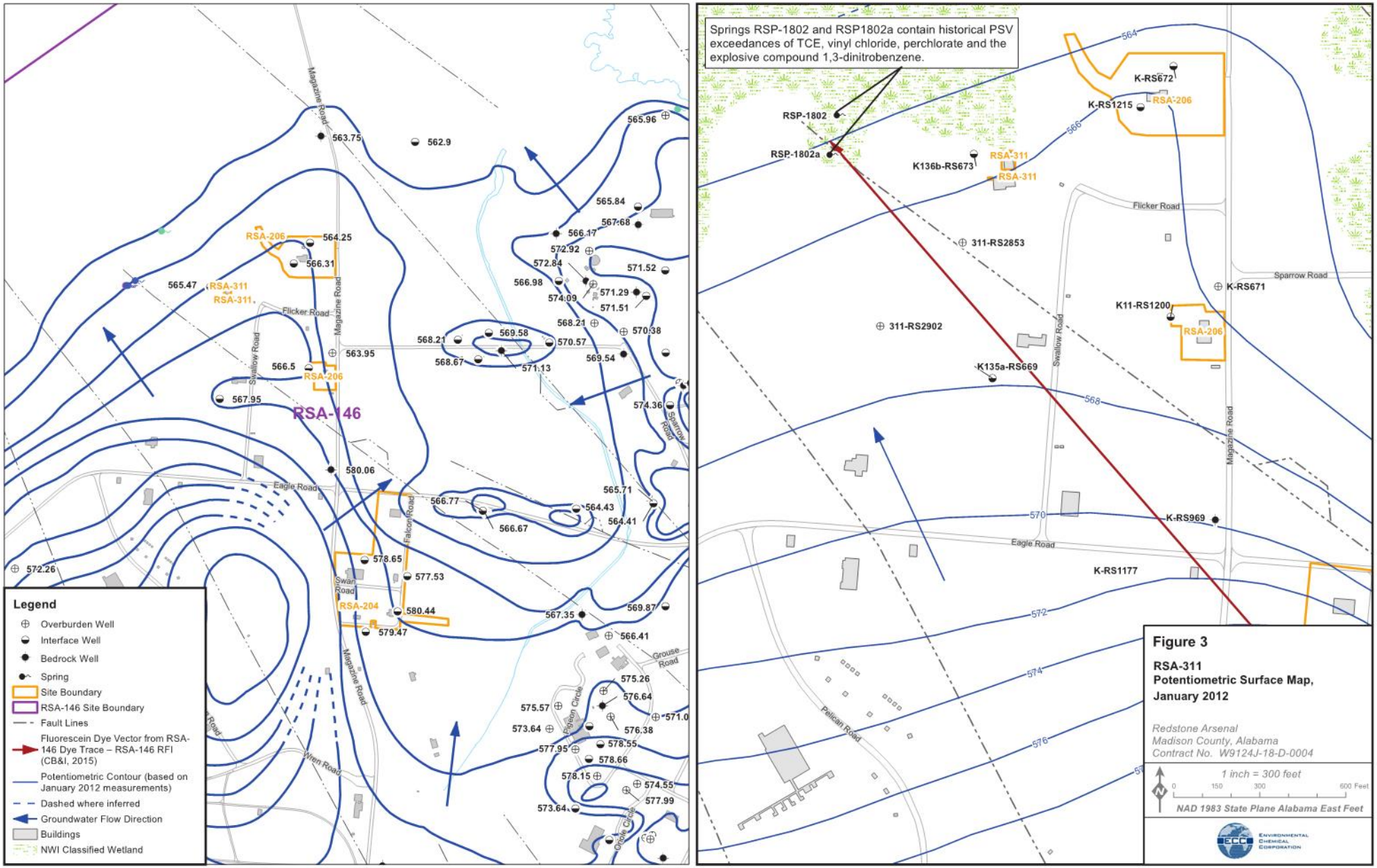
0 30 60 Feet

NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

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Springs RSP-1802 and RSP1802a contain historical PSV exceedances of TCE, vinyl chloride, perchlorate and the explosive compound 1,3-dinitrobenzene.
RSP-1802
RSP-1802a
K-RS672
K-RS1215
RSA-206
K136b-RS673
RSA-311
311-RS2853
K-RS671
K11-RS1200
311-RS2902
K135a-RS669
K-RS969
K-RS1177
RSA-146
RSA-204
Flicker Road
Sparrow Road
Swallow Road
Magazine Road
Eagle Road
Falcon Road
Swan Road
Grouse Road
Pelican Road
Wren Road
Orole Circle
Osprey Circle
564
566
568
570
572
574
576
565.96
563.75
562.9
565.84
567.68
566.17
572.92
572.84
571.52
566.98
574.09
571.29
571.51
568.21
570.38
569.58
570.57
568.21
569.54
571.13
565.47
564.25
566.31
563.95
566.5
567.95
574.36
580.06
565.71
566.77
564.43
564.41
566.67
572.26
578.65
577.53
580.44
579.47
567.35
569.87
566.41
575.26
576.64
575.57
573.64
576.38
577.95
578.55
578.66
578.15
574.55
577.99
573.64
Legend
Overburden Well
Interface Well
Bedrock Well
Spring
Site Boundary
RSA-146 Site Boundary
Fault Lines
Fluorescein Dye Vector from RSA-146 Dye Trace – RSA-146 RFI (CB&I, 2015)
Potentiometric Contour (based on January 2012 measurements)
Dashed where inferred
Groundwater Flow Direction
Buildings
NWI Classified Wetland
Figure 3
RSA-311
Potentiometric Surface Map, January 2012
Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004
1 inch = 300 feet
0
150
300
600 Feet
N
NAD 1983 State Plane Alabama East Feet
ECC
Environmental Chemical Corporation

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2018 Aerial Photo

206-RS2559
562.09

206N-RS2184
562.14

206N-RS2183
561.70

206N-RS2023
561.72

K-RS672
561.30

206N-RS1654
561.43

206N-RS1896
562.15

RSA-206
North

206N-RS2185
560.87

206-RS2558
561.23

206N-RS2024
561.34

7339

E7339

206N-RS1653
563.42

K-RS1215
561.88

206N-RS1856
561.94

311-RS2399
561.78

K136b-RS673
560.86

311-RS2398
561.41

206-RS2557
562.06

311-RS2396
561.58

311-RS2397
561.47

311-RS2636
561.50

Swallow Road

Flicker Road

Magazine Road

206-RS2556
562.05

7338

206-RS2555
561.58

206S-RS2187
561.57

206S-RS2188
561.44

K-RS671
560.80

206-RS2554
561.84

206S-RS2189
561.59

206S-RS1857
561.70

206S-RS1897
562.97

K11-RS1200
561.30

RSA-206
South

206S-RS1859
561.84

206-RS2551
561.95

7340

7353

206-RS2553
561.66

206S-RS2190
561.71

206-RS2552
561.98

7380D

561

561.5

562

LEGEND

- Overburden Well
- Interface Well
- Potentiometric Contour, May 2014
- Dashed where Inferred
- Groundwater Flow Direction
- RSA-311 Site Boundary
- RSA-206 Site Boundary
- Wetland
- Surface Drainage Features (Some Ephemeral)

Figure 4
RSA-311
Potentiometric Surface Map
May 2014

Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004

1 in = 150 ft
0 150 300 Feet

NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

ECC GIS Server: E:\Projects\Redstone\MapDocument\CMIP\RSA311\Fig03_RSA311_GWE2014.mxd

2018 Aerial Photo

311-RS2789
562.88

311-RS2790
563.84

311-RS2398
562.85

311-RS2399
562.78

K136b-RS673
562.04

311-RS2396
562.63

311-RS2397
563.07

311-RS2636
562.64

311-RS2795
562.65

562.5

563

563

562.5

562

Flicker Road

Swallow Road

LEGEND

- Overburden Well
- Interface Well
- Potentiometric Contour, January 2016
- Dashed where Inferred
- Groundwater Flow Direction
- RSA-311 Site Boundary
- Wetland
- Surface Drainage Features (Some Ephemeral)

Figure 5
RSA-311
Potentiometric Surface Map
January 2016

Redstone Arsenal
Madison County, Alabama Contract
No. W9124J-18-D-0004

1 in = 50 ft

0 50 100 Feet

NAD 1983 State Plane Alabama East Feet

ENVIRONMENTAL CHEMICAL CORPORATION

ECC GIS Server: E:\Projects\Redstone\MapDocument\CMIP\RSA311\Fig04_RSA311_GWE2016.mxd

2018 Aerial Photo

206-RS2775
0.38

14607C-HP03
0.5

14607C-HP04
ND

206-PZ006
ND

206-RS2559
2.61

206N-RS2184
31.5

206N-RS2183
27.8

206-RS2777
4.92

206N-RS2023
0.807

K-RS672
ND

RSA-206
North

206N-RS1654
219

206-PZ004
0.6

206N-RS1896
49.3

146-RS2620D
ND

146-RS2620S
15.6

206N-RS2185
24.3

206-RS2558
0.263

7339

K-RS1215
326

206N-RS2024
83600

206N-RS1653
5.94

RSP-1802
1.09

311-RS2789
22

206N-RS1856
4760

311-RS2398
ND

RSP-1802a
1.45

311-RS2790
1.54

206N-RS2186
20.8

K137a-HP01
ND

206-RS2557
0.276

K136b-RS673
ND

RSA-311

K136b-HP01
ND

311-RS2396
ND

311-RS2397
ND

311-RS2636
ND

Flicker Road

206-RS2556
ND

7338

311-RS2853
ND

206-RS2776
2.01

206-RS2555
1.28

206S-RS2187
11.6

311-RS2795
ND

146-RS2621S
12.5

206S-RS2188
11.2

146-RS2621D
ND

Sparrow Road

206-RS2554
134

K-RS671
1.45

K135a-HP02
ND

206S-RS2189
11800

206S-RS1897
8.27

206S-RS1857
108

206S-RS1859
4.28

206-PZ014
2.78

K11-RS1200
2.08

7353

7340

RSA-206
South

206-RS2551
0.482

206-RS2553
2.29

206S-RS2190
5.66

K135a-RS669
ND

206-RS2552
1.52

Swallow Road

ine Road

7336

LEGEND

- Hydropunch/Piezometer
- Overburden Well
- Interface Well
- Bedrock Well
- Spring

TCE Concentration in Groundwater (µg/L)

- > 10,000
- 1,000 to 10,000
- 100 to 1,000
- PSV to 100
- RSA-311 Site Boundary
- RSA-206 Site Boundary
- Groundwater Flow Direction
- Wetland
- Fence
- Surface Drainage Features (Some Ephemeral)

Red highlighting on location indicates a location with concentrations greater than PSV.
Green highlighting on location indicates a location with concentrations less than PSV.
PSV - Preliminary screening value
µg/L - micrograms per liter
ND - non-detected results

Figure 6
RSA-311
Trichloroethene in Groundwater (Most Recent Results)

Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004

1 in = 160 ft
N 0 160 320 Feet
NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

ECC GIS Server: E:\Projects\Redstone\MapDocument\CMI\RSA311\Fig05_RSA311_GW_TCE.mxd

2018 Aerial Photo

206-RS2775 ND
14607C-HP03 ND
206-PZ007 ND
206-RS2559 ND
206N-RS2184 0.482
206-RS2777 12.5
206-PZ005 15.8
206N-RS2183 ND
206N-RS2023 2.87
K-RS672 ND
RSA-206 North
206N-RS1654 ND
206-PZ004 0.57
206N-RS1896 4.41
206N-RS2024 ND
146-RS2620S 4.53
146-RS2620D 3.9
311-RS2854 4.39
206-RS2558 0.458
206N-RS2185 3.6
RSP-1802
K-RS1215 3.86
206N-RS1653 ND
206N-RS1856 28.3
206N-HP003 ND
311-RS2790 ND
311-RS2789 1.95
311-RS2399 ND
311-RS2398 ND
206-PZ001 0.49
RSP-1802a
K136b-RS673 ND
RSA-311
206N-RS2186 ND
206-RS2557 0.678
311-RS2396 ND
311-RS2397 ND
311-RS2636 ND
Flicker Road
206-RS2556 ND
7338
311-RS2853 ND
206-RS2555 ND
206S-RS2187 ND
206-RS2776 ND
311-RS2795 ND
146-RS2621S 4.29
206S-RS2188 ND
146-RS2621D ND
Sparrow Road
206S-RS2189 ND
K-RS671 ND
206S-RS1857 ND
206-RS2554 ND
206S-HP001 ND
206S-RS1859 1.17
K11-RS1200 27.9
7353
7340
206S-RS1897 ND
206-RS2553 ND
RSA-206 South
206-RS2551 0.287
Swallow Road
K135a-RS669 ND
206S-RS2190 0.606
206-RS2552 ND
K135a-HP01
ine Road
7336

LEGEND

- Hydropunch/Piezometer
- Overburden Well
- Interface Well
- Bedrock Well
- Spring

Vinyl Chloride Concentration in Groundwater (µg/L)

- > 100
- 10 to 100
- PSV to 10
- RSA-311 Site Boundary
- RSA-206 Site Boundary
- Groundwater Flow Direction
- Wetland
- Fence
- Surface Drainage Features (Some Ephemeral)

Red highlighting on location indicates a location with concentrations greater than PSV.
Green highlighting on location indicates a location with concentrations less than PSV.
PSV - Preliminary screening value
µg/L - micgrograms per liter
ND - non-detected results

Figure 7
RSA-311
Vinyl Chloride in Groundwater (Most Recent Results)

Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004

1 in = 160 ft
0 160 320 Feet
NAD 1983 State Plane Alabama East Feet

ENVIRONMENTAL CHEMICAL CORPORATION

ECC GIS Server: E:\Projects\Redstone\MapDocument\CMI\RSA311\Fig06_RSA311_GW_VC.mxd

2018 Aerial Photo

206-RS2775
ND

206-RS2559
49.1

206N-RS2184
77.2

206-PZ009
5.63

206N-RS2183
143

206-RS2777
5.97

206N-RS2023
ND

K-RS672
ND

RSA-206
North

206N-RS1654
320

206N-RS1896
5.92

206N-RS2185
7.9

146-RS2620S
ND

146-RS2620D
ND

206N-RS2024
24500

206N-RS1653
ND

K-RS1215
305

206N-RS1856
1040

311-RS2854
ND

206-RS2558
ND

311-RS2789
5.78

RSP-1802
125

311-RS2790
ND

311-RS2399
ND

311-RS2398
ND

206N-RS2186
ND

206-RS2557
ND

K136b-RS673
ND

RSA-311

311-RS2397
13.4

RSP-1802a
113

311-RS2396
2.76

311-RS2636
143

Flicker Road

206-RS2556
ND

7338

311-RS2853
ND

206-RS2555
ND

206-RS2776
3.76

311-RS2795
4.33

206S-RS2187
4.45

146-RS2621S
ND

206S-RS2188
12.4

Sparrow Road

146-RS2621D
ND

K-RS671
ND

206S-RS2189
ND

206-RS2554
ND

206S-RS1857
7.83

206S-RS1859
ND

K11-RS1200
ND

7340

206S-RS1897
8.13

RSA-206
South

206-RS2551
ND

7353

Swallow Road

206-RS2553
3.59

206S-RS2190
ND

K135a-RS669
0.825

206-RS2552
ND

ine Road

54

7336

LEGEND

- Hydropunch/Piezometer
- Overburden Well
- Interface Well
- Bedrock Well
- Spring

Perchlorate Concentration in Groundwater (µg/L)

- > 10,000
- 1,000 to 10,000
- 100 to 1,000
- PSV to 100
- RSA-311 Site Boundary
- RSA-206 Site Boundary
- Groundwater Flow Direction
- Fence
- Surface Drainage Features (Some Ephemeral)

Red highlighting on location indicates a location with concentrations greater than PSV.
Green highlighting on location indicates a location with concentrations less than PSV.
Blue highlighting on location indicates a location with concentrations greater than PSV as a result of historical propellant processing plat activities conducted throughout this region of RSA.
PSV - Preliminary screening value
µg/L - micgrograms per liter
ND - non-detected results

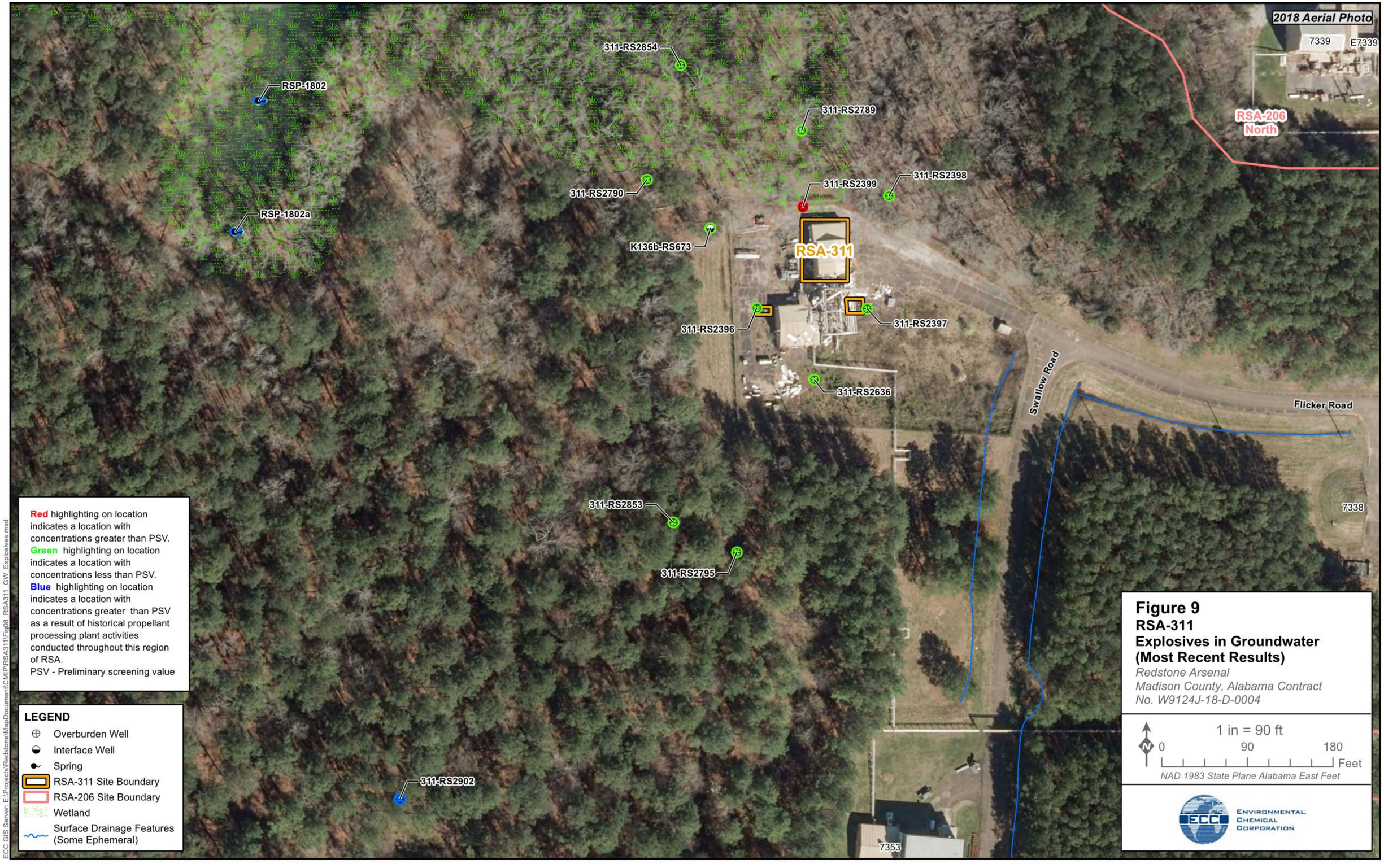
Figure 8
RSA-311
Perchlorate in Groundwater (Most Recent Results)

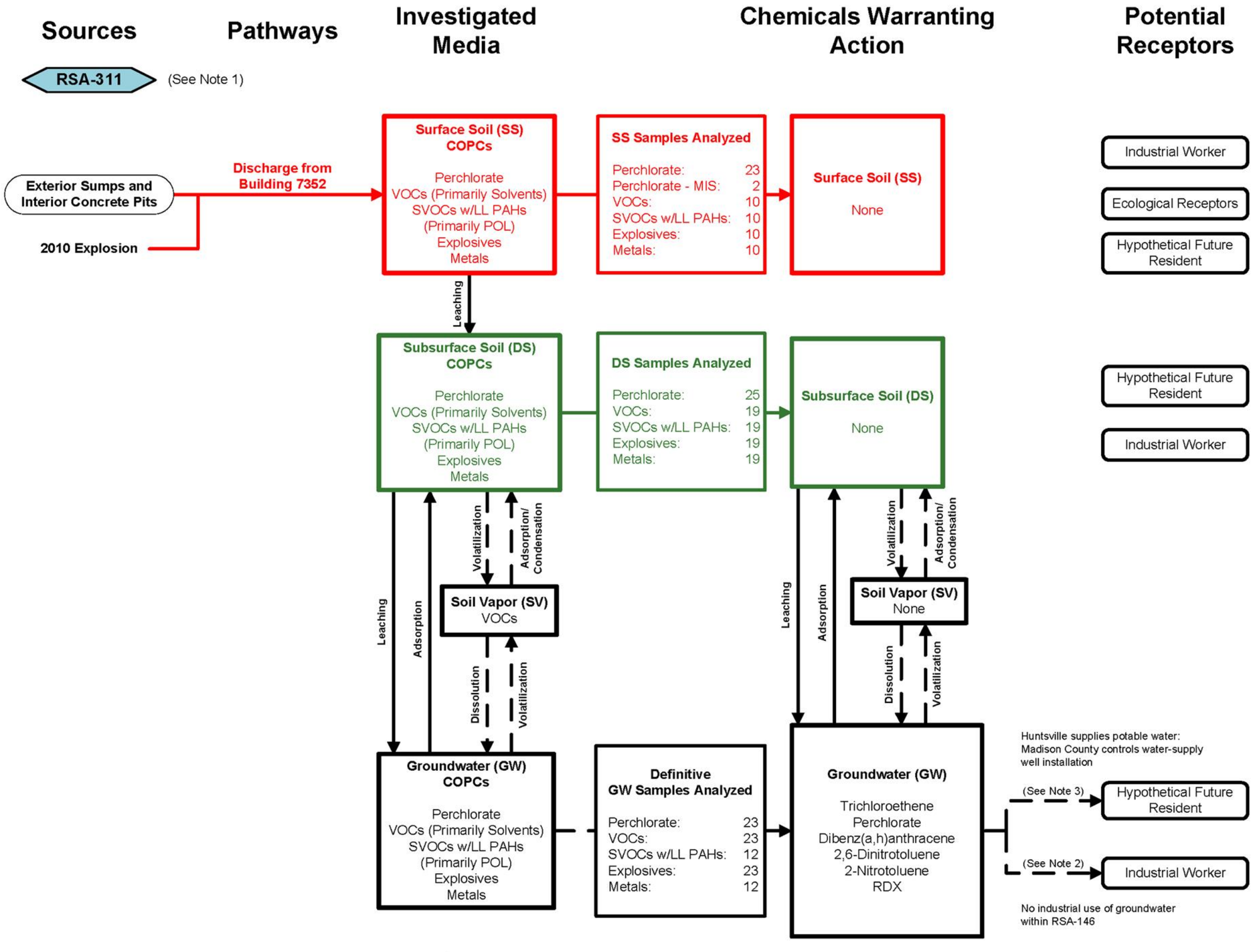
Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004

1 in = 160 ft
0 160 320 Feet
NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

ECC GIS Server: E:\Projects\Redstone\MapDocument\CMIP\RSA311\Fig07_RSA311_GW_Perchlorate.mxd


2018 Aerial Photo
7339
E7339
RSA-206
North
311-RS2854
RSP-1802
311-RS2789
311-RS2790
311-RS2399
311-RS2398
RSP-1802a
K136b-RS673
RSA-311
311-RS2396
311-RS2397
311-RS2636
Swallow Road
Flicker Road
311-RS2853
311-RS2795
7338
311-RS2902
7353
Red highlighting on location indicates a location with concentrations greater than PSV.
Green highlighting on location indicates a location with concentrations less than PSV.
Blue highlighting on location indicates a location with concentrations greater than PSV as a result of historical propellant processing plant activities conducted throughout this region of RSA.
PSV - Preliminary screening value
LEGEND
Overburden Well
Interface Well
Spring
RSA-311 Site Boundary
RSA-206 Site Boundary
Wetland
Surface Drainage Features (Some Ephemeral)
ECC GIS Server: E:\Projects\Redstone\MapDocument\CMIP\RSA311\Fig08_RSA311_GW_Explosives.mxd
Figure 9
RSA-311
Explosives in Groundwater
(Most Recent Results)
Redstone Arsenal
Madison County, Alabama Contract
No. W9124J-18-D-0004
1 in = 90 ft
N
0
90
180
Feet
NAD 1983 State Plane Alabama East Feet
ECC
Environmental
Chemical
Corporation



NOTES:

1. The current land use is designated as manufacturing and production. Future land use is designated as research, development, testing and evaluation and training.
2. At Redstone Arsenal, unmanaged exposure to Installation Restoration Program sites is prevented by the Arsenal's Site Access Control Program. Current and potential future receptors include groundskeeper and construction worker. The residential receptor evaluation will determine if the site is safe for trespassers.
3. The hypothetical residential receptor provides the basis for establishing some remedial responses including justification for the selection of land-use controls. Sites that do not exceed acceptable risk limits for a residential receptor can be released for any use without restriction.
4. Samples were analyzed for TCL VOCs, SVOCs with low-level PAHs, Explosives, perchlorate, and TAL metals. Not all chemicals on these standard lists are within the CSM of this site. See the text in Section 1.8 for discussion.

ACRONYMS:

COPCs	Chemicals of Potential Concern
LL	Low Level
MIS	Multi-Increment Sample
PAHs	Polynuclear Aromatic Hydrocarbons
POL	Petroleum, Oils, Lubricants
RDX	Royal Demolition Explosive
SVOCs	Semivolatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
VOCs	Volatile Organic Compounds

Common acronyms are listed in the report acronyms list.

Figure 10
RSA-311
Conceptual Site Model

Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004

ENVIRONMENTAL CHEMICAL CORPORATION

ECC GIS Server: E:\Projects\Redstone\MapDocument\CMIP\RSA311\Fig09_RSA311_CSM.mxd


2018 Aerial Photo
311-RS2854
RSP-1802
311-RS2789
RSA-206
North
311-RS2790
311-RS2399
311-RS2398
RSP-1802a
K136b-RS673
RSA-311
311-RS2396
311-RS2397
311-RS2636
Swallow Road
Flicker Road
311-RS2853
311-RS2795
Red highlighting on location indicates a location with concentrations greater than PSV for Perchlorate, VOC, or Explosives.
PSV - Preliminary screening value
LEGEND
Overburden Well
Interface Well
Spring
Candidate Well/Spring to be Monitored as part of MNA monitoring program
RSA-311 Site Boundary
RSA-206 Site Boundary
Wetland
Surface Drainage Features (Some Ephemeral)
Figure 11
RSA-311
Corrective Measures Implementation – Operations Network
Redstone Arsenal
Madison County, Alabama
Contract No. W9124J-18-D-0004
1 in = 70 ft
N
0
70
140
Feet
NAD 1983 State Plane Alabama East Feet
ECC
Environmental Chemical Corporation
ECC GIS Server: E:\Projects\Redstone\MapDocument\CMIP\RSA311\Fig10_RSA311_MNA_Wells.mxd

APPENDIX A

REGULATORY CONCURRENCE LETTER

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LANCE R. LEFLEUR
DIRECTOR

KAY IVEY
GOVERNOR

Alabama Department of Environmental Management
adem.alabama.gov

1400 Coliseum Blvd. 36110-2400 • Post Office Box 301463
Montgomery, Alabama 36130-1463
(334) 271-7700 • FAX (334) 271-7950

February 2, 2021

ELECTRONICALLY TRANSMITTED

Mr. A. Keith Cook, Chief
Environmental Management Division
US Army Garrison - Redstone Arsenal
4488 Martin Road
Redstone Arsenal, AL 35898

Re: **ADEM Review:** *Revision 4 RCRA Facility Investigation (RFI) Report RSA-311, Exterior Sumps and Interior Concrete Pits at Building 7352, Operable Unit (OU) 9,* dated August 2020
Redstone Arsenal, Madison County, Alabama
Facility ID No: AL7 210 020 742

Dear Mr. Cook:

The Alabama Department of Environmental Management (ADEM or the Department) has completed the review of the aforementioned document, dated August 2020. Based on this review, the Department has determined that Redstone Arsenal's (RSA) Revision 4 RFI Report for RSA-311 is complete and no additional information will be required at this time.

The Department concurs with the recommendation for no further action required for soil/surface media and with corrective measures implementation (CMI) to be performed for the groundwater. As stated in this RFI Report, corrective measures are needed at this site because groundwater at the site poses a current threat to human health. In accordance with Permit Condition VI.E.2. of RSA's Alabama Hazardous Wastes Management and Minimization Act (AHWMMA) permit, CMI Plans must be completed within 120 calendar days following notification from the Department that a CMI Plan is required. Therefore, RSA should submit a CMI Plan for RSA-311 within 120 calendar days of receipt of this letter.

ADEM will move RSA-311 to Table VI.6 (Sites requiring a corrective measures implementation work plan) in the facility's AHWMMA permit as part of the upcoming permit renewal.

If you have any questions on this matter, please contact Mr. Joseph Palk of the Remediation Engineering Section via e-mail at joseph.palk@adem.alabama.gov or at (334) 271-7739.

Sincerely,

Jason Wilson, Chief
Governmental Hazardous Waste Branch
Land Division

JJW/ATM/JJP/tlp

cc/via email: Clint Howard, Redstone Arsenal
Kelley Hartley, ADEM
Kevin Greaney, US EPA Region IV
Craig Benedikt, US EPA Region IV
Brian Roberson, NASA MSFC
Daniel Arthur, ADEM
Ashley T. Mastin, ADEM
Robert Morris, US EPA Region IV
Robert Pope, US EPA Region IV

APPENDIX B

REDSTONE ARSENAL RCRA PERMIT MODIFICATION REQUEST

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REQUEST FOR PERMIT MODIFICATION
RSA-311, EXTERIOR SUMPS AND INTERIOR CONCRETE PITS AT BUILDING 7352, OPERABLE UNIT 9
U.S. ARMY GARRISON – REDSTONE MADISON COUNTY, ALABAMA
August 2023

1.0 INTRODUCTION

As specified in Section VI.E.3 of the U.S. Army Garrison–Redstone (hereinafter referred to as the Army) Alabama Hazardous Wastes Management and Minimization Act (AHWMMA) Hazardous Waste Storage Facility/Thermal Treatment/Solid Waste Management Unit (SWMU) Corrective Action Permit, (hereafter referred to as the Permit) (dated July 19, 2021) (ADEM 2021), and the Permit Modification #1, dated August 12, 2022 (ADEM 2022), a request for permit modification is to be submitted along with a Corrective Measures Implementation (CMI) Work Plan. Therefore, Environmental Chemical Corporation (ECC) has prepared this request for modification to the Permit for RSA-311 Exterior Sumps and Interior Concrete Pits at Building 7352, Operable Unit (OU) 9, at Redstone Arsenal (RSA) in Madison County, Alabama.

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report (APTIM 2020) was prepared for RSA-311 to determine the nature and extent of contamination. The RFI Report received concurrence from the Alabama Department of Environmental Management (ADEM) on February 2, 2021. ECC has prepared the CMI Work Plan and is ready to implement the corrective measures (monitored natural attenuation [MNA] for groundwater) to evaluate the MNA effectiveness and permanence.

ADEM has listed RSA-311 in Table VI.6 in the Permit as requiring corrective measures for groundwater. Following approval of the CMI Work Plan, the Army requests that ADEM list in Table VI.6 that groundwater beneath RSA-311 will be addressed with the RSA-146 corrective measures. As specified in Section VI.E.3 of the Permit, this modification will serve to incorporate the proposed remedy, including all procedures necessary to implement and monitor the final corrective measure for RSA-311, into the Permit in accordance with Alabama Administrative Code (AAC) R. 335-14-8-.04(2).

2.0 FACILITY AND SITE DESCRIPTION

RSA is located in the southwestern portion of Madison County, which is in the northern portion of Alabama. RSA is an Army facility that encompasses approximately 38,300 acres and is approximately 10 miles long from north to south and 6 miles wide from east to west. The Army controls 36,459 acres of the total acreage, of which approximately 15,500 acres are woodlands; 5,360 acres are leased for agricultural use; and approximately 12,000 acres are managed as military test areas/ranges. Development within RSA has primarily centered on the historical production (and later disposal) of conventional and chemical munitions and, more recently, development and testing of missiles and rockets. These processes have produced chemical wastes since operations began in the early-1940s.

RSA-311 is located in Test Area 10 in the southeastern portion of RSA. RSA-311 consists of three non-contiguous areas (two interior concrete pits within the former Building 7352, exterior Sump 1, and exterior Sumps 2 and 3). The sumps drain two southern bays in Building 7352. The administrative site boundary for RSA-311 is approximately 3,490 ft^2.

The former Building 7352, built in 1989, was 5,464 ft^2 and consisted of the northern portion, southern portion, and exterior process units.

Northern portion:

- A northern bay (Truck Ramp Bay) with an interior concrete pit (Pit 1) that was 8 ft^2 and 8 feet deep with a 1-ft^2 by 1-foot-deep recessed sump. Mixing and casting equipment and tools were received from nearby propellant and mixing facilities at the truck ramp. Smaller equipment stayed in this room for cleaning above the grate-covered containment pit.
- A center bay with an interior concrete pit (Impoundment Tank [Pit 2]) that measured 36 by 16 feet and was 3.5 feet deep. Large equipment was transferred from the Pit 1 area into the Pit 2 area for high-pressure washing above the steel grate-covered containment pit. Two recessed sumps (approximately 2- ft^2 by 1-foot-deep sumps) were located on the eastern side of the impoundment tank where wastewater was pumped to the wastewater treatment system located above the pit on the steel-grate floor. The wastewater treatment system had two influent tanks and six carbon columns positioned on the metal grate floor.

The pits in the northern and center bay were connected by a 6-inch-deep pipe trench used for pumping water between pits.

Southern portion:

- Three smaller bays (Bay 1, Bay 2, and Bay 3) with Bays 1 and 2 having a floor trench drain that flowed to exterior sumps. Bays 1 and 2 were used as the final cleaning stage for large components and for small equipment and parts. Bay 3 was used as a storage room.

Exterior process units:

- Three exterior sumps
  - Two sumps (Sump 2 and Sump 3), located on the eastern side of the building, received drainage from southern Bay 1.
  - One sump (Sump 1), located on the western side of the building, received drainage from southern Bay 2.

The sumps measured approximately 5 by 10 feet and were 4 feet deep. The sumps were built to contain water and did not have drains or outlets to the soil.

Building 7352 was originally constructed for use as a bowl and wastewater cleanup facility for equipment and tools used in propellant mixing and casting operations at nearby facilities. The three bays in the southern portion of the building were used for large component cleaning, small parts cleaning, and equipment storage between 1989 and 1995. The two interior trench drains in the southern portion of Building 7352 were designed to capture floor washings and spills from Bays 1 and 2. The trench drains are recessed into the floor and connected to the exterior captive sumps located on the eastern and western sides of the building.

Decontamination of Building 7352 began in 1995, and acceptance inspection was signed in April 1996. The building was inspected during the ADEM visual site inspection in 2008.

Beginning in 2009, the southern bays were used for a missile recycling program Feasibility Study (FS). The process used anhydrous ammonia to dissolve explosives, energetics, and propellants and to remove the materials from the missile housings. Wastes from operations were stored at RSA-136b. It is unknown if any releases of hazardous constituents from the trench or sump occurred.

On May 10, 2010, an explosion occurred at Building 7352 when workers were working on a new process to separate ammonium perchlorate from other components in the missile fuel. The explosion killed two workers and injured a third. The accident resulted in damage to Bay 1.

The RSA-136b treatment, storage, and disposal facility is located east of Building 7352 and was used to store propellant wastes. ADEM recommended no further action in 2008.

Building 7352 and the associated sumps and pits were demolished from July to September 2019. Based on information provided by RSA personnel on April 14, 2020 (U.S. Army Garrison-Redstone 2020), operating equipment used in processes conducted in the former Building 7352 that were determined to have residual energetics were taken to the Open Burn/Open Detonation area for thermal treatment. Following removal of operating equipment, the building structure was reflashed to remove any potentially remaining energetics prior to demolition. Water in pits/sumps was pumped to the industrial sewer after sample results were non-detect for energetics and lead. Steel removed during demolition was taken to metal recyclers and concrete (including sumps and pits) was taken to the Construction and Demolition Landfill for disposition.

3.0 INVESTIGATIVE HISTORY AND INTERIM REMEDIAL ACTIONS

Environmental investigations were formally initiated at RSA-311 in 1996. This section describes the data collection performed under previous studies at RSA-311 and those efforts conducted in support of the current RFI (APTIM 2020). The following investigations were conducted at RSA-311:

- Phase I Environmental Baseline Study (Conestoga-Rovers & Associates 1996)
- RARE North Plant Phase II Environmental Baseline Survey (CH2M Hill 1998)
- Operable Unit (OU) 10 Phase II Field Investigations (IT 2002)
- Potential Source Area Investigation (Shaw 2005)
- ADEM RCRA Facility Assessment (RFA) (ADEM 2008)
- SWMU Assessment (Shaw 2009a)
- Rev 1 RFI for RSA-146 Groundwater Site (CB&I 2015)
- Rev 1 RFI for RSA-206, Propellent Mixing Facility #2 and Casting Facility (CB&I 2016)
- Rev 2 RFI for RSA-311 (CB&I 2017)
- Rev 4 RFI for RSA-311 (APTIM 2020).

4.0 SCOPE OF THE CORRECTIVE MEASURES FOR RSA-311

The overall strategy for cleanup at RSA has been presented to the regulators in two cleanup strategy documents: the Installation-Wide Groundwater (IWGW) Cleanup Strategy (Shaw 2009b) and the Installation-Wide Strategy for Cleanup of Impacted Wetlands (Shaw 2010). The overall RSA cleanup strategy includes the following elements:

- Expedite evaluation and release of surface media sites to allow for efficient, mission-related property reuse.
- Expedite cleanup of sources area at surface media sites and secondary sources of ongoing groundwater contamination, including dense, nonaqueous phase liquid.
- At SWMUs without approved decision documents, exposures to surface media will be managed through the use of the Army's Site Access Control (SAC) program, and exposure to groundwater that may result in unacceptable risks will be prevented or managed as required by RSA's IWGW Interim Record of Decision (IROD) (Shaw 2007).
- Coordinate the evaluation of groundwater units and their associated surface sites so that approval of groundwater RFIs is not delayed by unresolved surface media site issues.
- Design and implement an installation-wide monitoring network to monitor remedial progress and ensure that the selected remedies are protective of human health and the environment on a long-term basis.

The media and contaminant scope covered by the corrective measures at RSA-311 are limited to two volatile organic compounds (VOCs) (trichloroethene [TCE] and vinyl chloride [VC]); three explosive compounds (2-nitrotoluene, 2,6-dinitrotoluene [DNT], 1,3,5 trinitro-1,3,5-triazine [RDX]); and perchlorate in groundwater. Exposure to soil does not result in unacceptable health threats to human health or ecological receptors. Groundwater contaminants would pose unacceptable risk to potable users, including a construction worker, a commercial worker, and a hypothetical residential receptor, both now and in the future. Potable groundwater use at this site is precluded now and in the future. Non-potable uses are managed by RSA's SAC program according to the terms of the IWGW IROD (Shaw 2007). The Army has elected to perform corrective measures to address groundwater contamination:

- MNA would be implemented to track all chemicals of concern (COCs) (TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate) in groundwater until cleanup goals (CGs) were attained. Groundwater monitoring and reporting would be conducted for 8 consecutive years to verify that concentrations remain below CGs for 3 consecutive years.

5.0 SITE CHARACTERISTICS

RSA-311, Exterior Sumps and Interior Concrete Pits at Building 7352, OU 9, is located in the southeastern portion of RSA, northwest of the intersection of Flicker Road and Swallow Road. The site occupies approximately 3,490 ft^2. RSA-311 consists of three exterior covered sumps and two interior concrete pits associated with Building 7352. Building 7352 was originally used as a bowl and wastewater cleanup facility for equipment and tools used in propellant mixing and casting operations at nearby facilities. Beginning in 2009, the southern bays were used for a missile recycling program FS. On May 10, 2010, an explosion occurred at Building 7352. Topography at the site is flat, with little relief, and lies at 566 feet above mean sea level. The native soils beneath RSA-311 consist predominantly of medium- to high-plasticity clay with trace to small amounts of silt and fine-grained sand. The thickness of the overburden ranges from approximately 8 to 28 feet below ground surface (bgs). The average depth to bedrock is approximately 14 feet bgs. Stormwater drainage at the site is controlled by ephemeral unlined ditches. No perennial surface water features are associated with the site. The site is within the 100-year floodplain. Groundwater beneath RSA-311 occurs in the unconsolidated overburden and the upper portion of the carbonate bedrock. The overburden and upper bedrock comprise a single interconnected, unconfined water table aquifer.

A conceptual site model (CSM) was developed for RSA-311 based on historical operations, available site information, and available soil and groundwater data. The potential release locations and potential contaminants for soil and groundwater include releases from the cleaning of casting bowls and other equipment as well as materials (primarily ammonium perchlorate) released as a result of the 2010 explosion. Potential contaminants include VOCs, such as solvents; semivolatile organic compounds (SVOCs), such as petroleum, oil, and lubricants; metals; explosive compounds; and perchlorate. The potential exists for the pits and sumps to have received hazardous constituents from historical operations and released to the environment from leaks or overflows.

6.0 INVESTIGATIVE RESULTS

A complete discussion of the previous site investigations is available in the Rev 4 RFI Report (APTIM 2020) and within Section 2.0 of the CMI Work Plan. Twenty-three discrete and 2 multiple incremental surface soil samples, 25 subsurface soil samples, and 26 groundwater samples were collected during the RFI phase. Soil and groundwater samples were analyzed for metals, VOCs, SVOCs with low-level polynuclear aromatic hydrocarbons (PAHs), perchlorate, and explosives. The RFI concluded that exposure to RSA-311 soils poses no unacceptable health risk to any of the receptors evaluated herein under commercial/industrial or residential site use. Groundwater is contaminated with TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate, which have been identified as COCs that pose a threat if groundwater is developed as a potable source.

A summary of the contaminant fate and transport evaluation for TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate is presented below. COCs in site wells are summarized in Table 1 of the CMI Work Plan.

6.1 Metals

Per the Rev 4 RFI, all metals detected in soil and groundwater were determined to be background related. Therefore, no metals were determined to represent COCs requiring additional consideration within this CMS.

6.2 VOCs

No VOCs were detected at concentrations above the regional screening levels (RSLs) or RSA-specific dilution-attenuation factor (DAF)4 soil screening levels (SSLs) or TCE leachate test-based SSL in any surface or subsurface soil sample collected from RSA-311. However, TCE and VC were detected in shallow groundwater at concentrations exceeding the ADEM RSLs:

- In the most recent groundwater data set, TCE exceeded the RSL (5 micrograms per liter [µg/L]) in well 311-RS2789 at a concentration of 22 µg/L (January 21, 2016). TCE was not detected in any of the other eight wells sampled in January 2016. Previous sampling results showed TCE concentrations above the RSL in well 311-RS2398 (8.33 µg/L in April 2014) and in well K136b-RS673 (5.83 and 159 µg/L in April and May 2014, respectively).
- VC exceeded the RSL (2 µg/L) in well 311-RS2854 at a concentration of 4.39 µg/L in the initial sample collected from this well (December 14, 2016). No confirmation sampling results are available.

6.3 SVOCs

SVOCs were not detected in surface soil, and concentrations of SVOCs in subsurface soil were below the RSLs. One concentration of dibenz(a,h)anthracene in one groundwater sample was above the RSL during the May 2014 sampling event, but dibenz(a,h)anthracene was not detected during the previous sampling event in April 2014.

6.4 Perchlorate

No perchlorate ADEM RSL exceedances were reported in surface and subsurface soil samples analyzed from the RSA-311 site. In the most recent groundwater data (December 2016), perchlorate was detected in three sample locations (RSP-1802, RSP-1802a, and 311-RS2636) above the ADEM RSL. The groundwater exceedances at RSP-1802 and RSP-1802a are believed to be from historical propellant processing plant activities conducted throughout this region of RSA. The perchlorate concentrations in 311-RS2636 have been declining since April 2014. The most recent data from December 2016 demonstrate that the occurrence of perchlorate greater than the ADEM RSL is bounded in all directions.

6.5 Explosives

Explosives compounds were not detected in surface or subsurface soil samples. Only one explosive compound, nitroglycerin, in well 311-RS2399 was detected above the ADEM RSL in the most recent groundwater data (2016 or 2019 depending on the well). This lone ADEM RSL exceedance is delineated by wells located in all compass directions away from 311-RS2399. Explosives compounds were also detected at concentrations exceeding ADEM RSLs in sample location 311-RS2902 and RSP-1802 that do not directly monitor the RSA-311 site and would be representative of explosives originating from other locations associated with the historical propellent processing operations in this area of RSA, including RSA-206N to the northeast and RSA-206S to the southeast. Spring location RSP-1802 integrates

groundwater from a wide area that includes sites surrounding RSA-311. Due to its cross-gradient location, the explosives compounds in 311-RS2902 are likely unrelated to contaminants associated with RSA-311.

Prior to 2016, 1,3-dinitrobenzene (DNB), 2-6-DNT, 2-nitrotoluene, 3-nitrotoluene, nitrobenzene, nitroglycerin, and RDX were detected at concentrations above their ADEM RSLs in monitoring wells 311-RS2636, 311-RS2396, 311-RS2397, 311-RS2398, 311-RS2399, and 311-RS2853 (APTIM 2020).

6.6 Sump and Pit Liquid Waste

Liquid waste samples collected from two interior concrete pits and three external sumps at RSA-311 contained concentrations of metals (antimony, arsenic, and lead) that exceeded groundwater background screening values (BSVs) and leachate screening values derived from ADEM RSLs. RDX and perchlorate were detected at concentrations above their leachate screening values in one waste sample from one pit. No VOCs or SVOCs were detected at concentrations that exceeded their leachate screening values. No results exceeded associated toxicity characteristic leaching procedure (TCLP) values; therefore, this liquid does not have the characteristics of a hazardous waste. Sumps were cleaned out frequently as part of the maintenance performed by the site landlord. The sump and sump contents were removed as part of the Building 7352 demolition completed in 2019.

6.7 Fate and Transport

Contaminant fate and transport are dictated by the physical and chemical characteristics of site-related contaminants. The most significant potential contaminant migration pathway at RSA-311 is the dissolution of site-related chemicals from soil to form leachate and subsequent transport to the groundwater table resulting from the downward percolation of infiltrating rainfall. A contaminant migration assessment was conducted for RSA-311. Because chemical of potential concern (COPC) concentrations (individual sample or average borehole) in surface and subsurface soil are below DAF4 SSLs or leachate-based SSLs, and in the case of perchlorate, synthetic precipitation leaching procedures (SPLP) results are below the leachate threshold value, COPCs in soil do not represent a leaching threat from soil to groundwater.

7.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCES USE

RSA-311 is located in the southeastern portion of RSA in an area designated as Industrial in the RSA Master Plan. Current land use is designated as Manufacturing and Production and future land use has been designated as Research, Development, Testing, Evaluation, and Training.

It is not anticipated that RSA-311 will be developed for residential use. Although risk regulations, policy, and guidance are to only evaluate those receptors that are at a site or that could reasonably be anticipated to occur, the risk assessment includes a residential use scenario to comply with Alabama Environmental Investigation and Remediation Guidance (AEIRG) and Alabama Risk-Based Corrective Action (ARBCA) guidance. RSA is legally mandated to comply with the AHWMMA. In RSA's AHWMMA permit, ADEM requires that these guidance documents including approved risk assessment work plans (IT 2002, Shaw 2010) be adhered to during environmental investigations and evaluations. At RSA, the residential scenario is included in the risk assessment only to determine if a site is eligible for unrestricted use as defined in AAC 335-5-1-.03(r), or to support the use of land use controls (LUCs) as a component of the selected remedy. Therefore, risks to a residential receptor were assessed in the Rev 4 RFI Report (APTIM 2020).

There is no current potable use of groundwater at RSA-311, and development of groundwater as a potable source is precluded by the terms of the IWGW IROD (Shaw 2007). Nevertheless, the exposure to groundwater hypothetically developed as a potable source was evaluated in the Rev 4 RFI Report (APTIM 2020).

8.0 SITE RISKS

An ARBCA evaluation for human health and an ecological risk evaluation were performed for RSA-311 in accordance with the ARBCA Guidance Manual (ADEM 2017) as part of the Rev. 4 RFI Report (APTIM 2020). The complete ARBCA evaluation for human health and the ecological risk evaluation are provided in the Rev. 4 RFI Report (APTIM 2020).

8.1 Human Health Risk Assessment

The human health risk assessment for RSA-311 was prepared and presented in the Rev 4 RFI Report (APTIM 2020) in accordance with the ARBCA guidance (ADEM 2008). It consists of a three-tiered process: the preliminary screening level (PSL) evaluation (Tier 1); the Risk Management (RM)-1 evaluation (Tier 2); and the RM-2 evaluation (Tier 3). In the case of RSA-311, the RM-1 evaluation was not performed; instead, the evaluation proceeded directly from the PSL evaluation to the cumulative risk assessment in the RM-2 evaluation.

The PSL evaluation consists of a simple comparison of site concentrations with ADEM RSLs. In the case of soil, the RSLs generally were the U.S. Environmental Protection Agency (USEPA) (2018) RSLs for residential soil, based on the lower of an individual excess lifetime cancer risk (IELCR) of 1E-6 and a non-cancer hazard index (HI) of 0.1. In the case of groundwater, maximum contaminant limits (MCLs) were used as the RSLs, if available (USEPA 2018). Otherwise, tap water RSLs (USEPA 2018) were used. Residential RSLs were selected for the evaluation of this site to consider alternatives to attain unrestricted land use.

The PSL evaluation is conducted for all chemicals that are determined to be site related. Inorganics with maximum detected concentrations (MDCs) that do not exceed their BSVs or are shown in a site-to-background evaluation to be naturally occurring are judged not to be site related and are not evaluated further. All other detected chemicals are initially identified as COPCs, and site concentrations are compared to ADEM RSLs in the PSL evaluation. A COPC is identified as a COC if the MDC is greater than the ADEM RSL.

A screening-level vapor intrusion evaluation was conducted for this site. It was concluded that VOCs in soil and groundwater at RSA-311 do not represent a source that would pose an unacceptable health threat to occupants of current or future buildings at the site.

The soil and groundwater COCs identified in the PSL evaluation were brought forward for evaluation in the cumulative risk assessment (RM-2 evaluation). Receptor scenarios evaluated in the cumulative risk assessment included a commercial worker, a construction worker, and a hypothetical residential receptor. A hypothetical future residential receptor was evaluated as required by ADEM (ADEM 2017) to evaluate future use without restrictions and determine whether remedial measures and/or LUCs are warranted to achieve no further action status.

Groundwater was evaluated as if it were developed as a source of potable water in the future. Risks from exposure to groundwater were assessed even though groundwater use at this site is precluded now and in the future, and non-potable uses are managed because of RSA's SAC program (U.S. Army Garrison-Redstone 2012) and because of the terms of the IWGW IROD (Shaw 2007).

The ARBCA guidance considers an IELCR of 1E-05 to be the target cumulative risk. The target cumulative non-cancer hazard is an HI of 1.0. Estimated cumulative risks/hazards at or below these targets do not require additional action.

Cumulative IELCR and HI estimates for all receptor scenarios are summarized in Table 2 in the CMI Work Plan. No risk or hazard estimates were completed for soil exposures, as no COCs were identified in soil in the PSL evaluation. For groundwater, the cumulative IELCR estimate for the construction worker is

less than 1E-05; however, the IELCR is greater than 1E-05 for the hypothetical resident and the commercial worker. The cumulative HI for groundwater exceeded 1.0 for all receptors.

Table 3 in the CMI Work Plan summarizes the RM-2 evaluation of human health for RSA-311. It shows the relevant COCs identified through the ARBCA evaluation that require action. As shown in Table 3, no relevant COCs were identified in soil. Perchlorate, 2,6-DNT, 2-nitrotoluene, RDX, TCE, and VC were identified as relevant groundwater COCs for the residential receptor. No unacceptable risks/hazards were associated with 1,3-DNB, 3-nitrotoluene, nitrobenzene, nitroglycerin, and pentaerythritol tetranitrate (PETN); however, the historical concentrations of these chemicals exceeded the ADEM RSLs. Therefore, these chemicals are also included in the CMS evaluation only for monitoring purposes.

8.2 Screening-Level Ecological Risk Assessment

A screening-level ecological risk assessment was completed for RSA-311 as part of the Rev 4 RFI Report (APTIM 2020). The surface soil data for this site were compared to relevant BSVs and ecological screening values. A weight-of-evidence evaluation was completed to further evaluate the constituents identified in the initial screening and examined numerous lines of evidence to draw conclusions as to whether site-related constituents have the potential to pose hazards to ecological receptors.

The chemicals of potential ecological concern (COPECs) refinement process concluded that no further evaluation was warranted for the perchlorate, calcium, chromium, magnesium, manganese, mercury, and selenium in surface soil at RSA-311. The weight-of-evidence evaluation concluded that all metals detected in the RSA-311 samples were likely to be naturally occurring or essential nutrients. It was also concluded that perchlorate does not require further evaluation because it is not bioaccumulative.

Based on the results of the screening evaluation and COPEC refinement, the RFI concluded COPECs in surface soil are unlikely to pose hazards to ecological receptors, communities, and/or populations, and further evaluation of ecological hazards at RSA-311 is not warranted.

9.0 CORRECTIVE MEASURE OBJECTIVES

Based on the results of the RFI (APTIM 2020), the Corrective Measures Objective (CMO) for RSA-311 is to reduce or prevent human exposure to groundwater used for potable purposes contaminated with COCs requiring action such that regulatory limits are achieved, or no unacceptable hazard or risk is present.

While the above is the overarching goal, the Army has additional objectives that will be considered in the selection of corrective measures, in particular, because it is recognized that the achievement of the above goal may require an extended period of time. These additional objectives are oriented toward the selection of corrective measures that will reduce, to the extent feasible, the time to achieve the above objective. The additional objectives that were considered in the development and selection of corrective measures are as follows:

- Reduce contaminant mass (through source reduction)
- Minimize the footprint of contamination (plumes)
- Minimize life-cycle costs associated with long-term monitoring and maintaining institutional controls (e.g., SAC program).

The corrective measure objective for RSA-311 will be accomplished by MNA of groundwater for TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate and ongoing implementation of existing administrative controls for groundwater to protect potential receptors until CGs are attained for the COCs in groundwater.

The Army intends to achieve site closure for groundwater and protect human health through implementation of corrective measures that are needed to reduce the concentrations of COCs requiring action to the CGs. For relevant COCs in groundwater with MCLs, the MCLs are selected as the CGs (TCE and VC). In the case of perchlorate, the health advisory level (HAL) of 15 µg/L (DoD 2009) is used as the CG. For the other groundwater COCs requiring action, the CGs are based on risk, with the objective of achieving a cumulative cancer risk of 1E-05 and a cumulative HI of 1.0 or less.

10.0 DESCRIPTION AND COMPARISON OF ALTERNATIVES

The following information summarizes the analysis of technologies and alternatives and the selection of the corrective measures for RSA-311. Considering the limited area of the site and the relatively low COC concentrations detected in the subsurface soil and groundwater, alternatives to address these COCs were developed.

The following process options were evaluated for alternative development to meet the CMOs for the groundwater COCs at RSA-311:

- Alternative 1: No Action – Evaluation of the no action alternative will serve as a baseline for evaluating other corrective measures.
- Alternative 2: MNA – Alternative 2 involves documenting the passive reduction in the COC concentrations via natural attenuation. MNA would be implemented to track COC trends in groundwater until CGs were attained. Groundwater monitoring and reporting would be conducted for 8 years to verify that concentrations remain below CGs.

11.0 SELECTED CORRECTIVE MEASURE

Alternative 2, MNA, most appropriately addresses the contaminated groundwater at RSA-311. This alternative involves documenting the passive reduction in the COC concentrations via natural attenuation. MNA would be implemented to track COC trends in groundwater until CGs were attained.

The major components of the corrective measures in Alternative 2 include the following:

- Development of a Corrective Measures Implementation Plan (CMIP)
- Procurement
- Baseline groundwater sampling of 10 onsite overburden monitoring wells, which are part of the proposed MNA monitoring plan at RSA-311 and reporting
- Quarterly groundwater sampling of 10 wells and annual reporting in Year 1
- Semiannual groundwater sampling of 10 wells and annual reporting in Years 2 and 3
- Annual groundwater sampling of 10 wells and annual reporting in Years 4 through 8
- Closure of 10 overburden monitoring wells, following ADEM acceptance that site remediation goals have been met.

12.0 PUBLIC PARTICIPATION

Public participation requirements specified under AAC 335-14-8-.08(6) will be met during the permit modification process for the RSA-311 corrective measures.

13.0 REFERENCES

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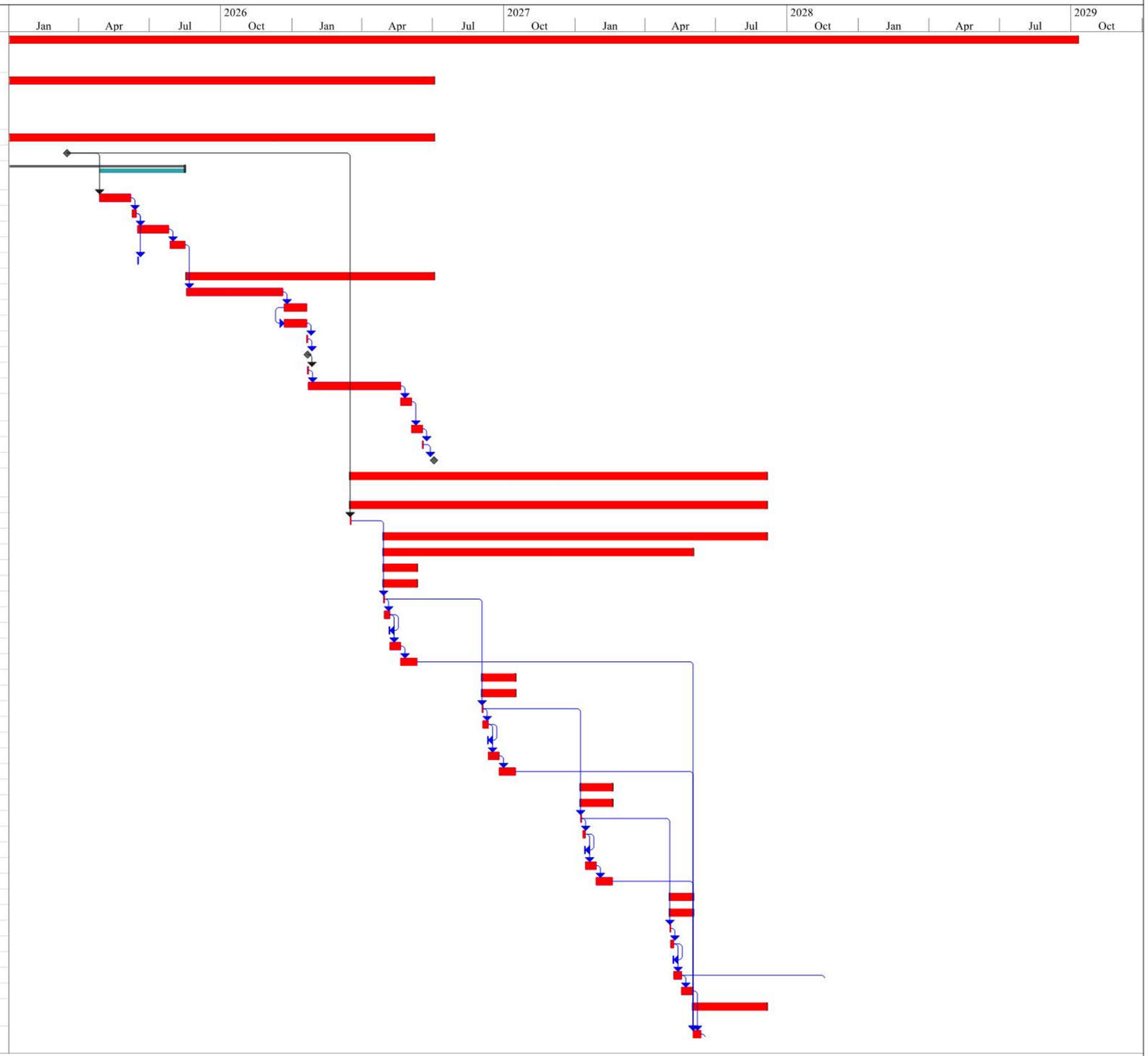
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APPENDIX C

CORRECTIVE MEASURES IMPLEMENTATION SCHEDULE

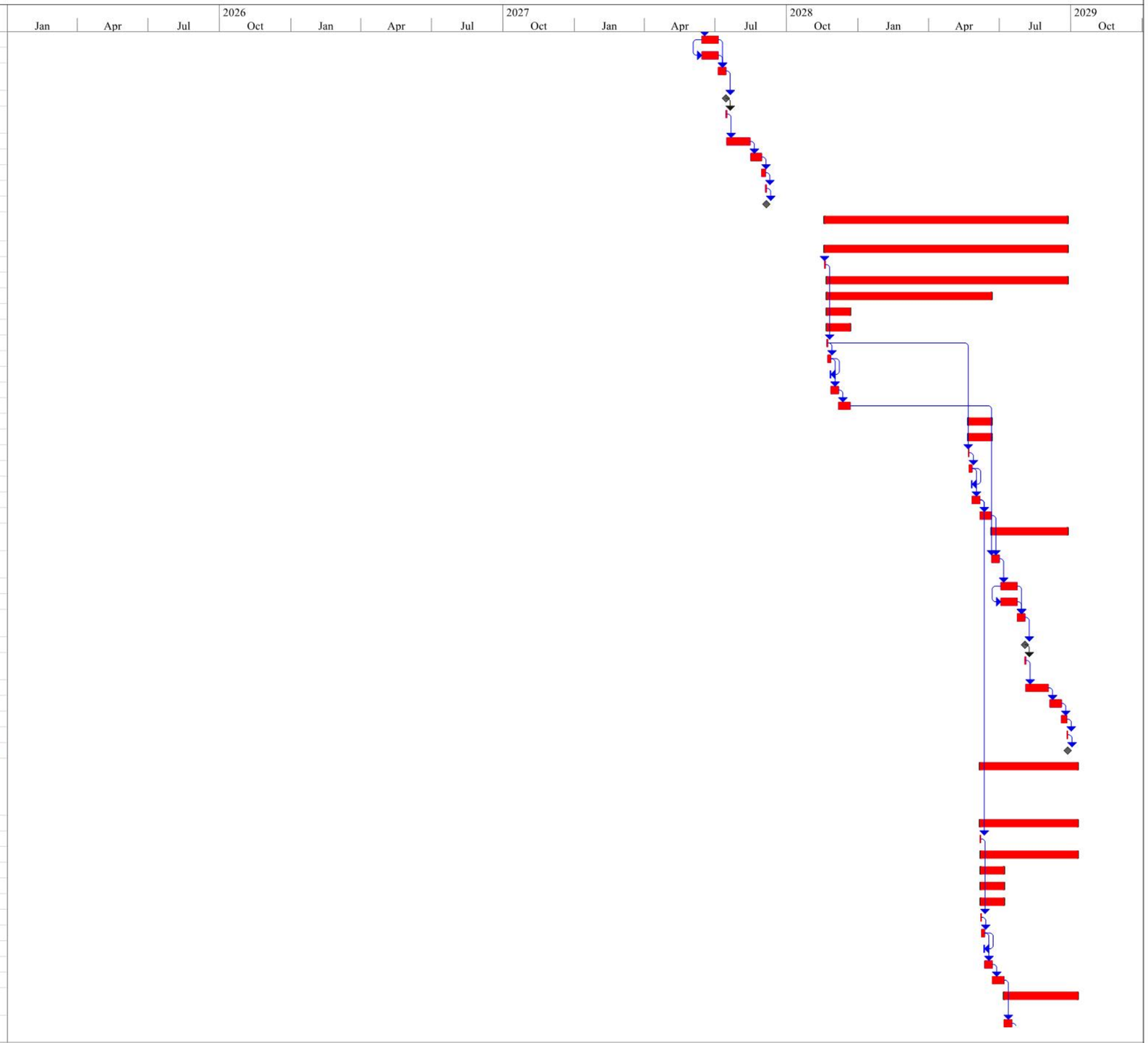
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ID	Task Name	Duration	Start	Finish
1	**Environmental Remediation Multiple Award Indefinite Delivery Indefinite Quantity (IDIQ) Contract Redstone Arsenal, AL**	**2148 days**	**Fri 1/15/21**	**Mon 10/9/28**
861	**CLIN 0022 - Achieve Corrective Measures Implementation – Construction (CMI-C) and Corrective Measures Implementation Report (CMIR) for Site RSA-311- Option Year Zero**	**1395 days**	**Fri 1/15/21**	**Thu 7/2/26**
862	**RSA-311**	**1395 days**	**Fri 1/15/21**	**Thu 7/2/26**
863	Notice to Proceed	0 days	Mon 3/17/25	Mon 3/17/25
864	**Corrective Measures Implementation – Construction (CMI-C) - Field Work**	**1166 days**	**Fri 1/15/21**	**Fri 8/15/25**
865	Subcontractor Procurement	30 days	Mon 4/28/25	Fri 6/6/25
866	Baseline Groundwater Sampling	5 days	Mon 6/9/25	Fri 6/13/25
867	Laboratory Analysis	30 days	Mon 6/16/25	Fri 7/25/25
868	Data Validation	15 days	Mon 7/28/25	Fri 8/15/25
869	Demobilization	1 day	Mon 6/16/25	Mon 6/16/25
870	**Corrective Measures Implementation Report (CMIR)**	**229 days**	**Mon 8/18/25**	**Thu 7/2/26**
871	Prepare and Develop Draft CMIR	90 days	Mon 8/18/25	Fri 12/19/25
872	Army Review of Draft CMIR	21 days	Mon 12/22/25	Mon 1/19/26
873	OPSEC Review of Draft CMIR	21 days	Mon 12/22/25	Mon 1/19/26
874	Respond to Army Comments on Draft CMIR	1 day	Tue 1/20/26	Tue 1/20/26
875	Army approve of Draft CMIR	0 days	Tue 1/20/26	Tue 1/20/26
876	Submit Draft Final CMIR to ADEM / EPA	1 day	Wed 1/21/26	Wed 1/21/26
877	ADEM / EPA Review of Draft Final CMIR	85 days	Thu 1/22/26	Wed 5/20/26
878	Develop response to ADEM / EPA Comments on Draft Final CMIR	10 days	Thu 5/21/26	Wed 6/3/26
879	Army Review of RTCs	10 days	Thu 6/4/26	Wed 6/17/26
880	Submit Final (Revision 1) CMIR	1 day	Thu 6/18/26	Thu 6/18/26
881	ADEM / EPA Approval of Final (Revision 1) CMIR	0 days	Thu 7/2/26	Thu 7/2/26
1071	**Achieve Corrective Measures Implementation – Operations (CMI-O) Option Year 1 for site RSA-311**	**430 days**	**Tue 3/17/26**	**Sat 9/4/27**
1072	**RSA-311**	**430 days**	**Tue 3/17/26**	**Sat 9/4/27**
1073	Notice to Proceed	1 day	Tue 3/17/26	Tue 3/17/26
1074	**CMI-O Field Work**	**399 days**	**Wed 4/29/26**	**Sat 9/4/27**
1075	**Quarterly Sampling and Reporting**	**304 days**	**Wed 4/29/26**	**Tue 6/1/27**
1076	**Quarterly Groundwater Sampling Event 1**	**31 days**	**Wed 4/29/26**	**Wed 6/10/26**
1077	**Field Work**	**31 days**	**Wed 4/29/26**	**Wed 6/10/26**
1078	Mobilization	1 day	Wed 4/29/26	Wed 4/29/26
1079	Groundwater Monitoring	5 days	Thu 4/30/26	Wed 5/6/26
1080	Demobilization	1 day	Wed 5/6/26	Wed 5/6/26
1081	Laboratory Analysis	10 days	Thu 5/7/26	Wed 5/20/26
1082	Data Validation	15 days	Thu 5/21/26	Wed 6/10/26
1083	**Quarterly Groundwater Sampling Event 2**	**31 days**	**Thu 9/3/26**	**Thu 10/15/26**
1084	**Field Work**	**31 days**	**Thu 9/3/26**	**Thu 10/15/26**
1085	Mobilization	1 day	Thu 9/3/26	Thu 9/3/26
1086	Groundwater Monitoring	5 days	Fri 9/4/26	Thu 9/10/26
1087	Demobilization	1 day	Thu 9/10/26	Thu 9/10/26
1088	Laboratory Analysis	10 days	Fri 9/11/26	Thu 9/24/26
1089	Data Validation	15 days	Fri 9/25/26	Thu 10/15/26
1090	**Quarterly Groundwater Sampling Event 3**	**29 days**	**Fri 1/8/27**	**Wed 2/17/27**
1091	**Field Work**	**29 days**	**Fri 1/8/27**	**Wed 2/17/27**
1092	Mobilization	1 day	Fri 1/8/27	Fri 1/8/27
1093	Groundwater Monitoring	3 days	Mon 1/11/27	Wed 1/13/27
1094	Demobilization	1 day	Wed 1/13/27	Wed 1/13/27
1095	Laboratory Analysis	10 days	Thu 1/14/27	Wed 1/27/27
1096	Data Validation	15 days	Thu 1/28/27	Wed 2/17/27
1097	**Quarterly Groundwater Sampling Event 4**	**30 days**	**Mon 5/3/27**	**Tue 6/1/27**
1098	**Field Work**	**30 days**	**Mon 5/3/27**	**Tue 6/1/27**
1099	Mobilization	1 day	Mon 5/3/27	Mon 5/3/27
1100	Groundwater Monitoring	4 days	Tue 5/4/27	Fri 5/7/27
1101	Demobilization	1 day	Fri 5/7/27	Fri 5/7/27
1102	Laboratory Analysis	10 days	Sat 5/8/27	Mon 5/17/27
1103	Data Validation	15 days	Tue 5/18/27	Tue 6/1/27
1104	**Annual Corrective Measures Implementation Operations (CMI-O) Report**	**95 days**	**Wed 6/2/27**	**Sat 9/4/27**
1105	Prepare and Develop Draft Annual CMI-O Report	10 days	Wed 6/2/27	Fri 6/11/27



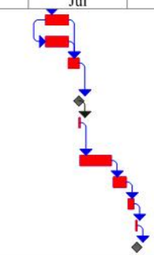
Project duration is displayed in working days
Critical path activities are displayed as red bars

ID	Task Name	Duration	Start	Finish
1106	Army Review of Draft Annual CMI-O Report	21 days	Mon 6/14/27	Sun 7/4/27
1107	OPSEC Review of Draft Annual CMI-O Report	21 days	Mon 6/14/27	Sun 7/4/27
1108	Respond to Army Comments on Draft Annual CMI-O Report	10 days	Mon 7/5/27	Wed 7/14/27
1109	Army approval of Draft CMI-O Report	0 days	Wed 7/14/27	Wed 7/14/27
1110	Submit Draft Final Annual CMI-O Report to ADEM / EPA	1 day	Thu 7/15/27	Thu 7/15/27
1111	ADEM Review of Draft Final CMI-O Report	30 days	Fri 7/16/27	Sat 8/14/27
1112	Prepare Responses to ADEM comments	14 days	Mon 8/16/27	Sun 8/29/27
1113	Army review of RTCs	5 days	Mon 8/30/27	Fri 9/3/27
1114	Submit Final CMI-O Report	1 day	Sat 9/4/27	Sat 9/4/27
1115	ADEM approval of Final annual Report	0 days	Sat 9/4/27	Sat 9/4/27
1116	**Achieve Corrective Measures Implementation – Operations (CMI-O) Option Year 2 and 3 for site RSA-311**	**313 days**	**Fri 11/19/27**	**Tue 9/26/28**
1117	**RSA-311**	**313 days**	**Fri 11/19/27**	**Tue 9/26/28**
1118	Notice to Proceed	1 day	Fri 11/19/27	Fri 11/19/27
1119	**CMI-O Field Work**	**310 days**	**Mon 11/22/27**	**Tue 9/26/28**
1120	**Semi-Annual Sampling and Reporting**	**212 days**	**Mon 11/22/27**	**Tue 6/20/28**
1121	**Semi-Annual Groundwater Sampling Event 1**	**30 days**	**Mon 11/22/27**	**Tue 12/21/27**
1122	**Field Work**	**30 days**	**Mon 11/22/27**	**Tue 12/21/27**
1123	Mobilization	1 day	Mon 11/22/27	Mon 11/22/27
1124	Groundwater Monitoring	4 days	Tue 11/23/27	Fri 11/26/27
1125	Demobilization	1 day	Fri 11/26/27	Fri 11/26/27
1126	Laboratory Analysis	10 days	Sat 11/27/27	Mon 12/6/27
1127	Data Validation	15 days	Tue 12/7/27	Tue 12/21/27
1128	**Semi-Annual Groundwater Sampling Event 2**	**30 days**	**Mon 5/22/28**	**Tue 6/20/28**
1129	**Field Work**	**30 days**	**Mon 5/22/28**	**Tue 6/20/28**
1130	Mobilization	1 day	Mon 5/22/28	Mon 5/22/28
1131	Groundwater Monitoring	4 days	Tue 5/23/28	Fri 5/26/28
1132	Demobilization	1 day	Fri 5/26/28	Fri 5/26/28
1133	Laboratory Analysis	10 days	Sat 5/27/28	Mon 6/5/28
1134	Data Validation	15 days	Tue 6/6/28	Tue 6/20/28
1135	**Annual Corrective Measures Implementation Operations (CMI-O) Report**	**98 days**	**Wed 6/21/28**	**Tue 9/26/28**
1136	Prepare and Develop Draft Annual CMI-O Report	10 days	Wed 6/21/28	Fri 6/30/28
1137	Army Review of Draft Annual CMI-O Report	21 days	Mon 7/3/28	Sun 7/23/28
1138	OPSEC Review of Draft Annual CMI-O Report	21 days	Mon 7/3/28	Sun 7/23/28
1139	Respond to Army Comments on Draft Annual CMI-O Report	10 days	Mon 7/24/28	Wed 8/2/28
1140	Army approval of Draft CMI-O Report	0 days	Wed 8/2/28	Wed 8/2/28
1141	Submit Draft Final Annual CMI-O Report to ADEM / EPA	1 day	Thu 8/3/28	Thu 8/3/28
1142	ADEM Review of Draft Final CMI-O Report	29 days	Fri 8/4/28	Fri 9/1/28
1143	Prepare Responses to ADEM comments	15 days	Mon 9/4/28	Mon 9/18/28
1144	Army review of RTCs	7 days	Tue 9/19/28	Mon 9/25/28
1145	Submit Final CMI-O Report	1 day	Tue 9/26/28	Tue 9/26/28
1146	ADEM approval of Final annual Report	0 days	Tue 9/26/28	Tue 9/26/28
1147	**Achieve Corrective Measures Implementation – Operations (CMI-O) Option Years 4 to 8 for site RSA-311, only dates for year 4, subsequent years will have same durations)**	**126 days**	**Tue 6/6/28**	**Mon 10/9/28**
1148	**RSA-311**	**126 days**	**Tue 6/6/28**	**Mon 10/9/28**
1149	Notice to Proceed	1 day	Tue 6/6/28	Tue 6/6/28
1150	**CMI-O Field Work**	**125 days**	**Wed 6/7/28**	**Mon 10/9/28**
1151	**Annual Groundwater Sampling and Reporting**	**30 days**	**Wed 6/7/28**	**Thu 7/6/28**
1152	**Annual Groundwater Sampling Event**	**30 days**	**Wed 6/7/28**	**Thu 7/6/28**
1153	**Field Work**	**30 days**	**Wed 6/7/28**	**Thu 7/6/28**
1154	Mobilization	1 day	Wed 6/7/28	Wed 6/7/28
1155	Groundwater Monitoring	4 days	Thu 6/8/28	Sun 6/11/28
1156	Demobilization	1 day	Sun 6/11/28	Sun 6/11/28
1157	Laboratory Analysis	10 days	Mon 6/12/28	Wed 6/21/28
1158	Data Validation	15 days	Thu 6/22/28	Thu 7/6/28
1159	**Annual Corrective Measures Implementation Operations (CMI-O) Report**	**95 days**	**Fri 7/7/28**	**Mon 10/9/28**
1160	Prepare and Develop Draft Annual CMI-O Report	10 days	Fri 7/7/28	Sun 7/16/28



Project duration is displayed in working days
Critical path activities are displayed as red bars

ID	Task Name	Duration	Start	Finish
1161	Army Review of Draft Annual CMI-O Report	21 days	Mon 7/17/28	Sun 8/6/28
1162	OPSEC Review of Draft Annual CMI-O Report	21 days	Mon 7/17/28	Sun 8/6/28
1163	Respond to Army Comments on Draft Annual CMI-O Report	10 days	Mon 8/7/28	Wed 8/16/28
1164	Army approval of Draft CMI-O Report	0 days	Wed 8/16/28	Wed 8/16/28
1165	Submit Draft Final Annual CMI-O Report to ADEM / EPA	1 day	Thu 8/17/28	Thu 8/17/28
1166	ADEM Review of Draft Final CMI-O Report	29 days	Fri 8/18/28	Fri 9/15/28
1167	Prepare Responses to ADEM comments	12 days	Mon 9/18/28	Fri 9/29/28
1168	Army review of RTCs	5 days	Mon 10/2/28	Fri 10/6/28
1169	Submit Final CMI-O Report	1 day	Mon 10/9/28	Mon 10/9/28
1170	ADEM approval of Final annual Report	0 days	Mon 10/9/28	Mon 10/9/28



Project duration is displayed in working days
Critical path activities are displayed as red bars

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APPENDIX D

QUALITY CONTROL PLAN

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RSA-311 PROJECT QUALITY CONTROL PLAN

ENVIRONMENTAL REMEDIATION SERVICES

REDSTONE ARSENAL

July 2023

Prepared for:

U.S. ARMY ENVIRONMENTAL COMMAND
Southeast-Environmental Service and Support Division
2455 Connell Road, Building 2266
Fort Sam Houston, TX 78234-7664

Contract No.: W9124J-18-D-0004, Delivery Order W9124J21F0045

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RSA-311 PROJECT QUALITY CONTROL PLAN

ENVIRONMENTAL REMEDIATION SERVICES REDSTONE ARSENAL

July 2023

Prepared for:

U.S. ARMY ENVIRONMENTAL COMMAND
Southeast-Environmental Service and Support Division
2455 Connell Road, Building 2266
Fort Sam Houston, TX 78234-7664

Prepared by:

ECC
9200 Church St
Suite 305
Manassas, VA 20110

Contract No.: W9124J-18-D-0004, Delivery Order W9124J21F0045

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QUALITY CONTROL PLAN

ENVIRONMENTAL REMEDIATION SERVICES AT

REDSTONE ARSENAL

W9124J-18-D-0004

I hereby certify that the enclosed Quality Control Plan (QCP) is in compliance with contract specifications and is submitted for Army approval. Once approved, the QCP will be implemented during the project W9124J-18-D-0004 execution of "*Environmental Remediation Services at Redstone Arsenal, Alabama".*

Approvals

Pamela Foti

Date: 7/20/2023

Deputy Program Manager,
Pam Foti, Certified Hazardous Materials Manager (CHMM), Project Management Professional (PMP)



Date: 06/28/2023

Quality Assurance/Quality Control Manager,
Leili Arjomand, Professional Engineer (PE), PMP,
Certified Manager of Quality/Organizational Excellence (CMQ/OE)

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ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
CHHM	Certified Hazardous Materials Manager
CMI	Corrective Measures Implementation
CMQ/OE	Certified Manager of Quality/Organizational Excellence
COC	Chain of Custody
COR	Contracting Officer's Representative
DoD	Department of Defense
DFW	Definable Feature of Work
DQCR	Daily Quality Control Report
ECC	Environmental Chemical Corporation
ERMA	Environmental Remediation Multiple Award
IDW	Investigative Derived Waste
LNAPL	Light Non-Aqueous Phase Liquid
LSP	Licensed Site Professional
LUC	Land Use Control
MEC	Munitions and Explosives of Concern
NCR	Nonconformance Report
PE	Professional Engineer
PG	Professional Geologist
PGM	Program Manager
PM	Project Manager
PMP	Project Management Professional
POD	Plan of the Day
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCM	Quality Control Manager
QCP	Quality Control Plan
QMS	Quality Management System
RSA	Redstone Arsenal
SSHP	Site Safety and Health Plan
SSHO	Site Safety and Health Officer
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency

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1.0 INTRODUCTION

Environmental Chemical Corporation (ECC) will implement a Quality Management System (QMS) to ensure all activities, products, information, data, and decisions resulting from quality-affecting activities are technically sound and defensible. The quality system and implementing procedures form the basis of ECC's QMS. The System was developed and is maintained per applicable State and Federal laws, rules, standards, guidance, contractual requirements and sound risk management practices.

The project consists of environmental services at Redstone Arsenal (RSA). The following are the definable features of work (DFWs) identified for RSA-311:

- Procurement and Subcontracting
- Mobilization/Demobilization
- Utility Marking / Dig Permits
- Vegetation Clearing
- Groundwater Monitoring
- Recordkeeping
- Decontamination
- Corrective Measures Implementation (CMI) Reporting

1.1 Quality Control Objectives

ECC's QMS consist of plans, procedures, and an organization that will produce an end product that complies with the requirements of the contract. The QMS covers all environmental operations, both on-site and off-site.

This Quality Control Plan (QCP) defines the procedures to manage and control activities of ECC personnel, subcontractors, and suppliers and to ensure that the completed project complies with all contract documents.

ECC will maintain responsibility for its work and the work of its subcontractors. To ensure compliance with contract requirements and maintain responsibility of all work performed under this deliverable, ECC will provide a continuous Three Phase Control inspection program to examine the quality of work, maintain standards of workmanship, ensure environmental quality standards of excellence, evaluate performances, identify and correct deficiencies, and provide finished work products which meet or exceed the requirements, while maintaining qualified personnel and equipment, and facilities which are necessary for the completion of the project.

The objective of this QCP is to ensure that the project activities are conducted and documented in an organized, efficient, and safe manner. This plan will define the management structure, organization, responsibilities, and authorities necessary for successful completion of the project. Performing quality work, implementing an effective quality control (QC) system and to ensure project compliance is the responsibility of all ECC staff members and subcontractors and can be achieved through a cooperative effort and commitment to quality by all program personnel.

All QC and quality assurance (QA) procedures related to sampling and analytical methods are included in the *Revision 4 Installation-Wide Quality Assurance Program Plan , U.S. Army Garrison Redstone, Madison County, Alabama*, completed by HydroGeoLogic, Inc. in 2019, and the site-specific work plans being prepared by ECC, as needed.

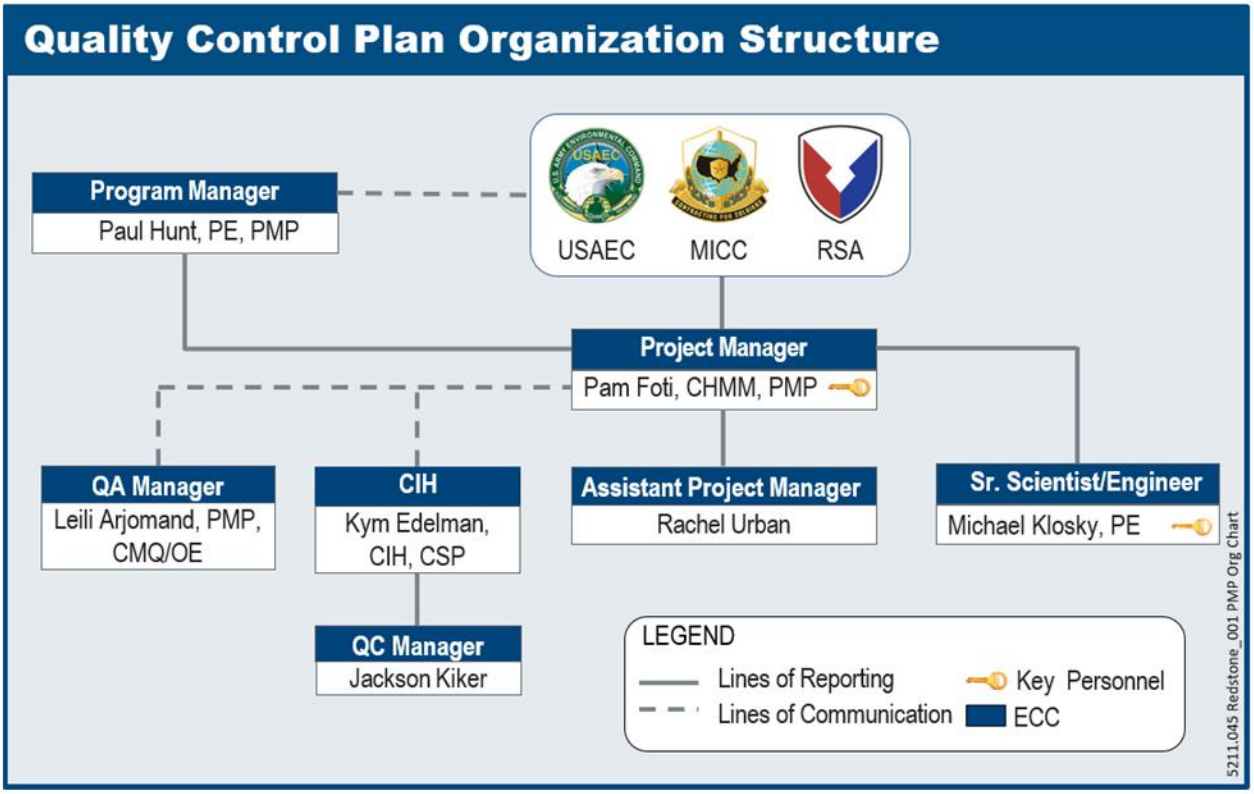
2.0 QUALITY CONTROL ORGANIZATION

The functions of the QC staff are to describe, integrate, monitor, evaluate, and document all QC practices of ECC and its subcontractors, and to ensure safety and contract compliance. The quality staff has the full support of management and has independent and delegated authority to accomplish assigned tasks, including stop work authority. The ECC quality control organizational structure, functional responsibilities, level of authority, lines of communication, and interfaces for activities affecting quality are identified and documented for assigned work tasks in the following sections.

Changes to ECC's QC staff organization requires the Army's Contracting Officer acceptance. Changes will be submitted in writing prior to the proposed change. Requests will include the names, qualifications, duties, and responsibilities of each proposed replacement.

Figure 2-1 shows the project organization chart identifying key personnel, responsibilities, and lines of authority for the QC personnel.

Figure 2-1: Quality Control Plan Organization Structure



2.1 Program Manager

The Environmental Remediation Multiple Award (ERMA) Program Manager (PGM), Mr. Paul Hunt, Professional Engineer (PE), Project Management Professional (PMP), Licensed Site Professional (LSP), is responsible for the quality of work performed by the assigned project staff. He is responsible for all operations associated with the implementation of the project and will ensure quality and schedule compliance. He will also be responsible for addressing all customer complaints and/or feedback.

2.2 Project Manger

The Project Manager (PM), Ms. Pam Foti, Certified Hazardous Materials Manager (CHMM), PMP, controls the budget and schedule with the concurrence of the PGM, ensuring the contract requirements are met. The PM is responsible for all environmental services related to the requirements of the contract and specifications, including subcontractors. The PM reports directly to the PGM and is responsible for ensuring that all project activities conform to requirements and specifications. The PM's duties also include the assignment of responsibilities for the preparation of various reports and the review of each form/report for accuracy and content. In addition to monitoring and appraising performance of staff and subcontractors, the PM has the primary responsibility of tracking any proposed changes to the contract and for the overall project and will report any proposed changes to the PGM.

2.3 Program Quality Assurance/Quality Control Manager

The Program QA/QC Manager, Ms. Leili Arjomand, PE, PMP, Certified Manager of Quality/Organizational Excellence (CMQ/OE), will have overall responsibility for the control and implementation of the approved QC program. She will be responsible for the management, training, and performance of all QC personnel and will serve as a technical resource to the QC officer and QC staff. All project QC records and activities are subject to review by the QA/QC Manger.

2.4 Quality Control Manager

The QC Manager (QCM), Mr. Jackson Kiker, is responsible for supervising all QC aspects of the project to ensure compliance with contract plans and specifications. The QCM has indirect reporting responsibilities to the PM so that the required authority and organizational freedom is provided, including sufficient independence from cost and schedule implications. The QCM has the authority to act in all QC matters for ECC. The QCM has overall responsibility and authority for the administration of all QC Program-related activities. The QCM will conduct QC project surveillances throughout the life of the project and ensure that the reporting requirements as defined in this QCP are implemented.

2.5 Site Superintendent

The Site Superintendent, Mr. Aaron Glad, reports to the PM. He will manage field operations and monitor and oversee field personnel, subcontractors, QC, and safety activities to ensure compliant work. He will host the plan of the day (POD) meetings and participate in preconstruction meetings, preparatory meetings, initial inspections, final acceptance inspections, and ensure that substandard work is corrected as soon as possible.

2.6 Field Personnel and Subcontractor

All field personnel and subcontractors will be required to adhere to the procedures set forth in this QCP. The Site Superintendent will be responsible for overall management and coordination of field personnel and subcontractors and ensuring they perform all aspects of the work in accordance with the Work Plans, the Site Safety and Health Plan (SSHP), and this QCP. The QCM will be responsible for ensuring the field personnel and subcontractors perform all aspects of the work in accordance with this QCP. The Site Safety and Health Officer (SSHO) will be responsible for ensuring the field personnel and subcontractors perform all aspects of the work in compliance with the SSHP.

3.0 MEETINGS

While performing work, ECC will take part in various meetings during which they will update the client, and when applicable, other stakeholders, on the progress, results, deviations or modifications, and recommendations for the fulfillment of the scope of work.

3.1 Coordination and Mutual Understanding Meeting

If needed, and in addition to the meetings specified in the Project Management Plan, the QCM shall meet with the Contracting Officer's Representative (COR) and/or RSA Army Environmental Coordinator or designated representative prior to the start of the site work to discuss the QC Project Plan required by this project.

During the meeting, a mutual understanding of the system details will be developed, including the forms for recording the QC operations, administration of the system for both on-site and off-site work, coordination of ECC's management, and the interrelationship of ECC's management and control with the Army's QA, production, and the QCM's duties with the COR.

As a minimum, ECC's personnel required to attend will include the PM, Site Manager, and QCM.

3.2 On-site Meetings

When field activities are being performed, meetings may take place, whether planned or unplanned, at the site to discuss specific issues or concerns. The QCM or her designated representative will be responsible for documenting discussions and decisions made at the meeting on the Daily Quality Control Report (DQCR).

3.3 Meeting Minutes

Minutes of all meetings will be prepared describing the general discussion, decisions, changes in approach, and action items. If requested, ECC will submit the meeting minutes to participants.

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4.0 QUALITY CONTROL REQUIREMENTS

4.1 Definable Features of Work

To ensure quality, ECC will implement the QC program, including the Three Phase Control Process for each DFW. A DFW is any task, which is separate and distinct from other tasks, has separate control requirements, or is identified by different disciplines. There may be more than one DFW in each activity. The Three Phase Control Process is used to ensure that all project activities comply with the approved plans and procedures. The DFWs for this project are included in **Section 1**.

4.2 Three-Phase Control System

The Three Phases of Control process assures control of work at every stage of an activity, from planning through execution and completion. The process includes the preparatory, initial, and follow-up phases. Work will only begin on a DFW when successful preparatory and initial phases are completed.

Additional preparatory and/or initial phases may be conducted on the same DFW if new crews or subcontractors are added to a DFW, when acceptable levels of quality are not being met, if there are changes in the applicable QC organization, if work on a DFW is resumed after a substantial period of inactivity, or if other problems develop.

4.2.1 Preparatory Phase

The preparatory phase will be performed prior to the beginning of work on each DFW after all required submittals have been approved and is typically conducted by the SSHO with other applicable site personnel in attendance (e.g., field personnel, subcontractors, etc.). The United States Army Environmental Command (USAEC) COR and Army Environmental Coordinator will also be invited to attend the meeting. Any subcontractors involved in the DFW will participate in this review as well. The QCM or designated representative will give the Army 48-hours' notice prior to the preparatory phase meeting. The results of the preparatory phase actions will be documented in the DQCR.

During this phase, it is imperative to review the specifications and drawings to ensure all preparatory steps have been taken, to verify that submittals have been prepared and reviewed, qualified manpower is assigned, and safety issues have been identified and addressed. Specifically, this phase will include, if applicable:

- Review each paragraph of applicable specifications and drawings
- Review of the applicable work plans, etc. including discussion of procedures for controlling quality of the work and how deficiencies are corrected
- Review provisions that have been made to provide required control testing and inspection
- Concurrence that required project training and qualifications are complete (QC, health and safety, technical, etc.)
- Review to ensure that all materials and/or equipment have been tested, submitted, and approved
- Review of applicable permit status and requirements
- Examine the work area to ensure that all required preliminary work has been completed and is in compliance with the contract
- Review the appropriate activity hazard analysis (AHA) to ensure safety requirements are met
- Discuss sampling methods, applicable standard operating procedures, and the testing facility

- Check to ensure the portion of the plan for the work to be performed has been accepted by the client
- Discuss the initial control phase

4.2.2 Initial Phase

This phase of inspection will document the completeness and acceptability of the particular items at the beginning of the work activity after a representative portion of the items has been completed is typically conducted by the SSHO or Site Superintendent.

This is the time to ensure that ECC's and our subcontractor's personnel/workers understand, through immediate inspection, the contract standards, and the standards of workmanship desired. If there is a difference of opinion in the interpretation of contract requirements, this is the time to settle the issue. The initial inspection phase is a practical method of performing preventive inspection and resolving conflicts. The following will be accomplished during this phase, if applicable:

- Review minutes of the preparatory meeting for open items
- Check the work to ensure it is in full compliance with the project requirements
- Establish level of workmanship and verify it meets the desired acceptable workmanship standards.
- Resolve all differences between personnel and subcontractors
- Check safety to include compliance with and upgrading (if necessary) of the Accident Prevention Plan (APP)/SSHP and AHA. Review the AHA with each worker, if deemed necessary.
- Prepare documentation of the initial phase inspection, including a narrative description of detailed inspection procedures, minutes of meetings, inspection results, corrective measures, etc., using forms presented in **Appendix A** of this QCP or included in field book.
- The initial phase will be repeated for each new crew member arriving to work on-site or any time acceptable specified quality standards are not being met.

4.2.3 Follow-up Phase

Follow-up inspection is geared toward a level of effort to verify the continuation of project compliance and standards of workmanship established during the previous two phases. This inspection is typically conducted periodically by the SSHO, or Site Superintendent to ensure a continuation of satisfactory quality standards. Follow-up inspections will be made a matter of record in the DQCR. The QCM will verify proper procedure technique, sample handling, and Chain of Custody (COC), if required. The SSHO or Site Superintendent will monitor testing results and compare them with the project requirements, and if acceptable, document the results and provide a timely authorization to proceed with subsequent work. If the QCM determines the work is otherwise, not acceptable, he will notify the PM for stopping work and initiating a conformance action. Final follow-up checks will be conducted, and all deficiencies will be corrected before the start of additional DFWs.

4.3 Additional Preparatory and Initial Phases

Additional preparatory and initial phases will be conducted on the same DFW if the quality of ongoing work is unacceptable; if there are changes in the applicable QC staff, on-site supervision, or work crew; if work on a DFW is resumed after a substantial period of inactivity; or if other problems develop.

4.4 Control for Off-Post Work

When necessary to complete the objectives required in the PWS and as acknowledged in Table 1-1 of the Project Management Plan, work may take place off-post (laboratory analysis). To the extent practicable, ECC will monitor the quality and workmanship of products developed off-site by implementing the same control measures as work that takes place at a project site to ensure the products and/or materials meet the overall quality and technical standards (i.e., Work Plans or equivalent documents with Quality Assurance Project Plan [QAPP]-like requirements). Should any off-Post work be of a complexity that would warrant an effort beyond these measures (and those referenced in **Section 5.1** below), it would be discussed and agreed to by the ECC PM and the Army COR.

4.5 Deficiency Management

The ECC quality program evaluates the effectiveness of our QC program and ensures continuous improvement in the quality of our work. The primary goals of our quality program are to prevent non-conformances and to facilitate continual process improvement. If the first goal is not achieved, the identified deficiencies or non-conformances will be corrected in a timely and cost-effective manner in order to prevent their recurrence. This QCP includes provisions for preventing quality issues, facilitating process improvements, as well as identifying, documenting, and tracking deficiencies until corrective actions have been verified.

4.5.1 Preventive Measures

While the entire QC program is directed toward problem prevention, certain elements of the program have greater potential to be pro-active. The primary tools for preventing problems include:

- Employee qualification and training
- Preparatory, initial, and follow-up inspections
- Equipment calibration and maintenance.

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5.0 TESTING AND INSPECTION

5.1 Analytical Testing

ECC will procure the services of an independent analytical laboratory with DoD Environmental Laboratory Accreditation Program certification to perform analytical testing required by this project. The testing laboratory will have an established and documented quality system in compliance with the DoD Quality Systems Manual for Environmental Laboratories.

Laboratories must possess any required state or host nation certification and/or be accredited for each applicable method by a nationally recognized laboratory accreditation body.

Changes to the Laboratory Accreditation Status will be notified in writing to the Army within 30 calendar days of the change.

Chemical analysis will be performed using current USEPA procedures and in conformance with DoD Quality Systems Manual for Environmental Laboratories and State agency requirements unless otherwise specified in the project Performance Work Statement.

ECC will provide the analytical results citing applicable contract requirements or test procedures used. Analytical results will also provide a statement indicated if the analysis performed "conforms" or "does not conform" to the requirements.

5.2 Inspection

Inspection activities involve the evaluation of a characteristic as it relates to a specific requirement. ECC may perform the following inspections below, as appropriate to the DFW.

5.2.1 Punch-Out Inspection

A "punch list" of items that do not conform to the approved work plan, specifications, etc. will be prepared and included in the QC documentation. The list of deficiencies will include the estimated date by which the deficiencies will be corrected. The QCM or staff will make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, ECC will notify the Army that the item(s) is ready for their pre-final inspection.

5.2.2 Pre-Final Inspection

ECC will notify the Army when all of the items from the Punch-Out Inspection have been corrected and a Pre-Final Inspection will be scheduled. The Army will conduct the Pre-Final Inspection and a Pre-Final punch list may be developed if deficiencies are noted. The punch list will include estimated dates of completion that will ensure the deficiencies are completed timely and within the contract dates. When the punch list items are completed and verified by the QCM (or designee), the Army will be notified that a final inspection can be scheduled.

5.2.3 Final Acceptance Inspection

ECC will notify the Army 14 days prior to the Final Acceptance Inspection and the Army will formally schedule this inspection. The notification will include assurance that all items previously identified as being unacceptable along with all remaining work performed under the project will be complete and acceptable by the date scheduled for the final acceptance inspection. The QCM, Site Manager, or other primary

management person will represent ECC at the final acceptance inspection. Army personnel will be present as required.

5.3 Instrumentation/Equipment Testing, Inspection, and Maintenance

All equipment used at a project site shall be manufacturer-calibrated to national standards. Each time the instrument is about to be used, the calibration shall be verified and tested for functionality in accordance with *Final Revision 1 Installation-Wide QAPP* completed by Shaw Environmental, Inc. in 2013. Equipment found to be damaged, inoperable, or out of calibration shall not be used until the discrepancy is corrected and verified by the QCM (or designated representative). As necessary, a detector sensitivity or test grid may be used to test the functionality prior to daily use and results documented in the field logbook. Once equipment has been used, it shall be maintained following manufacturer's recommendations. The QCM, SSHO or Site Manager will make periodic verification/audits of the logs and procedures and report the findings in the DQCR.

6.0 QUALITY CONTROL DOCUMENTATION

The QCM serves a critical role in documenting, reporting, and storing data in support of the QC process and its effectiveness in attaining a high-quality work product.

6.1 Reporting Requirements

The QCM will complete and maintain the QC records to provide factual evidence of compliance with project requirements and to document all QC activities, including maintaining a record of all tests and inspections performed. These records include all work performed by subcontractors and suppliers. The QCM will sign each report and provide copies to the PM and USAEC, if requested. The primary QC reports are listed below.

6.1.1 Daily Reports

During field operations, DQCRs will be prepared describing QC and operations activities performed each day as well as the resources on-site and activities performed, including work performed by subcontractors. The reports will present an accurate and complete picture of QC and operations activities and site management. The report will include both conforming and deficient conditions in a precise, factual, legible, and objective manner. Copies of supporting documentation such as checklists and test reports will be attached as required, if requested. Work will be reported by terminology consistent with the work schedule.

The DQCR will be prepared, signed, and dated by the QCM (or her designated representative) and maintained on ECC's project SharePoint site. A copy of the DQCR will be submitted to RSA and the COR on a daily basis.

6.1.2 Monthly Summary Report

When field activities are being performed, the PM will submit a monthly summary report electronically to the client.

6.1.3 Quality Control Meeting Minutes

The QCM shall submit one copy of the meeting minutes within seven calendar days of the meeting.

6.1.4 Safety and Health Deficiency Tracking

6.1.5 Field Logbook

The QCM (or designee) shall be assigned a QC logbook for documenting details of field activities during QC monitoring activities. The logbook will be a bound manuscript with pre-printed page numbers. The QCM (or designated representative) will document his/her daily duties, summarize field activities, including arrival and departure time, note QC tests and results, depict the site layout, and other data. The information in the QC logbook will serve as a detailed description of events to aid in the preparation of the DQCR and in addressing follow-up questions that may arise.

All entries made in the QC logbook shall be made in ink. Any changes shall be made by a single strike through the error and initials. At the beginning of each day, notes will begin on the following page in the logbook. Descriptions shall be made in coherent English and in a manner, that would allow others to

recreate the daily events in the absence of the QCM. At the end of each day, the QCM (or designee) will mark the remainder of the page with a single line and sign across or under it.

6.2 Records Management

Records are considered completed documents, validated data, and other materials that provide objective evidence of the quality of items or activities. A document that contains objective information can become a record once it is complete and identified as a record. Records include, but are not limited to:

- Work plans, technical proposals, and other work assignment planning documents
- Field plans and procedures
- Training records
- Project reports, including letter reports
- Field logbooks and project notebooks
- Three phase inspection records
- DQCR and Production Reports
- COC records
- Audit, surveillance, and independent project self-assessment reports
- Field change notices
- Laboratory data

The PM will define work assignment documents that are expected to become records.

Records will be maintained in the project office in a manner that prevents deterioration and provides for the safeguarding of the records. A record indexing system that allows for easy retrieval and provides sufficient information to permit the correlation of records with the items or activities to which they apply will be used. Inactive records will be stored for the mutually agreed upon time after which they are either archived or properly disposed

Disposition of records is controlled and documented. Records are destroyed only after the proper notification to USAEC and the approval of the ERMA PGM.

7.0 SUBMITTALS

Preparation of submittals is the responsibility of the PM at the project level using project staff resources. For preparation of technical submittals, the appropriate staff will be chosen; those who have the background and knowledge required for assuring the technical submittal is complete and accurate. Additionally, the PM will perform a separate technical peer review for highly technical submittals.

The QCM will review submittals for acceptance with QC requirements before transmitting to the client or other required approval authorities. Submittals requiring modifications or changes will be returned to the originator, subcontractor, or vendor for correction and resubmission. Submittals from subcontractors and vendors will be reviewed for technical content and accepted as a part of this submittal preparation procedure.

7.1 Transmittal Form

Transmittals by ECC to the Army will be documented via email correspondence and/or Project Portal upload (with corresponding email to notify the parties of document availability). The transmittal and distribution of documents to Regulators will be managed directly by RSA and supported by ECC as discussed in Section 3.4.2.3 of the Project Management Plan.

7.2 Comment Response Matrix

Upon receiving comments from Army, regulatory, or other outside reviewers, ECC will prepare a comment response matrix to document each reviewer's comment along with a response describing how the comment will be resolved, incorporated, or addressed. To expedite reviews of the comment responses, ECC may request that the Army schedule a conference call or meeting with reviewers to discuss their comments. The completed comment response matrix will then be submitted to the client for review and approval prior to submitting elsewhere, as appropriate and applicable. At such a time when all responses are accepted, ECC will incorporate changes into the document.

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8.0 NONCONFORMANCE REPORTING

8.1 Nonconformance Definition

The definition of a nonconforming condition can be a deviation from product, process, procedure or compliance specifications. All items determined to be nonconforming must be corrected through systematic corrective actions. Any time a condition exists not in compliance with drawings, specifications, codes, workmanship standards, facility requirements, or Army requirements, the nonconformity must be documented, corrected, and closed-out through the following means. All personnel are responsible for identifying deficiencies and the QCM is responsible for ensuring the proper tracking and documentation of deficiencies, including those identified by the Army. ECC will implement the ECC Causal Analysis System (see **Appendix B**) to determine the root causes of quality related incidents and non-conformances. We will perform trend analyses at least annually by reviewing all incidents and identifying common basic causes that need to be addressed to prevent similar occurrences.

8.2 Deficiency Identification

The QCM (or designee) will be responsible for managing the nonconformance process. All nonconforming items must be reported to the QA/QC Manager. Anyone finding a deficient item is responsible for reporting it to the appropriate management staff.

8.3 Nonconformance Determination

During routine site activities, the majority of corrective actions can be implemented immediately (within 48 hours) by the field personnel and documented in field logbook. If the condition is not quickly corrected, the individual initiates a Nonconformance Report (NCR) as shown in **Appendix A** and submits it to the QCM (or designee). The QCM (or designee will notify the PM and identify the person responsible for implementing corrective action (often the Site Superintendent), sets a date on which the response is due, and distributes the NCR.

8.4 Planning and Implementing the Corrective Action

The responsible person to initiate corrective actions should identify the cause of the problem, if known or suspected, on the NCR. The responsible person will develop a Corrective Action Plan, identify the date the corrective action has been or will be accomplished, describe the action taken on the form, and return the form to QCM (or designee) by the response due date. If possible, objective evidence that the corrective action has been completed should be included with the NCR response. If this is not possible, the responsible person should return the NCR by the due date and provide the evidence as soon as possible.

8.5 Accepting Corrective Action

The QCM (or designee) will review the NCR response to determine the adequacy of the corrective action. If the stated corrective action is unacceptable, the NCR will be returned to the responsible person for further discussion and corrective action.

8.6 Verifying Corrective Action

If the evidence provided to the QCM (or designee) concerning completed corrective action is acceptable, the NCR will be signed and dated. If evidence is obtained through an audit, surveillance, or follow-up

review, the individual conducting the follow-up will sign and date the form once the corrective action has been verified.

A distribution list for NCRs will be determined at the initial project-planning meeting. At a minimum, distribution will include the USAEC Representative, QCM, PGM, QA/QC Manager, PM, Site Superintendent, and any other applicable client-related individuals.

9.0 AUDITS AND ASSESSMENTS

Assessments are a learning process intended to increase the user's understanding of the program or system being assessed and to provide a basis for improving such programs or systems. The purpose of assessments is to improve the quality of work by comparing the system or element to the specified requirements. Assessments are conducted at all levels: corporate, contract, project, and activity. Response refers to the actions taken by the assessed organization as a result of the assessment. Typically, responses involve corrective actions to rectify the deficiencies identified in the assessment.

Project assignments will be monitored and assessed as deemed appropriate by the QCM (or designee) and QA/QC Manager. The following sections identify and describe many assessment types. Not all types may be applicable for this project. The requirement to conduct applicable assessment types may be further defined in the work plans and field plans. The ERMA PGM, PM, or the QA/QC Manager may specify additional assessments, as necessary, to ensure that the quality of work meets the Army and ECC's expectations. Assessment reports generated under this project will be made available to the Army, upon request.

9.1 Management System Reviews

Management systems reviews are self-assessments conducted annually, or as determined appropriate by the QA/QC Manager, to establish whether the quality management structure, policies, and procedures are adequate to ensure quality data. Management systems reviews may cover multiple contracts and quality plans. The primary focus of the management systems review is performance improvement through:

- Fostering individual ownership of the quality program by increasing employee involvement in quality
- Encouraging employees to routinely identify opportunities for quality improvement
- Meeting with management, technical, and QA staff to solicit specific suggestions to improve quality, such as more practical implementation methods, procedural modifications, etc.
- Training the management, technical, and QC staff on quality plan requirements
- Communicating lessons learned from other management systems reviews
- Checking on implementation and effectiveness of the quality program within the office.

9.2 Project Audits

Project audits may be conducted on ECC and subcontractor work activities by QC staff independent of the work activities or the appropriate staff appointed by RSA or the USAEC. The implementation and use of appropriate quality measures identified in this QCP, work plans, field plans, specifications, procedures, and any other applicable document specifying requirements can be used for checking during the audit. The auditor will also ensure that obsolete documentation has been removed from project work areas and check briefly on preparation of required deliverables and the condition of project files.

Project auditors will be trained in auditing procedures and authorized by the QA/QC Manager.

9.3 Project Self-Assessments

Project self-assessments are evaluations of work activities conducted by project personnel who are knowledgeable in the project requirements to determine if the technical requirements are being met. They are intended to provide rapid feedback to the project staff to facilitate timely corrective action.

The ERMA PGM makes the selection of project assignments or activities for project self-assessment and the personnel to conduct them with the assistance of the QA/QC Manger or QCM. Project self-assessments are conducted using a standardized or customized checklist.

Appendix A

QCP Forms

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DAILY SITE REPORT

Project Title: Redstone Arsenal
Date: _____
Activity Name: _____
Location: _____
Contract No.: W9124J-18-D-0004, DO W9124J21F0045

Weather	Sunny	Clear	Overcast	Rain	Snow
Temperature	< 32	32 – 50	50 – 70	70-85	> 85
Wind	Still	Moderate	High		
Humidity	Dry	Moderate	Humid		

Personnel On Site:

Name	Hrs.	Affiliation	Location/ Description of Work

Field Changes: YES _____ NO _____

If yes, filed Nonconformance and Corrective Action Report number (NCR No.):_____

Work Performed:	
Equipment Used:	
Health & Safety (Briefing held, PPE, injuries, near misses, etc.):	
Samples Collected/ Shipped:	
IDW Generated and Disposition:	
Verbal Instructions Received/Given:	
Changed Conditions/ Delays/ Conflicts Encountered or Resolved:	
Other Comments or Additional Information:	
Next Day's Planned Activities:	

Contractor Verification: On behalf of the contractor, ECC, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

_____ _____ _____ _____
Signature Date Reviewer Signature Date

INSTRUMENT CALIBRATION LOG

Project: Redstone Arsenal **Site:** **Date**

Calibrated By Instrument Serial Number

Weather:

Parameters	Calibration	Calibration Temp	Post Calibration	Comments
Conductivity (mS/cm^c)				
pH (7)				
pH (4)				
pH (10)				
ORP (mV)				
Dissolved Oxygen (%)				
Barometric Pressure (mmHg)				
Turbidity	**<0.10 NTU**	**15.0 NTU**	**100 NTU**	**750 NTU**
PID		**Isobutylene / 100ppm**		

	Environmental Chemical Corporation	EQUIPMENT DAILY CHECK LIST

Equipment Name /Number _____ **Date** _____

Engine Hrs/Mileage _____ **Project Name** _____

BRAKES	COOLING WATER
AIR SYSTEM	OPERATING CONTROLS
TIRES/TRACKS	LIGHTS/REFLECTORS
HORN	WINDSHIELD WIPERS
SAFETY DEVICES	FIRE EXTINGUISHER
GLASS	BACKUP ALARM
MIRRORS	ENGINE OIL Add/Check
DEFROSTER	EXHAUST SYSTEM
STEERING SYSTEM	FLUID LEVELS
WIRE ROPE	ELECTRICAL SYSTEM
APPEARANCE	BREATHING AIR BOTTLES

These items are to be checked each shift before operating this piece of equipment.
Report ALL items requiring repair to supervisor prior to operation of equipment.

Note:

_____

_____

_____

_____

_____

_____

_____

_____

_____

OPERATOR'S NAME	
	(Please Print Name)

	Environmental Chemical Corporation	**FIELD WORK VARIANCE**

Project Name _____ Variance No _____

Project No _____ Page ___ of ___

Contract No. _____ CTO No. _____ Date: _____

Variance (include justification and present requirements) Requested by: _____

Proposed Change

Technical Justification

Cost/Schedule Impact

Reason for Change ☐ Addition ☐ Deletion

Change Order Required ☐ No ☐ Yes Change Order No. _____

Applicable Document

Approved By		
	Project Manager	**Date**
Approved By		
	CQC Manager	**Date**
Approved By		
	Contracting Officer	**Date**

	Environmental Chemical Corporation	MATERIALS DELIVERIES STORAGE CHECKLIST

Project Name:	Date:	Serial No.

Building Name:		Control #	
Specified Location:		Reference #	
Drawing Reference:			

Description of Activities	Disposition			Inspection Date (Initials)
	ACCEPT	REJECT	HOLD	
1 Material: _____	☐	☐	☐	
2 Date of Delivery _____	☐	☐	☐	
3 Handling method _____	☐	☐	☐	
4 Storage method _____	☐	☐	☐	
5 Protection _____	☐	☐	☐	

Remarks:

Checked By:	Inspected By:	Witnessed By:
Contractor Representative	Q.C. Inspector, Contractor	Prime Contractor Representative
Date:	Date:	Date:

	Environmental Chemical Corporation	NON-CONFORMANCE REPORT TRACKING

Contract _____ **Project No** _____

CTO No _____ **NCR Number** _____

Nonconformance Description (include specific requirement violated):	
Identified By	**Date**

Root Cause of Nonconforming Action:

Corrective Action(s) to be Taken (include date when action(s) will be complete):	
To Be Performed By	**Date**

Action(s) to be Taken to Preclude Recurrence:	
To Be Performed By	**Date**

Acceptance By		
	Project Manager	**Date**
	CQC Manager	**Date**

Corrective Action(s) Completed by and Date:	Verification Completed by and Date:

	Environmental Chemical Corporation	NON-CONFORMANCE REPORT TRACKING LOG

Contract _____ Project Name _____

CTO No _____ Page ____ Of ____

NCR No.	Orig. Date	Initiated By	Nonconformance Description			Status	
Project No.	Close Date	Close By		Resp. Party	C/A Due	C/A Recommended And Approved	Re-inspection Results

	Environmental Chemical Corporation	RECORD OF TESTING ON -OR- OFF SITE

To: _____

Testing To Be Carried Out By: _____

Contract Number: _____ Contractor: _____

Item or Work for Test: _____

_____

Location of Test: _____

Proposed Date & Time of Test: _____

Specified Testing Requirements: _____

_____

Notified By: _____ Date: _____

To Be Inspected By: _____ ☐ _____ ☐ _____ ☐

_____ ☐ _____ ☐ _____ ☐

Test Record

Date of Test: _____ Location or Grid Ref. _____

Type of Test: _____

Test Conditions Maintained: Start ☐ Finish ☐

Accepted ☐ Rejected ☐

Test Result

Comments/Observations: _____

_____

_____

_____

Test Witnessed By:

_____ _____

QC Inspector (Signature) Supplier (Signature)

_____ _____

Contractor Repr (Signature) Prime Contractor Repr (Signature)

	Environmental Chemical Corporation	REWORK ITEMS LIST

Contract _____ **Project No** _____

CTO No _____

Item	Date Identified	Date Corrected
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
20. 21.		
22.		
23.		
24.		

	Environmental Chemical Corporation	STATUS SUMMARY ON NON-CONFORMANCE NOTICES

PROJECT: _____ DATE: _____

SEQUENTIAL SERIAL NO.	DATE OF ISSUE	DESCRIPTION	DATE RECEIVED BY CONTRACTOR	DATE RETURNED BY CONTRACTOR	Q.C. ENGINEER		COMMENTS
					ACCEPTED DATE	REJECTED DATE	

	Environmental Chemical Corporation	STOP WORK ORDER

Project Name		**Date**	
SWO No.		**Page**	
Contract No.		**CTO Number**	

1. Written Notice			
Issued to:		P.O. # or Activity:	
Name:		Location:	
Title:		Issued by (name):	
Origination:		Issued by (title):	
2. Verbal Notice			
Issued to:		Date:	
Title:		Time	

3. Associated NCR No.	**4. Associated CAR No.**

5. Stop Work Order Condition Description

6. Remedial Action Required:			
By Whom		By When	

7. Required Remedial Action Determined by:	
Project Manager	Date
CQC Manager	Date

8. Follow-up of Remedial Action Taken:

Verbal Notice to Resume Operations Given to:

Name	Title	Date	Time

Stop Work Order Cancellation Authorized by:

Program CQC Manager:	Date

Appendix B

ECC Causal Analysis System

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ECC CAUSAL ANALYSIS SYSTEM

Step 1. Incident Description

Type of incident:

- Quality
- Vehicle/property loss >$500
- Environmental release or permit exceedance
- Injury or illness
- UXO-related
- Security
- High loss potential (HiPo)

Describe what happened:

_____

Evaluation of future risk if not controlled:

Probability of Recurrence	*Severity of Loss Potential*		
	Minor	*Serious*	*Major*
Will probably occur soon	Medium	High	High
Reasonable likelihood in future	Low	Medium	High
Unlikely	Low	Low	Medium

Step 2. Select Event Type

• Fall from elevation • Fall on same level • Struck by vehicle, equipment, load or moving object • Struck against or bump into • Caught in, between or under • Caught on, snagged or hung • Contact with harmful agent (chemical, biological, radiological, noise, temperature extreme, vibration)	• Ergonomic, overexertion, stress, strain, sprain • Overpressurization, excessive temperature • Equipment failure • Environmental release • Permit exceedence • Product or process non-conformity • Customer/stakeholder complaint, poor project performance rating • Cost/schedule overrun

ECC Core Values

Service

Prosperity

People

Friendship

Safety

Step 3. Identify the Immediate Cause(s)

Identify those behaviors or conditions that directly resulted in the event or loss.

Substandard Acts or Behaviors	
• Failure to follow established procedure • Operating equipment without authority • Exceeding the boundaries of the task envelope • Operating at improper speed • Failure to warn or secure • Failure to control hazardous energy (de-energize, secure, lockout) • Making safety devices inoperable (including jumpering interlocks) • Using wrong or defective tools or equipment • Poor lifting, pulling, turning technique	• Poor body positioning • Using tools or equipment improperly • Substance abuse or working under influence of prescription medication • Inappropriate behavior • Failure to check/monitor • Failure to coordinate work activity • Failure to identify customer/stakeholder expectations • Failure to identify and reject non-conforming parts, materials or workmanship

Substandard Conditions	
• Exposure to chemical, physical or biological agents • Inadequate engineering controls • Inadequate administrative controls • Inadequate PPE • Inadequate warning system or barricade • Inadequate site layout or design • Defective tools or equipment • Congestion/restricted action • Housekeeping/disorder	• Fire or explosion hazard • Hazardous weather conditions • Improper maintenance of infrastructure or plant facilities • Failure to comply with designs, stakeholder expectations • Inadequate resources on project • Inadequate identification of regulations, codes, standards, specifications, permits to operate • Inadequate communications equipment, software or process controls

Step 4. Identification of Root Cause(s)

Identify the system or personal factors that caused or permitted the immediate causes to be present.

System Factors

1. Leadership and Management

- Management commitment
  - to processes, policies and procedures
  - lead by example
- Management involvement
  - in ESQ activities (meetings, inspections, audits)
  - visible leadership
- Supervision
  - employee tasking, direction, follow-up
  - subcontractor oversight
- Line management accountability
- Adequate budgeting
- Assessment of risks and hazards
- Qualifications of supervisors and managers
- Performance evaluations and feedback
- Reporting relationships
- Employee involvement/inclusion in hazard evaluation and decision making

2. Communications and Training

- Training
  - Formal
  - OJT
- Evaluation of training effectiveness
  - Testing
  - Demonstration
  - OJE
- Competency determination
- Communications with client
- Communications with stakeholders
- Communications with employees
- Communications between organizations
- Communications between work groups or shifts
- Communications between individuals
- Communications with subcontractors

3. Project Development and Planning *(Plan)*

- Project Development
  - Understand SOW
  - Understand contract
  - Understand client and stakeholder relationships
  - Understand client and stakeholder expectations
- Risk analysis and management plan
  - PIP
  - Bid analysis
  - Process Safety Reviews
- Identification of codes, standards, specifications, SOPs
- Engineering and task planning
  - Multi-disciplinary, SME involvement
  - Review procedures
  - Value engineering
  - Site layout
  - Work task planning
- Project plans
- AHAs/JSAs
- Submittal process
- Hazardous work permits
- Regulatory permits
- Procurement
  - Subcontractor evaluation and selection
  - Requirements in RFP/SOW
  - Material specifications

4. Project or Work Task Execution *(Do)*

- Implementation of plan/procedure
- Schedule/work sequence
- Tools/equipment/PPE
  - Tools
  - Construction equipment
  - Infrastructure
  - Facilities
  - Process equipment
- Qualified personnel
- Compliance with codes/standards
- Documentation
- Document control
- Incident identification, notification, investigation and reporting

5. Measuring and Monitoring of Work Activities and Products *(Check)*

- Document reviews
- Design reviews
- Readiness reviews
- Four phase process
- Subcontractor oversight
- Exposure monitoring procedures
- Testing
  - Materials
  - Process equipment
  - Alarms and interlocks
  - Commissioning
  - Pilot and bench scale
  - Weights and measures
  - Calibration
- Inspections
  - Tools
  - Equipment
  - PPE
  - Competent person
  - Hazardous work activities
  - Materials receipt
  - Workmanship
  - Superintendent weekly safety
  - PM monthly safety
- Audits
- Customer feedback solicitation
- Employee feedback solicitation
- Internal Project Management Reviews
- Change identification, notification and impact assessment

6. Follow Through and Improvement *(Act/React)*

- Corrective action follow up
- Lessons learned
  - Develop
  - Communicate
  - Consult
  - Implement
- Response to client, user and employee feedback
- Emergency response
- Change management/risk management

Personal Factors

7. Capabilities

- Size, strength, reach
- Pre-existing physical limitations or medical conditions
- Sensory deficiency
- Intelligence
- Aptitude
- Memory
- Emotional disturbance
- Mental illness
- Fears/phobias

8. Stress

- Fatigue due to task load, duration or repetition
- Fatigue due to extended work schedule/ lack of rest
- Boredom
- Sensory overload
- Emotional overload
- Conflicting demands/confusion
- Frustration

9. Knowledge or Skills

- Experience
- Training
- Orientation
- Infrequent activity/lack of practice
- Coaching, evaluation and feedback

10. Motivation

- Convenience – save time or effort
- Improper behavior is approved, allowed, condoned or rewarded
- Proper behavior is ignored or punished by intended or unintended consequences
- Inadequate reinforcement of proper behavior
- Peer pressure
- Inadequate discipline
- Resistance to change

11. Abuse or Misuse

- Intended
- Unintended

Step 5. Corrective Action Plan

Development of an Action Plan to correct the root cause(s). Consider various systems, and whether or not 1) we have a process [P]; 2) our process consists of adequate standards [S]; and 3) whether we have sufficient compliance with our standards [C].

Improvement Action Guide

1. Leadership (P S C)

Core values
Mission
Policies
Balanced score card
Client alignment
Business processes
Visible leadership
Lead by example

2. Management, Supervision, and Employee Involvement (P S C)

Operations management responsibilities and accountability
Project management procedures
Qualified supervision
Adequate resources
Involvement of SMEs
Employee involvement activities
Standard operating procedures

3. Risk Evaluation (P S C)

PIP
Incorporation of PIP/RMP into project plans
Hazard identification and evaluation
Environmental impact assessment
Customers and stakeholders expectations and change probability
Process risk or hazard analysis
Activity hazard analysis

4. Project Development (P S C)

Understanding requirements
Understanding the contract
Estimating procedures
Bid/proposal review procedures
Inclusion of SMEs

5. Planning (P S C)

Understanding requirements
Understanding the contract
Handoff and tasking
Integration of risk management plans
Identification of requirements
Project plans and plan reviews
Client alignment meetings
Kickoff, MUM, pre-construction meetings
Schedule procedures
Engineering design and review procedures
Submittal development and review
Site layout, facility arrangement and task design
Means and methods
Communication of plans and procedures

6. Procurement and Subcontractor Management (P S C)

Subcontractor pre-qualification
RFP/SOW
Materials and equipment specifications
Selection
Integration
Oversight
Evaluation

7. Risk Controls (P S C)

Risk management plans
Standard operating procedures
Quality control system
Engineering controls
Administrative controls
PPE procedures
Permit procedures
Environmental policies, procedures and controls
Process controls
Accident prevention signs, tags and barricades
Hazardous work permits
Preventive maintenance
Rules
Security controls

8. Human Resources (P S C)

Hiring
Placement/assignment
Training
Competency
Evaluation and feedback
Incentive plans
Level of effort requirements and resource allocation

9. Emergency Procedures (P S C)

Analysis
Plans
Communication and training
Drills and tests
Critique and follow-up
Dedicated supplies
Warnings and alarm systems

10. Communications and Promotions (P S C)

ECCONET postings
Meetings
Tailgates
Orientation, new employee and site-specific
Postings
Promotion campaigns

11. Monitoring and Measuring (P S C)

Progress meetings and reporting
Four-phase process
Inspections
Audits and surveillances
Testing
Exposure monitoring
BSC progress reporting
Client feedback solicitation
Employee perception surveys
Hotline and reporting mechanisms
ECCOSLIPS
PMRs

12. Continuous Improvement (P S C)

Incident reporting
Lessons learned
Action item tracking
Client and stakeholder feedback and follow-through
Employee feedback system
Consultation of LL and incident databases
Change management procedures

13. Management Reviews (P S C)

PMR process
Audit tracking
BSC progress monitoring
Client reporting

Never Compromising Safety

Never Compromising Quality

APPENDIX E

SITE SAFETY AND HEALTH PLAN

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ADVANCE REVIEW
SITE SAFETY AND HEALTH PLAN

Environmental Remediation Services
U.S. Army Garrison-Redstone

June 2023

Prepared for:

U.S. ARMY ENVIRONMENTAL COMMAND
Southeast-Environmental Service and Support Division
2450 Connell Road, Building 2264
Fort Sam Houston, TX 782347664

Prepared by:

ECC
9200 Church St.
Suite 305
Manassas, VA 20110

Contract No.: W9124J-18-D-0004, Delivery Order W9124J-22-F-045

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SITE SAFETY AND HEALTH PLAN

Site RSA-311
Redstone Arsenal
Madison County, Alabama

June 2023

I hereby certify that the enclosed Site Safety and Health Plan, shown and marked in this submittal, is that proposed to be incorporated with Contract Number W9124J-18-D-0004, Delivery Order W9124J-22-F-045. This Site Safety and Health Plan is in compliance with contract specifications and is submitted for Government approval.

Plan Preparer:

Courtney Bigelow	06/29/2023	415-404-5375
Courtney Bigelow, Associate Staff Scientist Assistant Project Manager	Date	Phone Number

Plan Reviewer:

Kym Edelman Digitally signed by Kym Edelman Date: 2023.06.29 11:33:31 -04'00'		757-435-53849
Kym Edelman, Certified Industrial Hygienist, Certified Safety Professional Environment, Safety and Healthy Manager	Date	Phone Number

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<	Less than
>	Greater than
%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
Abs	skin absorption
AED	Automated external defibrillator
AHA	Activity Hazard Analysis
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
APP	Action Prevention Plan
APTIM	Aptim Federal Services, LLC
ARBCA	Alabama Risk-Based Corrective Action
bpm	beats per minute
BTEX	benzene, toluene, ethylbenzene and xylene
C	Ceiling Limit
Ca	Carcinogen.
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Material Manager
CIH	Certified Industrial Hygienist
CM	Construction Manager
Con	Skin and/or eye contact
COPC	Contaminants of Potential Concern
COR	Contracting Officer's Representative
CP	Competent Person
CRC	Contamination Reduction Corridor
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
dBA	decibels (adjusted)
DCE	Dichloroethene
DFW	Definable Features of Work
DIA	Defense Intelligence Agency
DNT	Dinitrotoluene
DOT	U.S. Department of Transportation
ECC	Environmental Chemical Corporation
EGDN	Ethylene glycol dinitrate
ESQ	Environment, Safety and Quality
EZ	Exclusion Zone
HEMSI	Huntsville Emergency Medical Services Inc.
HGL	HydroGeoLogic, Inc.
IDLH	Immediately Dangerous to Life and Health
IDW	Investigation-derived waste
IOC	Installation Operations Center
Ing	Ingestion
Inh	Inhalation
ISEB	in situ Enhanced Bioremediation
LEL	Lower explosive limit
LTM	Long-Term Monitoring/Long-Term Management
LUC	Land Use Controls
MEC	Munitions and Explosives of Concern
mg/m^3	milligrams per cubic meter

MNA	Monitored Natural Attenuation
MTBE	methyl tert-butyl ether
NA	Not applicable
ND	Not determined
NFA	No Further Action
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NT	Nitrotoluene
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbons
PEL	Permissible Exposure Limit
PETN	Pentaerythritol tetranitrate
PG	Professional Geologist
PM	Project Manager
PMP	Project Management Professional
PPE	Personal Protective Equipment
ppm	parts per million
QC	Quality Control
QCP	Quality Control Plan
QP	Qualified Person
RCRA	Resource Conservation and Recovery Act
RDX	1,3,5-trinitro-1,3,5-triazine
REL	NIOSH Reportable Exposure Limit
RFI	RCRA Facility Investigation
RSA	U.S. Army Garrison, Redstone Arsenal
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental, Inc.
SHM	Safety and Health Manager
SLERA	Screening-Level Ecological Risk Assessment
SOH	Safety and Occupational Health
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SSHS	Site Safety and Health Supervisor
STEL	Short-term Exposure Limit
SVOC	Semivolatile organic compound
SZ	Support Zone
TCE	Trichloroethene
TLV	Threshold Limit Value
TTZ	Targeted Treatment Zone
TWA	Time Weighted Average
UL	Underwriters Laboratories
U.S.	United States
USAEC	United States Army Environmental Command
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UXO	Unexploded Ordinance
VOC	Volatile Organic Compound

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1.0 INTRODUCTION

This Site Safety and Health Plan (SSHP) has been prepared by Environmental Chemical Corporation (ECC) under contract number W9124J-18-D-0004, Delivery Order W9124J-22-F-045 for U.S. Army Environmental Command (USAEC), Fort Sam Houston, Texas, for environmental fieldwork to be conducted at United States (U.S.) Army Garrison Redstone Arsenal (RSA), Madison County, Alabama. Additional health and safety requirements are presented in the Activity Hazard Analysis (AHA) sheets (**Attachment 1),** and ECC's Corporate Health and Safety Standard Operating Procedures (SOP) as identified in this SSHP.

1.1 Redstone Arsenal History and Description

The RSA occupies approximately 38,300 acres in Madison County, Alabama. The RSA is bounded on the north and east by the city of Huntsville, on the west by the city of Madison, on the west and southwest by Wheeler National Wildlife Refuge, and on the south by the Tennessee River. Huntsville has a population of nearly 165,000; Madison County population is about 320,000. Approximately 330 military families reside in government quarters on RSA and approximately 40,000 government employees and contractors work at the facility. The primary mission of RSA is the development, acquisition, testing, fielding, and sustainment of aviation and missile weapon systems. Most of the installation tenants support this effort; however, RSA is also home to such diverse activities as training for handling explosives and ordnance devices, Defense Intelligence Agency (DIA) activities, and the production of iron carbonyl. The RSA is home to over 70 different tenant organizations.

1.2 Site Description and Scope of Work

RSA-311, Exterior Sumps and Interior Concrete Pits at Building 7352, is located in the southeastern portion of Redstone Arsenal (RSA), northwest of the intersection of Flicker Road and Swallow Road. The site occupies approximately 3,490 ft^2. The area lies above groundwater site RSA-146. RSA-311 consists of three non-contiguous areas (two interior concrete pits within the former Building 7352, exterior Sump 1, and exterior Sumps 2 and 3). The sumps drain two southern bays in Building 7352 (Figure 1-3). The administrative site boundary for RSA-311 is approximately 3,490 ft2.

Building 7352 was originally constructed for use as a bowl and wastewater cleanup facility for equipment and tools used in propellant mixing and casting operations at nearby facilities. The three bays in the southern portion of the building were used for large component cleaning, small parts cleaning, and equipment storage between 1989 and 1995. The two interior trench drains in the southern portion of Building 7352 were designed to capture floor washings and spills from Bays 1 and 2. The trench drains are recessed into the floor and connected to the exterior captive sumps located on the eastern and western sides of the building.

Building 7352 and the associated sumps and pits were demolished in July to September 2019. Based on information provided by RSA personnel on April 14, 2020 (U.S. Army Garrison-Redstone 2020), operating equipment used in processes conducted in the former Building 7352 that were determined to have residual energetics were taken to the Open Burn/Open Detonation area for thermal treatment. Following removal of operating equipment, the building structure was reflashed to remove any potentially remaining energetics prior to demolition. Water in pits/sumps was pumped to the industrial sewer after sample results were non-detect for energetics and lead. Steel removed during demolition was taken to metal recyclers and concrete (including sumps and pits) was taken to the Construction and Demolition Landfill for disposition.

The former Building 7352, built in 1989, was 5,464 ft2 and consisted of the northern portion, southern portion, and exterior process units.

The Revision 4 RFI Report for RSA-311 (APTIM 2020) recommended no further action for soil/surface media but recommended development of corrective measures for the underlying groundwater at the site. Perchlorate, 2,6-DNT, 2-nitrotoluene, RDX, TCE, and VC are identified as groundwater COCs requiring action. Therefore, monitoring of groundwater at RSA-311 for 8 years is the corrective measure.

The corrective measure selected involves the following components:

- Groundwater MNA

The provisions of this plan are mandatory for all contractor and subcontractor onsite personnel engaged in activities at RSA-311 and Installation-Wide Groundwater Long-Term Management (LTM). The SSHP will be reviewed upon award of these optional sites to ensure that the provisions of this plan address all hazards. Revisions to the SSHP will be made accordingly if needed. The scope of field services includes Long-Term Monitoring (LTM). The Definable Features of Work (DFWs) addressed in this plan include, but are not limited to:

- Mobilization and site preparation
- Environmental Sampling
- Equipment decontamination
- Monitoring well and borehole abandonment
- Investigation-Derived Waste (IDW) Handling and Storage
- Monitoring well installation and development
- Monitoring Well Gauging, Inspection and Maintenance
- Site reconnaissance
- Groundwater, surface water, and spring sampling

If hazards or conditions are identified that are not covered by this SSHP, the Contractor's staff must contact the Project Manager (PM) or the Site Safety and Health Officer (SSHO).

Table 1-1 reviews applicable safety, health, and emergency response requirements for this project.

Table 1-1: Site Safety and Health Plan Requirements

	Applicable to this Project?	**If Required, Location or Reference**
Site Layout and Support Facilities		
Haul road plan	No	
Night operations lighting plan	No	
Public safety requirements	No	
Site layout plans	Yes	SAPs
Site sanitation plan	Yes	APP Attachment 5*
Emergency Preparedness		
Emergency phone numbers	**Yes**	SSHP/**Section 5**
Emergency route to the hospital	**Yes**	SSHP/**Section 5/Attachment 3**
Emergency procedures and tests	**Yes**	SSHP/**Section 5**
Fire protection plan	**Yes**	ECC EHS-SOP-02-09/**Attachment 2B**
Spill plans	**Yes**	SSHP/**Section 5.3**
Wild land fire prevention plan	No	
Man overboard/abandon ship	No	
Severe weather contingency plan for floating plant or marine operations	No	

	Applicable to this Project?	If Required, Location or Reference
Emergency rescue (tunneling)	No	
Underground construction fire plan	No	
Hazard Assessment and Control	**Required Yes/no**	**If Required, Location or Reference**
Abrasive blasting plan	No	
Activity Hazard Analyses	**Yes**	AHA list SSHP/**Attachment 1**
Drug free workplace	**Yes**	HR-SOP-1.8
Asbestos abatement plan	No	
Blasting plan	No	
Confined space entry	No	
Compressed air plan	No	
Critical lift procedures and plans	No	
Demolition plan	No	
Diving plan	No	
Electrical safety	No	
Excavations	No	
Fall protection plan	No	
Formwork and shoring erection and removal plans	No	
Hazard communication program	**Yes**	ECC EHS-SOP-02-10
Hazardous energy control plan	**Yes**	ECC EHS-SOP-04-03
Health hazard control program	**Yes**	SSHP all sections
Lead abatement plan	No	
Jacking and slab plans	No	
Scaffolding	No	
Machinery and mechanized equipment including drilling	**Yes**	ECC EHS-SOP-02-03
Respiratory protection plan	No	
Steel erection plan	No	

Notes:
*– ECC. 2021. *Accident Prevention Plan, Environmental Remediation Services, U.S. Army Garrison- Redstone Arsenal*, June.
AHA – Activity Hazard Analysis
APP – Accident Prevention Plan
ECC – Environmental Chemical Corporation
SAP – Sampling and Analysis Plan
SSHP – Site Safety and Health Plan
SOP – Standard Operating Procedures

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2.0 HAZARD ASSESSMENT

The following section outlines the AHAs, referenced SOPs, chemical, and physical hazards associated with this project. The AHAs outline personnel risk minimization.

Table 2-1 lists ECC's applicable SOPs for this project. AHAs related to the field activities at the site are presented in **Attachment 1**. The AHAs will be reviewed periodically and revised as applicable.

During daily safety tailgate meetings, applicable AHAs will be reviewed with the work crew prior to commencing work. All site visitors will be required to review the daily tailgate safety issues and sign the visitor log. If necessary, the AHAs will be revised for site-specific activities, and reviewed with work crew before commencing any work.

Table 2-1. Referenced Standard Operating Procedures

SOP Number	SOP Title
1.0	Field Documentation
2.0	Collection And Field Screening of Soil Samples
3.0	Field Equipment Decontamination
4.0	Investigation-Derived Waste
7.0	Groundwater Sampling
8.0	Standards for Conducting Well Development
11.0	Field Generated Records Management
12.0	Field Measurable Physical Characteristics
13.0	Field Measurable Chemical Characteristics
15.0	Non-Hazardous Sample Handling, Packaging, and Shipping
16.0	Groundwater Level Measurements
17.0	Monitoring Well Installation
18.0	Surface Water Sampling
19.0	Sediments/Sludge Sampling
20.0	Drilling Unconsolidated Materials
21.0	Monitoring Well And Borehole Abandonment
22.0	Description of Geologic Materials
24.0	Field Equipment Calibration
ECC EHS-SOP-02-09	Fire Protection Plan
ECC HR-SOP-1.8	Drug Free Workplace
ECC EHS-SOP-02-10	Hazard Communication Program
ECC EHS-SOP-04-03	Hazardous Energy Control Program
ECC EHS-SOP-02-03	Machinery and Mechanized equipment including Drilling

[1] – Program Standard Operating Procedures (SOPs) are included in *Revision 4 - Installation-Wide Quality Assurance Program Plan (IW-QAPP)* for the Program Management Contract (HydroGeoLogic, Inc. [HGL], 2019).

2.1 Chemical Hazards

Based on their historical detections in surface soil, subsurface soil, or groundwater samples collected at RSA-311, specific potential contaminants are listed below: **Table 2-3** outlines the chemical hazards for sites RSA-311, respectively, including Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs) for the applicable chemicals.

Table 2-3: Toxicological and Physical Properties of Chemicals, RSA-311

Chemical	TWA[(a)]	STEL/ C (b)	Source (c)	IDLH (NIOSH) (d)	Route	Symptoms of Exposure
Groundwater						
TCE	100 ppm 50 ppm 25 ppm	100 ppm	PEL TLV REL	Ca (1,000 ppm)	Inh, Abs, Ing, Con	Irritation of eyes, skin; headache, vertigo; visual disturbances, fatigue, tremor, nausea, vomiting; dermatitis.
Vinyl chloride	1 ppm	5 ppm	PEL	Ca [N.D.]	Inh, Con,	lassitude; abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]
Perchlorate	10 mg/m^3 Inhalable particles 3.0 mg/m^3 Respirable Particles	NA	PEL TLV REL	NA	Inh, Ing, Con, Abs	Local irritation or stinging effect. Chronic ingestion of sufficient quantities may interfere with uptake of iodine by the thyroid which may cause hypothyroidism. Irritation of the eyes will cause stinging effect.
RDX	1.5 mg/m3	NA	REL	N.D.	Inh, Ing, Con, Abs	irritation eyes, skin; headache, irritability, lassitude, tremor, nausea, dizziness, vomiting, insomnia, convulsions
2,6-Dinitrotoluene	1.5 mg/m^3 1.5 mg/m^3	NA	PEL REL	Ca [50 mg/m3]	Inh, Ing, Con, Abs	Anoxia, cyanosis; anemia, jaundice; reproductive effects; [potential occupational carcinogen]
2-Nitrotoluene	5 ppm 2 pm 2 ppm	NA	PEL TLV REL	200 ppm	Inh, Abs, Ing, Con	Anoxia, cyanosis; headache, lassitude, dizziness; ataxia; dyspnea; tachycardia; nausea, vomiting.

Notes:
(a) The TWA concentration for a normal workday (usually eight or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day without adverse effect.
(b) STEL. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
(c) Occupational Safety and Health Administration (OSHA) PEL (29 Code of Federal Regulations [CFR] 1910.1000, Table Z).
(d) IDLH (NIOSH)— Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
(e) Exposure limits are based on coal tar pitch.

% – percent
Abs – skin absorption
ACGIH - American Conference of Governmental Industrial Hygiene
C – Ceiling limit value which should not be exceeded at any time.
Ca – Carcinogen
Con – skin and/or eye contact
DCE - dichloroethene
DNT – dinitrotoluene
IDLH - Immediately Dangerous to Life and Health
Inh – inhalation
Ing – ingestion
LEL – lower explosive limit
mg/m^3 – milligrams per cubic meter
NA – Not applicable
ND – Not determined
NIOSH – National Institute for Occupational Safety and Health
NT – Nitrotoluene
PEL – Permissible Exposure Limit
PETN - pentaerythritol tetranitrate
ppm – parts per million
RDX – 1,3,5-trinitro-1,3,5-triazine
REL – NIOSH Reportable Exposure Limit
STEL – Short Term Exposure Limit
TCE – trichloroethene
TLV – Threshold Limit Value
TNT – Trinitrotoluene
TWA – Time-Weighted Average

2.2 Special Medical Monitoring

Employees on this project whose work involves potential exposure to site contaminants will be included in the medical surveillance program.

Personnel will have a current medical exam clearance (physician's written opinion) in accordance with Occupational Safety and Health Administration (OSHA) standards prior to entering regulated work areas in accordance with 29 Code of Federal Regulations (CFR) 1910.120. ECC uses the services of WorkCare, whose principal is Dr. Peter Greaney, a Board-Certified Occupational Physician to review all exams and provide the clearances, which include an assessment of employee ability to wear respiratory protection and Personal Protective Equipment (PPE) safely. Complete results of everyone's medical examination results are maintained by the medical provider and will not to be kept on-site. The SSHO will ensure appropriate subcontractor's medical screenings are completed, documented, and the physician's written opinions are available at the work site.

3.0 PERSONAL PROTECTIVE EQUIPMENT

Unless otherwise approved by the SSHO, all activities will include at least American National Standards Institute (ANSI)-approved hard hats, safety-toe footwear, safety glasses with side impact protection and high visibility garments. **Table 3-1** summarizes the PPE anticipated during performance field activities.

Table 3-1. Personal Protective Equipment Selection

Activity	Respiratory Protection	Body Protection*	Hand Protection	Eye/Face/Other Protection	Hearing Protection	Fall Protection
Mobilization, Site Inspection and Site Preparation	NA	Level D	Leather palm work gloves; cut resistant gloves if sharp objects, cutting devices, or sharp edges are present	Safety glasses	Plugs or muffs if necessary, based on equipment use, where noise levels exceed 85 dBA	NA
Environmental Sampling		Modified Level D[(a)]	Leather or cut resistant gloves when cutting plastic tubes/ nitrile gloves when sampling	Safety glasses; for splash hazards, face shield with safety glasses or goggles		
Well Installation, Maintenance, and Abandonment			Nitrile or Leather palm work gloves	Safety glasses		
Equipment Decontamination, Demobilization and Site Restoration[(b)]			Nitrile or Leather palm work gloves	Safety glasses and face shield and apron (if necessary, for equipment decon)		

Notes:

a) A face shield with safety glasses or goggles shall be used during activities where a splash hazard exists. Wear permethrin treated gaiters when in grassy areas.

b) If direct contact with soils, boot covers/ over boots and Tyvek® may be required. Site Safety and Health Officer (SSHO) will determine when boot covers and Tyvek ® are needed

* - Level D body protection includes high visibility Class II garment.

dBA – decibels (adjusted)
NA – Not applicable
ISEB – In-Situ Enhanced Bioremediation
PPE – Personal Protective Equipment
SDS – Safety Data Sheet

3.1 Use and Limitations

Read and follow all manufacturer instructions regarding product use and limitations.

- ***Body protection*** – Wear normal work clothing including high visibility Class II garment. During soil disc and raking and excavation activities, boot covers /over boots and Tyvek ® may be required. The SSHO will determine when these over garments are required.
- ***Hand protection*** – Use gloves described in **Table 3-1**. Chemical protective gloves are meant for incidental contact. Change gloves in the event of immersion unless specifically selected for that purpose. Inspect frequently and change gloves on signs of contamination, and when protection is compromised by wear and tear.
- ***Eye/face protection*** – Wear protection prescribed in **Table 3-1**. Discard when protection is scratched or worn impacting visibility. If face shields are worn for chemical splash, also wear splash goggles underneath. Safety glasses will be worn under face shields for impact protection and under welding helmets. Lens shade will be selected based on hazard, following SOP Environment, Safety and Quality (ESQ)-6.1 (Task Instruction 6.1.02)
- ***Hearing Protection*** – Wear hearing protective devices in accordance with manufacturers' instructions, including fitting and insertion. Use of specific devices will be limited to exposures within the noise reduction ratings.
- ***Fall Protection*** – For the activities covered by this SSHP, fall protection is not anticipated; however, if it becomes necessary, the Safety and Health Manager (SHM) will prepare a site-specific fall protection plan and submit it to the Contracting Officer's Representative (COR) for acceptance

before proceeding.

3.2 Work Mission Duration

Work mission durations will be limited to accommodate acceptable service life of the PPE.

Where PPE may cause a hazard, such as heat stress, work mission duration will be determined in the AHA by the SSHO with the assistance of the SHM. Employees must exit the Exclusion Zone (EZ) for rest or monitoring in accordance with the established schedule.

3.3 Personal Protective Equipment Maintenance and Storage

It is important that all PPE be kept clean and properly maintained. Cleaning is particularly important for eye and face protection where dirty or fogged lenses could impair vision. Employees must inspect, clean, and maintain their PPE according to the manufacturers' instructions before and after each use. Supervisors are responsible for ensuring that users properly maintain their PPE in good condition.

Personal protective equipment must not be shared between employees until it has been properly cleaned and sanitized. PPE will be distributed for individual use whenever possible. Where employees provide their own protective equipment, ECC will be responsible for assuring its adequacy, including proper maintenance, and sanitation of such equipment.

3.4 Personal Protective Equipment Decontamination and Disposal

It is anticipated that most of the PPE utilized on the project, beyond the basic PPE elements (hard hat, safety glasses, steel-toed boots, leather gloves), will be of a disposable nature (nitrile or other chemical gloves, ear plugs, boot covers, and Tyvek®). Contaminated PPE will be collected in a dedicated container and disposed of appropriately at a suitable facility. Based on the contaminants present and their concentrations it is anticipated that disposable PPE will be disposed of as non-hazardous waste.

Earmuffs, safety glasses, and other non-disposable forms of PPE will be routinely wiped clean of any visible contamination after each use.

3.5 Personal Protective Equipment Training and Proper Fitting

Users will be trained on the selection, use and limitations of PPE. Each affected employee will demonstrate an understanding of the training specified in this section, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE.

Should ECC have reason to believe that any affected employee who has already been trained does not have the understanding and skill required of this section, the employer will retrain that employee.

Gloves, head gear, coveralls, and footwear must fit properly to avoid tripping and snagging hazards, or constriction and tearing. Hearing protection will be checked by the user and SSHO for proper fit and must be inserted/worn in accordance with manufacturer instructions.

3.6 Personal Protective Equipment Donning and Doffing Procedures

The SSHO will train on and demonstrate proper donning and doffing procedures for PPE ensembles worn in EZs during site orientation.

3.7 Personal Protective Equipment Inspection Procedures

Each person who is required to wear PPE will inspect their equipment prior to, during, and after each use. Defective or damaged equipment will not be used. Heavily contaminated PPE that cannot be adequately cleaned will be discarded. Stored PPE will be inspected every month to ensure that it has not been damaged and is suitable for use. Workers who wear PPE in the field will take note of the condition of the PPE worn by their co-workers and inform them of any apparent problems, such as missing equipment, tears in protective clothing, excessive contamination, improper use of PPE, inadequate PPE, etc.

3.8 Evaluation of Effectiveness of PPE Program

The SSHO will inspect the jobsite each day and as frequently as necessary to ensure that PPE has been properly selected and is being used as designed. The SSHO will also inspect PPE stored for emergency use every month. Similar PPE inspections will be conducted by ECC's SHM during scheduled visits of the project site.

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4.0 CONTAMINATION CONTROL, SANITATION AND WASTE MANAGEMENT

The following sections describe the contamination control during the field activities.

4.1 Work Zones

Access to the sites are limited to authorized project personnel, approved subcontractors and their employees, and local/State/Federal agency staff escorted by site personnel.

For the purposes of Work Zone Delineation, the site perimeters will encompass an area slightly larger than the portion of the site identified for activities. The perimeter of the sites will be properly delineated (caution tape or high visibility fencing).

4.1.1 Support Zone

The Support Zone (SZ) is located outside the Contamination Reduction Zone (CRZ) and within the site perimeter. The support zone is an uncontaminated (clean) area where personnel will not be exposed to hazardous materials or contaminants.

4.1.2 Contamination Reduction Zone

The CRZ is located in between and serves as a buffer between the SZ and the EZ. The CRZ is intended to prevent the spread of contamination and is utilized for both personnel and equipment decontamination.

4.1.3 Exclusion Zone

The EZ is the work area where, based on planned activities, there is potential for worker exposure to site contaminants. The EZ is bounded by the CRZ and accessed only through the Contamination Reduction Corridor (CRC). The EZ perimeter will be delineated with caution tape or high visibility fencing.

4.2 Access Controls

The SSHO and Site Superintendent will establish the physical boundaries of each zone and instruct all workers and visitors on the limits of the restricted areas. No one will be allowed to enter the restricted area without the required PPE for that area. The Site Superintendent will ensure compliance with all restricted area entry and exit procedures. The Site Superintendent will also designate a decontamination point for personnel to exit the contaminated area and to enter the clean area, which is where personnel may eat and rest.

All site personnel and/or visitors entering and exiting the EZ or the CRZ will be required to log-in/log-out from the site on a daily basis. The log will be maintained at the entrance.

4.3 Hazard Briefing

No person will be allowed on the site during site operations without first participating in a hazard briefing. In general, the briefing will consist of a review of the SSHP and the tailgate safety meeting. All persons on the site, including visitors, must sign the SSHP Acknowledgment Sheet and Daily Safety Meeting Form which is included in **Attachment 1.** Tailgate safety meetings will be held daily before site activities begin.

4.4 Visitor Access

The following section describes how to handle visitors to the site.

4.4.1 Approach

If unannounced visitors arrive at a site, ECC employees should approach them, introduce themselves, and respectfully ask the visitors to identify themselves and state their business. An effort should be made to distinguish between ECC workers and subcontractors and people for whom ECC is not responsible for enforcing health and safety rules on job sites, such as client representatives, agency representatives, and other visitors authorized by the client. For example, hardhats and safety glasses may be a requirement in the SZ or anywhere on the site for workers, but to enforce this requirement on all visitors may not be necessary. A respectful explanation of what areas to avoid may be all that is necessary.

4.4.2 Unauthorized Visitors

If visitors are unauthorized, ECC employees should explain to the visitors that entry to the site is restricted because the site contains hazards. The site boundaries and any other relevant restrictions should be pointed out to the visitors.

4.4.3 Visitors Authorized to View the Site from the Support Zone

If visitors are authorized by the client to see the site from the SZ, ECC employees should do the following:

- Review the tailgate safety meeting form with them and ask them to sign it.
- Provide the visitors with hardhats, safety glasses, and safety vests, if applicable; and,
- Prohibit entry to the EZ.

4.4.4 Visitors Authorized to Enter the Exclusion Zone During Ongoing Work Activities

If the visitors are authorized by the client to enter the EZ, ECC employees should do the following:

- Verify that they have current Hazardous Waste Operations and Emergency Response (HAZWOPER) training.
- Verify that they had a current physical exam authorizing work on hazardous waste sites.
- Review the SSHP and the tailgate safety meeting form and have the visitors sign the acknowledgement forms of all documents.
- Provide the PPE required for the site; and,
- Escort the visitor while in the EZ.

4.4.5 Refusal

If visitors refuse to comply with any one of the requirements listed in the previous sections, and the **client authorizes** the visitor to enter the EZ anyway, ECC will **shut down** any potentially hazardous equipment and take all practicable steps to eliminate other hazards and exposures. The event will be thoroughly documented.

Visitors who refuse to comply and are not authorized by the client should be asked to leave. Contact the local police if problems occur with visitors who refuse to leave.

4.5 Emergency Entry and Exit

People who will enter the site on an emergency basis will be briefed by the Site Superintendent regarding the hazards. All hazardous activities will cease in the event of an emergency. **Attachment 2A** provides more information for emergency procedures.

4.6 Personal Hygiene and Decontamination Procedures

The importance of good hygiene practices will be emphasized with all site workers. Upon exiting the EZ and CRZ, workers and/or site visitors will enter the CRZ and carefully remove all designated PPE, wash their hands, face, and forearms prior to eating, drinking, or smoking. Smoking, eating and drinking will only be allowed in clean work areas (i.e., SZ).

4.7 Equipment Decontamination Procedures

Heavy equipment will be decontaminated using dry methods, a pressure washer, and/or equivalent. Hand tools and smaller equipment will be decontaminated using a non-phosphate detergent scrub, followed by fresh water, and distilled or deionized water rinses. Prior to removal from site, decontaminated equipment and material will be inspected and accepted by the SSHO and the Site Superintendent.

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5.0 EMERGENCY PLANNING

Prior to the commencement of work, the Site Safety and Health Supervisor (SSHS) will contact potential emergency response personnel and will serve as the main point of contact of any on-site emergency. Additionally, field staff will be familiar with emergency condition identification, notification, and response procedures. Emergency response training shall be a part of the initial SSHP pre-work training required of all employees. Additional discussions or refreshers shall take place periodically throughout the project as part of the daily tailgate safety meetings.

The emergency telephone numbers for local emergency response and reporting organizations are provided in **Table 5-1**. Key personnel will have a copy of this table readily available at all times. The Emergency Action Plan and The Fire Protection and Prevention Plan are provided in **Attachments 2A and 2B, respectively)**. Directions to the nearest hospital from the site are provided below and a map is provided in **Attachment 3.** The SSHS will review emergency procedures and/or applicable site contingencies during the initial tailgate safety meeting with site personnel. Off-site emergency personnel will ultimately handle on-site emergencies. Initial response and first aid treatment, however, will be provided on-site. First aid kits, portable eyewash units, and fire extinguishers will be maintained on-site in accordance with ANSI.

The following lists the emergency call list and the project organization. This table must be available to the crew at all time. In case of an emergency, the crew must be transported to the designated medical center.

Table 5-1. Emergency Call List

Name/Organization	Phone Number
Fire Department (ask for Redstone Arsenal [RSA] Fire Department)	911
Fire Department (from cellular phone)	256-876-2117
Ambulance (Huntsville Emergency Medical Services Inc.[HEMSI])	911
Installation Emergency Operations Center (non-911 emergencies)	256-313-1043
Military Police	256-876-2222
Huntsville Hospital (Emergency Room)	256-265-8144
Huntsville Hospital (Trauma Center)	256-265-8137
Chemical Agent Emergencies (state that you are at Redstone)	911
Unexploded Ordnance (UXO) Emergencies (state that you are at Redstone)	911
Installation Operations Center (IOC)	256-313-1043
Garrison Safety Office • Michael Moore, Safety Manger • Michael Moore, Safety Manager (DSN) • Keith Coates, Safety & Occupational Health Specialist • Bobby Taylor, Safety & Occupational Health Specialist • Jonathan Niedergeses (Munitions and Explosives of Concern [MEC] Support)	256-876-2944 256-313-3297 256-897-3297 256-876-3383 256-313-3294 256-876-6027
Primary Site Emergency Contact, Matt Berry, Site Manager, RSA	601-278-4390
Clint Howard, U.S. Army Garrison, Chief Installation Restoration Branch	256-758-7084 (cellular) 256-842-3702 (office)
National Response Center	80-424-8802
Poison Control Center	800-222-1222
United States Environmental Protection Agency (USEPA) Region IV	404-347-3931
Pam Foti, ECC Project Manager	508-274-3084 (cellular) 865-288-0357 (office)
Kym Edelmen, ECC Corporate Safety Director	757-435-5384 (cellular)
Aaron Glad, Site Manager and ECC Site Safety and Health Officer (SSHO)	256-452-986
ECC Hot Line (ECC incident reporting)	650-347-7512 Ext 111

Note: KEY PROJECT/FIELD PERSONNEL ARE TO HAVE A COPY OF THIS LIST READILY AVAILABLE AT ALL TIMES.

5.1 Emergency Conditions

Fire, a medical emergency, a spill, severe weather, criminal or terrorist activity, incidents, accidents, injuries, and mishaps are the conditions that may lead to an emergency situation.

5.2 Evacuation and Rally Points

The SSHS will review procedures during the first tailgate safety meeting. Topics will include conditions leading to an emergency, location of rally point, contact numbers, and head counts. At least two of the Contractor's employees on-site will be trained/certified in First Aid/Cardio-Pulmonary Resuscitation/Bloodborne Pathogen Program.

5.3 Spill or Release Potential

In case of release or spill (i.e., fuel from associated with motorized equipment, the following is needed to prevent the release or spill of spreading:

- Non-combustible absorbent pillows or pads or speedi-dri;
- U.S. Department of Transportation (DOT)-approved 55-gallon drums
- Shovels; and
- Appropriate Personal Protective Equipment (PPE).

Water and/or sludge generated from spills will be transferred to DOT-approved 55-gallon drums.

5.4 Directions to Hospital

In case of a medical emergency, the closet hospital is Huntsville Hospital located at 101 Sivley Road SW, Huntsville, Alabama 35801 Driving directions from Main Gate No. 9 – Visitors Center, are given below:

Leaving from Main Gate N0. 9 – Visitors Center – Redstone Arsenal

Instructions: 6.2 miles – 11 minutes

1. Take Redstone Gateway SW to Rideout Road 2 min (0.2 miles)
2. Use the left 3 lanes to turn left onto Rideout Road (0.3 miles)
3. Use the right lane to take the ramp onto I-565 E (2.8 miles)
4. Use the right 2 lanes to take exit 17B for AL-53 S toward Governors Dr (0.5 miles)
5. Continue onto AL-53 S/Governors Dr SW - *Continue to follow Governors Dr SW, pass by AutoZone Auto Parts (on the right in 0.2 miles)* (2.2 miles)
6. Turn left 85 feet
7. Turn right 315 feet
8. 11. Turn left 420 feet
9. Huntsville Hospital will be on the left.

A hospital map with directions from each site is included in **Attachment 3**.

5.5 Heat Stress/Cold Stress

See **Attachments 4A** and **4B**.

5.6 Rescue Plan(s)

The SSHS will prepare a Rescue Plan(s) and present the Rescue Plan(s) to the crew, if the field crew will be working under any of the following situations:

- Geographically remote sites;
- Elevated positions;
- Using personal fall arrest systems;
- Confined spaces; and/or
- Atmospheres considered potentially Immediately Dangerous to Life and Health (IDLH).

None of these conditions are anticipated for the field activities at the site.

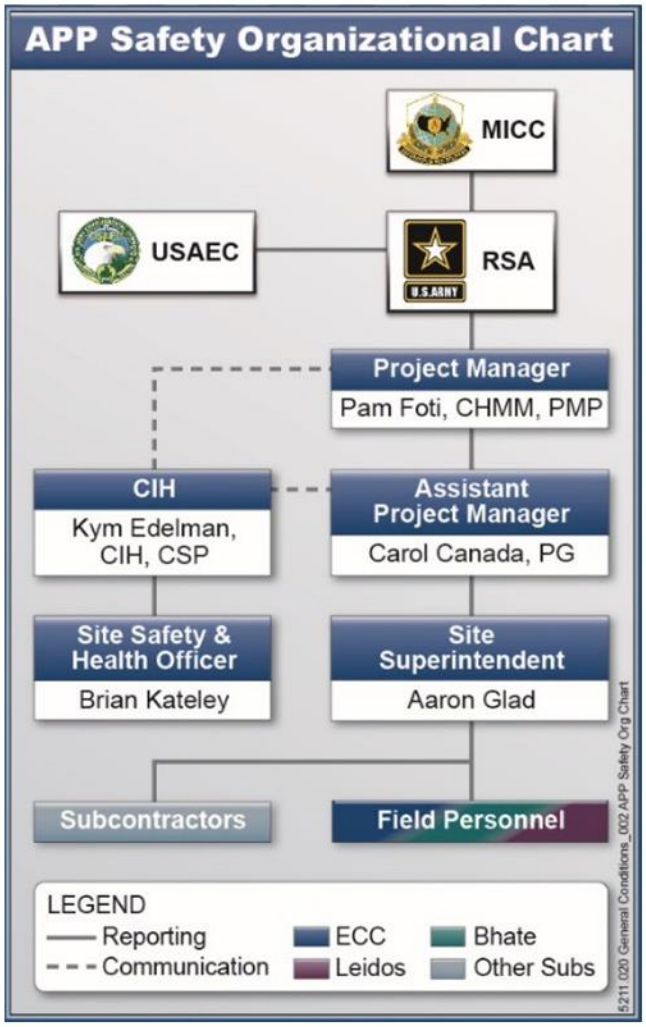
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6.0 ORGANIZATION, RESPONSIBILITIES, AND LINES OF AUTHORITY

ECC and its subcontractors are responsible for implementing this SSHP. Personnel responsibilities for project safety and the lines of authority of these safety personnel are described below. Refer to **Figure 6-1** for the project safety organization. Resumes of the SHM and SSHO are provided in **Attachment 5.**

ECC, as the prime contractor, is the "controlling authority" for all work site safety and health of the subcontractors. ECC is responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.

Figure 6-1: Safety Organization



6.1 Health and Safety Responsibilities

The following sections describe the key personnel involved in this project and their responsibilities. To achieve the goals of the SSHP, each individual must fulfill their responsibilities and comply with the health and safety requirements. Failure to do so could result in removal from the site.

No work will be conducted on the site without the presence of the Site Safety and Health Officer (SSHO) or designated CP. Pre-task analysis (AHA, daily tailgate, Job Safety Analysis) will be conducted prior to doing work.

6.1.1 ECC Project Manager

Reports through Program Director to the Chief Operating Officer.

The PM, Ms. Pam Foti, Certified Hazardous Material Manager (CHMM), Project Management Professional (PMP), represents ECC in all aspects of work under the contract and is responsible for the following:

- Providing leadership by setting an example for all site personnel through actions and words regarding the importance of proper health and safety practices and holding project staff accountable for safety performance.
- Ensuring adequate resources are available to implement the SSHP.
- Ensuring that subcontractor Statements of Work include appropriate safety provisions and expectations.
- Ensuring that mishaps are properly reported to the Army and ECC's ESQ reporting network.
- Notifying the SHM of any changes in the SOW or site conditions.
- Ensuring that the SSHP is updated to address new hazards.

6.1.2 ECC Safety and Health manager

Reports to the Vice President of Operations.

The SHM, Ms. Kym Edelman, Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP) will oversee the overall project health and safety structure and implementation and is responsible for the following:

- Reviewing and signing the SSHP prior to submittal and approving any modifications.
- Developing and/or reviewing AHAs prepared for the project.
- Approving the appointment of the SSHO and ensuring that the SSHO has the appropriate training and competencies to perform all expected duties.
- Being available on a 24-hour basis for consultation with the SSHO during on-site emergencies or as needed.
- Providing on-site consultation as needed to ensure the SSHP is fully implemented.
- Conducting general safety inspections during site visits and at least once per quarter.
- Participating in the investigation of mishaps.
- Evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.
- Assisting in development of on-site training, which will be provided by the SSHO.

6.1.3 Site Safety and Health Officer

Reports to the PM and SHM.

The SSHO, Mr. Brian Kateley, implements the task-specific SSHP. In accordance with United States Armh Corps of Engineers (USACE) EM 385-1-1, the SSHO must have completed the 30-hour OSHA Construction Safety course, the 30-hour General Industry Safety course, or an equivalent course meeting

the 30-hour training objectives; eight hours of safety and health coursework every year; and at least five years of experience in construction or general industry safety or four years of experience plus a third party, nationally accredited Safety and Occupational Health (SOH) certification.

The SSHO will be responsible for:

- Serving as the general site Competent Person (CP) for safety and health (EM 385-1-1 01.A.17 and 29 CFR 1926.20(b) (2)). No work will be done unless the SSHO or a suitable CP is on site.
- Overseeing compliance with the SSHP procedures and OSHA regulations through informal daily inspections.
- Developing (or assisting subcontractors with the development of) project-specific AHAs before work begins.
- Reporting to the site on a full-time basis for the duration of field activities.
- Serving as a member of the Quality Control (QC) staff on matters relating to safety and health.
- Stopping work if unacceptable safety and health conditions exist and taking necessary action to re-establish and maintain safe working conditions.
- Consulting and coordinating modifications to the SSHP with the SHM, ECC PM, and designated U.S. Army representative.
- Ensuring all site personnel and visitors are properly trained in site hazards.
- Ensuring all employees and subcontractors are properly trained on the SSHP /AHAs and implement the SSHP.
- Conducting air monitoring and preparing air monitoring reports.
- Conducting site safety surveys and maintaining deficiency logs.
- Ensuring accidents are reported, investigated, and corrective actions are implemented.
- Monitoring decontamination methods to determine effectiveness.
- Ensuring proper training on PPE usage and monitoring the effectiveness of the PPE program.
- Maintaining all required safety and health records (e.g., OSHA 300 Logs, incident/accident reports, training certificates and qualifications, equipment checklists, safety plans, air monitoring data and reports) throughout the life of the project.

6.1.4 Site Superintendent

Reports to the PM.

The Site Superintendent, Mr. Aaron Glad**,** is responsible for:

- Setting an example for all site personnel through actions and words regarding the importance of proper health and safety practices on the job.
- Assisting in the development of AHAs before beginning work.
- Communicating daily work plans and schedules with the SSHO.
- Monitoring overall safety performance of field personnel.
- Conducting a weekly general safety inspection of the site, when needed.
- Enforcing safety rules and correcting work practices or conditions that may result in injury or hazard exposure.
- Immediately stopping site operations in emergencies or serious hazard exposure.

- Participating in mishap investigations.
- Ensuring proper equipment is provided, utilized, and maintained in accordance with manufacturer recommendations.

6.1.5 Field Personnel

Reports to the SSHO, Site Superintendent, or CP.

Field personnel are responsible for understanding and abiding by the SSHP and performing work in a safe and responsible manner. Specific responsibilities include the following:

- Acting in a responsible manner at all times in order to prevent incidents, injury, and exposure to themselves and co-workers.
- Reporting all incidents, including near misses, and hazards to the SSHO.
- Attending and participating in all health and safety tailgate meetings.
- Following the instructions and directions of the SSHO, Site Superintendent, and/or CP.
- Utilizing the PPE provided.
- Following all field safety procedures for safe work practices.
- Performing tasks as instructed (unless the individual feels unqualified to perform the tasks safely).
- Conducting work in a manner compliant with the SSHP and AHAs.
- Reporting any personal condition that could affect their safety and/or the safety of coworkers (e.g., fatigue, drowsiness, illness, impairment by medications, influence by drugs or alcohol, emotional stress).

6.1.6 Subcontractors

Report to the SSHO or CP.

Subcontractors who perform work for ECC under this SSHP are responsible for the health and safety of their employees. The presence of an SSHO and the implementation of the SSHP do not relieve subcontractors of their responsibilities as employers. Specific responsibilities of subcontractors include:

- Complying with the requirements of their SOW.
- Development of AHAs for their work activities.
- Maintaining a safe and healthy work environment.
- Complying with contract requirements, laws, regulations, and EM 385-1-1.
- Reviewing the SSHP to ensure that the health and safety requirements of their specific tasks are satisfied.
- Performing all work in accordance with the SSHP requirements.
- Providing trained and experienced workers for the specific work activities.
- Participating in the Safety Tailgate Meetings.
- Identifying additional training needs for unique tasks.
- Reporting all incidents and participating in the investigations.
- Participating in routine site inspection activities.

- Ensuring all equipment brought to the site is in a "new or like new" condition, routinely inspected, and maintained in safe working order.
- Setting a positive safety example for all project staff.

6.1.7 Site Visitors

Site visitors will be responsible for the following:

- Participating in a site briefing before leaving the administrative office or site entry point.
- Following all site rules and instructions.
- Being escorted at all times unless otherwise approved by the SSHO.
- Wearing appropriate PPE.

6.2 Lines of Authority

ECC as the prime contractor is responsible for the implementation of the SOH Program as described in this SSHP and attachments. ECC will enforce compliance with the program requirements among our own employees, subcontractors and all others on the worksite.

The SSHO has a technical and administrative reporting relationship to the SHM who reports directly to ECC's President and Chief and Executive Officer. The reporting relationship provides for access to safety and health expertise as well as an independent reporting and line of communication. The SSHO has a functional reporting relationship to the PM, providing the PM and team with a resource for safety and health support for the project.

During field event, an SSHO or CP will perform daily and weekly health and safety inspections and provide general support to the PM for health and safety issues.

6.3 Competent Persons

The SSHO serves as the general CP, per EM 385-1-1 01.A.17 and 29 CFR 1926.20(b)(2). The qualifications of the SSHOs are included in **Attachment 5**.

CPs for specific activities will be designated in the AHAs for those activities, and their qualifications will be submitted and accepted with the AHA at the Preparatory Meeting.

No work will be performed unless a designated CP/SSHO is present at the job site.

6.4 Disciplinary Procedures

All employees are required to comply with APP and SSHP policies and procedures. Discipline will be in accordance with the Disciplinary Procedure described in the ECC Employee Handbook, which allows for immediate termination for serious infractions. ECC expects that all subcontractors will exercise proper discipline or terminate its employees at its sole discretion when justified. ECC retains the right to deny access to the site to any individual not compliant with safety requirements, in accordance with our subcontract agreement.

6.5 Manager and Supervisor Accountability

ECC managers and supervisors are accountable for providing a safe work environment through proper staffing, training, equipment availability, and by setting a leadership example for safety. Annual performance reviews for managers and supervisors include assessments of project safety performance as well as the individual's demonstrated attitude toward safety.

7.0 TRAINING

All ECC and subcontractor project personnel will have the training and certifications required to complete environmental remediation at RSA.

7.1 Project Meetings and Training Requirements

The training listed in **Table 7-1** will be provided to project personnel as noted. In addition to the topics listed below, the SSHO (in cooperation with the assistant SSHO), may identify additional topics and work tasks to be included in the training requirements. These special requirements may be noted on Project AHAs requiring additional training. All required training will be documented, and this documentation will be maintained on site.

Table 7-1: Project Meetings and Training Requirements

Topic	Description	Trainer	When Conducted	Personnel
General Training				
New Employee Indoctrination	Responsibilities for accident prevention; general SOH policies and procedures; reporting of mishaps; medical facilities and emergency response procedures; reporting of unsafe conditions and practices; job hazards and controls; other specific training as required.	SHM, SSHO, or other authorized by SHM	Before beginning field work	All new hires, and employees new to the project site.
APP/ SSHP	Review of APP/ SSHP requirements during site orientation.	SSHO	Before beginning field work	All project personnel
AHAs	Activity-specific hazards, controls, and training requirements for a specific phase or activity.	SSHO or designated CP	Before beginning specific tasks	Workers, supervisors, and oversight personnel engaged in the activity
HAZWOPER – General Training	40-Hour OSHA HAZWOPER initial training for general site employees, and three days of supervised on-the-job training for site workers.	HAZWOPER sites	Before beginning field work	Workers, supervisors, and oversight personnel working on-site who must enter the EZ or whose work exposes them to health or safety hazards related to hazardous waste or contaminated media.
HAZWOPER Supervisor Training	Eight-Hours of training for supervising activities on hazardous waste sites.	HAZWOPER sites	Before beginning field work	Supervisors at HAZWOPER sites
Respiratory Protection	In accordance with 29 CFR 1910.134	SHM, SSHO, or other authorized by SHM; by Subcontractor CP	Before use of respiratory protection	Employees engaged in operations requiring use of respirators
HAZWOPER Refresher	Eight-Hours of annual refresher training for workers on hazardous waste sites.	HAZWOPER sites or SHM	Before beginning field work	Workers, supervisors, and oversight personnel working on-site who must enter the EZ or whose work exposes them to health or safety hazards related to hazardous waste or contaminated media.
Emergency Action Plan	Roles, responsibilities, recognition of emergency conditions, reporting and notification, evacuation, and other procedures.	SSHO	Before beginning field work	All project personnel, with detailed information on procedures for workers with special responsibilities
Hazard Communication	Requirements for SDSs and labels; hazards of site materials and controls; signs and symptoms of exposure; location of and access to Hazardous Materials and their SDSs.	SSHO	Before beginning field work	All project personnel potentially exposed to hazardous materials

Topic	Description	Trainer	When Conducted	Personnel
Fire Protection and Prevention	Requirements of the Fire Protection and Prevention Plan, general education on selection, distribution, and proper use of fire extinguishers.	SSHO	Before beginning field work as necessary to document training	All project personnel. Fire extinguisher use for personnel designated as Fire Watch (other personnel as deemed necessary)
OSHA 30-hour construction or equivalent	Common hazards, controls, and OSHA requirements for construction activities.	Authorized OSHA Trainer	Prior to beginning field work	SSHO
Daily Safety Briefing	Review of Plan-of-the-Day and daily hazards; presentation of a specific topic; refresher training on various issues; and changes in hazards, controls, or procedures.	SSHO, Site Superintendent, CP	Daily, prior to work	All field workers, and field oversight personnel
Weekly safety Meeting	Incidents, modification to SSHP , upcoming work, new hazards, etc.	SSHO, CP	Weekly	All field personnel and field oversight personnel
Special Training				
First Aid/CPR	Principles and techniques for First Aid and CPR.	Red Cross, American Heart Association, or other authorized provider	Prior to beginning field work	At least two project personnel (SSHO, and other field personnel)
Fall protection	Fall (from elevation) hazards, fall protection techniques, proper use of personal fall arrest systems and rescue procedures.	SSHO, other qualified instructors	Prior to work at elevation	Task-specific, workers exposed to fall hazards
Lockout/tagout	Site-specific energy control and verification procedures.	SSHO, other qualified instructors	Prior to utilization of Lockout/tagout procedures	Authorized personnel engaged in lockout/ tagout, and affected employees whose work may be impacted by a lockout/ tagout situation
Forklifts	Hazards and operation procedures, including machine-specific safe operating procedures.	SSHO	Prior to operation of forklift; every three years	Forklift/powered industrial truck operators
Other heavy equipment operations	Qualified by SSHO, Site Superintendent or Equipment Supervisor as documented on ECC Equipment Operator Qualifications Form.	SSHO, Equipment Supervisor	Prior to heavy equipment operations on site	Equipment operators
Power tools (e.g., chain saws, chippers, powder-actuated tools, compressed air systems)	Hazards: proper use and maintenance of tools as described in operations manual. Powder-operated tool users certified by manufacturer.	SSHO, or trainer authorized by manufacturer (explosive-actuated tools)	As part of general site orientation; prior to use of specific tools	Project personnel using power tools
UXO Awareness Training	Recognition of munitions and explosives of concern that may be encountered during site activities	UXO Qualified Personnel	Prior to beginning site operations	All site personnel

Notes:

AHA – Activity Hazard Analysis
APP – Accident Prevention Plan
CFR – Code of Federal Regulations
CP – Competent Person
CPR – Cardiopulmonary Resuscitation
EZ – Exclusion Zone
HAZWOPER – Hazardous Waste Operations and Emergency Response
OSHA – Occupational Safety and Health Administration
SDS – Safety Data Sheet
SHM – Safety and Health Manager
SOH – Safety and Occupational Health
SSHO – Site Safety and Health Office
SSHP – Site Safety and Health Plan
UXO – Unexploded Ordnance

7.2 Safety Indoctrination Training for New Employees

New employees to ECC receive indoctrination training before they are allowed to participate in field work. The indoctrination training consists of the following:

- ECC COVID-19 Prevention Program (**Attachment 6)**
- Review requirements and responsibilities for accident prevention and maintaining a safe and healthy workplace.
- Review ECC's general safety and health policies and procedures.
- Review ECC's incident reporting system and procedures.
- Identify employees' responsibilities for reporting incidents (safety, health, and quality).
- Review medical treatment facilities of the employee's assigned office.
- Review safety, emergency, and evacuation procedures for the employee's assigned office.

7.3 Periodic Safety and Health Training for Supervisors and Employees

All project personnel will participate in training/refresher topics throughout the project. These topics may be presented as part of the daily tailgate meetings, or as separate classes established for specific project work activities and procedures. All supervisors, managers, and employees are encouraged to participate in other seminars or courses provided by outside vendors as necessary to increase knowledge and to maintain currency with construction topics, hazards, and controls.

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8.0 EXPOSURE MONITORING AND AIR SAMPLING

Based on historical sampling analysis data (low-level concentrations of VOCs), elevated levels of VOCs in the breathing zone are not anticipated, air monitoring is required during intrusive activities. Air monitoring will be performed in the general work area and the breathing zone prior to starting and during intrusive activities. Personnel performing testing and monitoring will be trained in testing and monitoring procedures and hazards. Monitoring equipment will be used, inspected, maintained, and properly calibrated in accordance with the manufactures' instructions and standard industrial hygiene practice.

Table 8-1 below lists the monitoring requirements and response actions for this project. All direct and integrated air monitoring equipment will be properly calibrated before and after each period of use in accordance with the manufactures' instructions and standard industrial hygiene practice.

Table 8-1. Exposure Monitoring

Instrument / Contaminant	Frequency	Action Levels	Actions/Upgrade and Rationale
Real Time (air, noise, heat, radiation, light)			
Multi-RAE Plus or equivalent / VOCs	During any intrusive activities	Work Area: Sustained readings of 5 ppm VOC, 20.8% O_2 < 10% LEL 15 ppm CO < 5 ppm H_2S in the breathing zone.	Stop activities, suspend work activities for 15 to 30 minutes; if readings are sustained then contact SHM[(a).]
OSHA/NIOSH HEAT Index App + Body Temp / Heart Rate Monitoring	Daily during work in hot conditions (> 85°F Level D, > 70°F when impervious coveralls worn)	Variable depending on the individual and work activity	Follow Precautions recommended by the HEAT Index app. Implement physiological monitoring when Heat Index indicates Moderate Risk for employees in protective clothing working in sunlight; and for other workers when Heat Index indicates High Risk; and for any workers indicating signs and symptoms of heat stress.

Notes:

a. Contact with the SHM must be made prior to continuance of work. The SHM may then initiate perimeter/integrated air sampling along with additional engineering controls

% – percent
°F – degrees Fahrenheit
> – greater than
< - less than
CO – carbon monoxide
H_2S – hydrogen sulfide
LEL – lower explosive limit
NIOSH – National Institute for Occupational Safety and Heath
O_2 – oxygen
PID – Photoionization detector
ppm – parts per million
OSHA – Occupational Safety and Health Administration
SHM – Safety and Health Manager
VOC – Volatile organic compounds

Records will include the date, time, substances or hazards monitored, person conducting monitoring, calibration date and method, operations and location of monitoring, and results. Records are available to employees, their representatives, and to the Army.

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9.0 EFFECTIVENESS OF P`LAN

The effectiveness of this SSHP will be determined by the inspections listed below, as well as from incident investigations and input by site personnel including reports of hazards, safety observations, and suggestions for improvement.

9.1 Safety and Health Inspections

ECC and its subcontractors will perform periodic health and safety inspections throughout the duration of the environmental remediation field activities at RSA. Results of all health and safety compliance review audits or inspections will become part of the project file.

9.2 General Inspection Procedures

Table 9-1 lists the general inspection requirements for this project.

Daily site-wide inspections will be conducted by the SSHO. Other CPs identified in specific AHAs will also conduct daily inspections of the work activities within their responsibility, as deemed necessary. Findings that represent deficiencies in the implementation of the SSHP or EM 385-1-1 will be added to the Tracking Log. Actions, timetable, and responsibility for correcting the deficiencies shall be recorded in the Deficiency Tracking Log. Follow-up inspections to ensure correction of any identified deficiencies will also be conducted and documented in the Deficiency Tracking Log. The Deficiency Tracking Log will be posted in the administrative area and updated daily. A monthly evaluation of the data should be discussed in the QC or SOH meeting with everyone on the project.

Table 9-1: General Inspection Requirements

What	Who	When	Documentation
General site conditions	SSHO	Daily	Mobile safety app
	CM/QC	Bi-Weekly	Site Health and Safety Inspection Checklist and Action Item Report, cc: SSHO, PM, Program/SHM
	PM	Monthly (as travel permits)	
	Program SHM	Monthly (as travel permits)	
Mobile construction equipment	Operators	Initial and Daily	Inspection checklist, cc: Construction/Equipment Supervisor (Note: Notify Army before initial to coordinate joint inspection)
Construction tools and equipment	Users	Daily	None. Tag defective items "out of service"
Lock out/Tag Out	SSHO	Prior to working on machinery, equipment, or process units where employees may be exposed to hazardous energy sources.	Lockout/Tagout Permit
Rigging	CP	Daily	None. Rigging items must be tagged with load capacities.
Ladders	SSHO	Weekly	Logbook, tag or inspection log form
Emergency supplies and equipment (fire extinguishers, spill response, PPE, First Aid, etc.)	SSHO	Weekly	Logbook, tag or inspection log form

What	Who	When	Documentation
PPE	SSHO	Initial, Periodic	None
	Users	Daily	None
Hazardous energy sources and processes (electrical systems, pneumatic equipment, etc.)	CP or QP	Initial	Per operating instructions, QCP, O&M procedures
	User/Operator	Daily	TBD

Notes:
CM – Construction Manager
CP – Competent Person
O&M – Operations and Maintenance
PPE – Personal Protective Equipment
PM –Project Manager
QC – Quality Control
QCP – Quality Control Plan
QP – Qualified Person
SHM – Safety and Health Manager
SSHO – Site Safety and Health Officer
TBD – To be Determined

9.3 External Inspections and Certifications

If regulatory agency personnel arrive on site to conduct an inspection, the ECC PM and the following individuals will be contacted immediately:

- COR
- Subcontractor's site representative
- ECC SHM
- ECC General Counsel

If a citation is issued to ECC or its subcontractors, a copy of the citation will be submitted to the COR along with a Corrective Action Plan.

9.4 Follow-up Procedures for Inspection Deficiencies

All deficiencies identified during project or equipment inspections are noted and tracked through closure. Deficiencies identified by operators during equipment inspections are noted on the equipment inspection form. Any deficiency noted must be reviewed by the SSHO or site supervisor/foreman prior to the equipment being allowed to operate. Any deficiency that affects safe work performance must be corrected before the equipment is put back into operation. Minor deficiencies that do not affect safe performance will be corrected as soon as practical. Following correction of the deficiency, the noted item is initialed by the SSHO on the inspection form as corrected.

Deficiencies identified during the weekly formal site inspections are noted on the inspection form (with a due date and responsible individual) as well as on the SOH Deficiency Tracking Log posted on the project Safety and Health Bulletin Board. These deficiencies are also tracked to closure and verified upon completion. Deficiencies corrected immediately will be noted on the weekly inspection form.

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10.0 REFERENCES

APTIM. 2020a. *RCRA Facility Investigation Report, RSA-115, Inactive East Side Blowdown Lagoon at Test Area 5, Operable Unit 13, Revision 3, U.S. Army Garrison* – Redstone, Madison County, Alabama. August.

APTIM. 2020b. *RCRA Facility Investigation Report, RSA-116, South Side Blowdown Lagoon at Test Area 5, Operable Unit 13, Revision 4, U.S. Army Garrison* – Redstone, Madison County, Alabama. November.

Occupational Safety and Health Administration (OSHA). 1999. *Occupational Safety and Health Standards, 29 Code of Federal Regulations 1910*. 1 July.

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ATTACHMENTS

ATTACHMENT 1

ACTIVITY HAZARD ANALYSIS

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Activity/Work Task: **Mobilization, Site Inspection, and Site Preparation Activities**	Overall Risk Assessment Code (RAC) (Use highest code): **L**
Project Location: **Redstone Arsenal (RSA), Alabama (AL)**	
Contract Number: **W9124J-18-D-0004/ W9124J-22-F045**	
Date Prepared / Revised: **01 June 2023**	
Prepared by (Name/Title): **Courtney Bigelow, Associate Scientist**	
Reviewed by (Name/Title): **Kym Edelman, CIH, CSP / Site and Health Manager**	
Competent Person (Name/Title): **Aaron Glad, Site Superintendent**	
Notes: (Field Notes, Review Comments, etc.)	

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

JOB STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS Consider People, Equipment, Materials and Environment *(Note: Standard PPE required for this activity includes Hard Hat, Safety glasses with side protection, and safety-toe footwear. Additional PPE requirements are listed in this column depending on the hazard. This constitutes the Workplace Hazard Assessment per 29 CFR 1910.132. Additional assessments and PPE selection when needed will be documented on a daily briefing sign-in form and signed by the SSHO in accordance with WE SOP ESQ 6.1. Hazard assessment and respirator selection for inhalation hazards are documented in the site Respiratory Protection Plan if respirators are part of PPE.)*	RAC
Underground utility survey Identify all overhead utilities	Contact with Overhead Utility Lines – Electrocution, Fires/underground utilities	General Safety - To minimize potential hazards all personnel shall attend site orientation prior to start of work activities in addition to daily Safety Tailgate meetings to familiarize themselves to hazards, emergency procedures, operational aspects & heavy equipment use, and change(s) in site work conditions. Daily housekeeping will be implemented during and at the ends of each workday. Equipment vehicles must be set up with a fire extinguisher (min 10:BC & a FA Kit). Drinking water must be stored in a cooler clearly marked "Food & Drink Only – No Samples". • Before work begins, survey the site for overhead power lines. LOOK UP! Equipment will not be used that is able to reach overhead power lines. • If work must be conducted closer to utilities than guidelines allow, the utility company must be contacted. • An observer/spotter shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. This shall be the ONLY job the observer is performing when an observer is required.	L

Underground utility survey Identify all overhead utilities (Continued)	Contact with Overhead Utility Lines – Electrocution, Fires/underground utilities (Continued)	• Keep all personnel well away from the equipment whenever it is close to power lines. • If intrusive activities, Louisiana 811 shall be notified prior to with sufficient time allowed for white-lining and utility marking. — Excavation Permit Procedure: Mark the area for the requested clearance and then submit an excavation permit with RSA. Alabama 811 is contacted 48 hours prior to activity start. • ECC personnel will "white-line" or otherwise mark the area where the wells are to be installed, prior to utility marking. • Intrusive soil activities conducted within a five foot "Buffer Zone" (horizontal or vertical, as measured from the outside edge of the utility) of any utility (electric, gas, high pressure, chemical storage tanks, pipelines, sewers, etc.) may require the use of non-aggressive excavation methods such as hand excavation using non-conductive hand tools, use of an air spade, hydro-excavation, or similar means (some jurisdictions require more stringent buffer zones). Spotter will assist the operator/workers to identify unknown conditions during drilling. • If a previously unknown utility line is identified, uncovered, or disturbed during intrusive activities, stop immediately and project management notified. Intrusive operations shall not recommence until the line has been evaluated, identified, and the appropriate utility notified. • Most utilities and marking services utilize the American Public Works Association Uniform Color Code for marking out utilities. All personnel involved in excavation projects will be familiar with this code.	L
	Back Strain or Sprain	• Use proper lifting techniques, move heavy objects with wheelbarrow/carts, seek assistance if items weigh over 50 pounds.	L
Receipt and placement of equipment vehicle: Spotting of equipment vehicle	Struck-by moving truck	• Always ensure a spotter for delivery truck stays in line-of-sight of driver at all times.	L
	Caught in or under equipment vehicle	• Use a spotter to coordinate activities of driver and person setting cribbing, tie-downs, chains. • Keep hands out of pinch points. • Wear leather work gloves.	L
	Contact with Overhead Utility Lines – Electrocution, Fires	• Before work begins, survey the site for overhead power lines. LOOK UP! Equipment will not be used that is able to reach overhead power lines. An observer/spotter shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. This shall be the ONLY job the observer is performing when an observer is required. • Keep all personnel well away from the equipment whenever it is close to power lines.	L
Installation of temporary work zones construction fencing	Struck-by hand tools	• Wear leather gloves, safety-glasses, hard hats, safety-toe footwear. Keep hands out of pinch points. • Use post driver, not sledgehammer, for placing fence posts. Tape top of fence post or install mushroom caps to reduce potential for scrapes.	L

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Installation of erosion controls	Sprains/strains Struck-By (hand tools)	• Use two people to carry heavy loads of fencing/posts. Do not lift and carry more than comfortable weight for individual; 50 lbs. maximum.	L
Establishment of work zones, decontamination stations for personnel and equipment	Slips/trips/falls	• Wear high traction safety-toe footwear. • Keep loads manageable to not obstruct vision.	L
	Scrapes and cuts	• Wear safety glasses, gloves and long sleeves.	L
	Contact with poisonous plants (e.g. poison ivy)	• Inspect area before starting. • Wear long sleeve shirts, tuck sleeves and pant legs. If there is heavy growth, wear disposable coveralls and use barrier cream (e.g. Ivy Block). • Have Tecnu or other poison ivy cleanser on-hand, and wash immediately after contact.	L
	Stung by bees/hornets, bit by ticks or snakes	• Inspect areas for hives. • Ensure allergic individuals have emergency medical kit and are committed to using it. • Use insect repellant containing DEET on exposed skin and Permethrin on clothing. • Do not approach snakes. If bitten, seek medical attention.	L
	Struck by moving equipment	• Personnel will stay out of equipment swing areas and pinch-points.	L
	Fire/explosion of gasoline	• Allow equipment to cool before refueling and eliminate other sources of ignition. • Use only approved NFPA safety cans for gasoline. • Cleanup spills immediately.	L
	Heat Stress/Cold Stress (applies to all job steps)	• Monitor weather conditions and implement controls in accordance with Heat/Cold Stress Prevention Plan in APP. • Stay hydrated. • Stop and rest in cool shaded area if heat strain symptoms occur and when instructed by SSHO. • Report all signs and symptoms of heat strain immediately to SSHO.	L
	Severe Weather (applies to all job steps)	• Shut down operations during severe electrical storms, heavy rain, high wind and evacuate site/take cover. • Train personnel on Emergencies Response. • Monitor weather systems.	L
	Eye injuries	• Safety glasses with side shields (impact resistant).	L

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Stop work and notify the Team Leader if you are not sure how to perform your task safely!	*Stop work and notify the Team Leader if you are not sure how to perform your task safely!*	*Stop work and notify the Team Leader if you are not sure how to perform your task safely!*
Equipment to be Used	**Training Requirements**	**Inspection Requirements**
1. Support Vehicles 2. Skid steer/forklift <u>Support Zone</u> • Cell phone or Radio communication • Eyewash station • Fire extinguishers • First aid kit • Drinking water • 911 Air horn • Spill containment supplies • Air Monitoring equipment, if needed • Emergency decontamination supplies **PPE: Level D (hardhat, steel toe boots, work gloves, orange safety vest, safety glasses, and hearing protection, as needed)**	• Only qualified operators permitted to operate mobile equipment • Operators of forklifts will have recent certification / training in safe forklift operation (20 CFR 1910, Subpart N – Powered Industrial Trucks) • First Aid/Cardiopulmonary Resuscitation training (at least two individuals onsite) • Initial Safety Orientation • Daily Safety Tailgate Meetings • Emergency Response Plan/Procedures • Fire extinguishers. **Competent Person: Site Superintendent and/or SSHO**	• SSHO daily site inspection • Equipment - Receipt and inspected by SSHO • Competent person will inspect equipment daily prior to each use. No equipment will be placed in service until all deficiencies are corrected • Complete ECC daily equipment inspection form • Weekly inspection of first aid kits • Monthly inspection of fire extinguishers • GFCIs (at least monthly).

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Activity/Work Task: **Environmental Sampling**	Overall Risk Assessment Code (RAC) (Use highest code) **L**
Project Location: **Redstone Arsenal (RSA), Alabama (AL)**	
Contract Number: **W9124J-18-D-0004/ W9124J-22-F045**	
Date Prepared / Revised: **01 June 2023**	
Prepared by (Name/Title): **Courtney Bigelow, Associate Scientist**	
Reviewed by (Name/Title): **Kym Edelman, CIH, CSP / Site and Health Manager**	
Competent Person (Name/Title): **Aaron Glad, Site Superintendent**	
Notes: (Field Notes, Review Comments, etc.)	

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

JOB STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS **Consider People, Equipment, Materials and Environment** *(Note: Standard PPE required for this activity includes Hard Hat, Safety glasses with side protection, and safety-toe footwear. Additional PPE requirements are listed in this column depending on the hazard. This constitutes the Workplace Hazard Assessment per 29 CFR 1910.132. Additional assessments and PPE selection when needed will be documented on a daily briefing sign-in form and signed by the SSHS in accordance with ECC SOP ESQ 6.1. Hazard assessment and respirator selection for inhalation hazards are documented in the site Respiratory Protection Plan if respirators are part of PPE.)*	RAC
Labeling sample containers Handling sample containers w/ preservation / adding preservation to containers Purging monitoring wells Filling sample containers from soil borings or well sample pump Cleaning outer surface of sample containers	• Personal injury • Slips & Trips • Lifting Strains & Sprains • Heat Stress/Cold Stress • Splash hazard • Handling Materials Containing Hazardous Materials • Proper Material Handling • Biohazard and Controls	General Safety - To minimize potential hazards all personnel shall attend site orientation prior to start of work activities in addition to daily Tailgate meeting. Review JSA to familiarize themselves to hazards, emergency procedures and equipment, operational aspects & heavy equipment use, and change(s) in site/work conditions. Daily housekeeping will be implemented at the end of each workday. Equipment/vehicles must be set up with a fire extinguisher (min 10:BC & a FA Kit w/ eye wash. Drinking water must be stored in a cooler clearly marked "Food & Drink Only – No Samples". **Stay on established pathways and ensure tools, cords, other objects are removed from walk areas to prevent trips and falls.** **Be cautious of muddy, wet, icy, or other slippery surfaces. Ensure surfaces are cleared and proper footwear is utilized to prevent slips/falls.**	L

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Labeling sample containers Handling sample containers w/ preservation / adding preservation to containers Purging monitoring wells Filling sample containers from soil borings or well sample pump Cleaning outer surface of sample containers (CONTINUED)	• Personal injury • Slips & Trips • Lifting Strains & Sprains • Heat Stress/Cold Stress • Splash hazard • Handling Materials Containing Hazardous Materials • Proper Material Handling • Biohazard and Controls (CONTINUED)	**Hand & Power Tool Use:** Prior to use all tools must be inspected. Any damaged or defective tools will be tagged and removed from service for repair and/or discarded. Ensure all guards are in place on tools. Wear protective gloves based on hazard associated with tool. Cutting devices must have blade protection. Fixed blade utility knives that cannot be retracted are prohibited. Ensure electrical tools are double insulated or properly grounded. Extension cords shall be connected to a GFCI. **Working with Hazardous Materials:** Employees will be provided with an overview of the hazards associated with the chemicals that will be used. A copy of the SDS will be available for review and proper PPE will be provided.	L
		Heat Stress/Cold Stress: • Monitor weather conditions and implement controls in accordance with Heat/Cold Stress Prevention Plan in APP. • Stay hydrated. • Stop and rest in cool shaded area if heat strain symptoms occur and when instructed by SSHO. • Report all signs and symptoms of heat strain immediately to SSHO. **PPE:** Modified Level-D PPE will be worn inside posted areas. Any PPE upgrade will be in accordance with the SSHP action level guidelines. A face shield or goggles shall be used during activities where a splash hazard exists. Use of chemical resistant gloves shall be worn when there is potential skin contact with contaminated fluids. Hearing protection shall be worn if noise survey results above TWA of 85dBA. Wear Permethrin treated gaiters. **Material Handling & Storage:** No individual employee is permitted to lift any object that weights over 50-pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting are for lifting objects over the 50-pounds limit. Know the weight of the load and ensure loads are stable and secure before transporting. Ensure stages materials are properly stacked and secured to prevent sliding/falling. **Biohazard Controls:** • Inspect area before starting. • Wear long sleeve shirts, tuck sleeves and pant legs. If there is heavy growth, wear disposable coveralls and use barrier cream (e.g. Ivy Block). Wear Permethrin treated gaiters. • Have Tecnu or other poison ivy cleanser on-hand and wash immediately after contact. • Do not approach any wild animals. If bitten seek medical attention.	L

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Use of Generator	• Lift and carrying generator • Fire hazard while refueling	**Back Injury:** • Do not lift awkward sized items use proper lifting techniques • Do not use equipment to lift and move drums, equipment and supplies. Lift with your legs not with your back. • Additional personnel will be used to lift items weighing over 60 pounds. If possible, use mechanical movement aids (i.e., hand truck or wheelbarrow). • A fire extinguisher and spill containment supplies should be readily available. Ensure generator is on the ground while refueling. • Fuel generator only after engine has been shut down and cooled	**L**

Stop work and notify the Team Leader if you are not sure how to perform your task safely!	***Stop work and notify the Team Leader if you are not sure how to perform your task safely!***	***Stop work and notify the Team Leader if you are not sure how to perform your task safely!***
Equipment to be Used	**Training Requirements**	**Inspection Requirements**
• Hand Sampling Tools • Generator <u>Support Zone</u> • Cell phone or Radio communication • Eyewash station • Fire extinguishers • First aid kit • Drinking water • 911 Air horn • Spill containment supplies • Air Monitoring equipment, if needed • Emergency decontamination supplies **PPE: Modified Level D (hardhat, steel toe boots, nitrile gloves when sampling/leather gloves when cutting plastic tubes, gaiters, orange safety vest, safety glasses, and hearing protection, as needed). A face shield or goggles shall be used during activities where a splash hazard exists. Wear Permethrin treated gaiters.**	• Only qualified operators permitted to operate First Aid/Cardiopulmonary Resuscitation training (at least two individuals onsite) • Initial Safety Orientation • Daily Safety Tailgate Meetings • Emergency Response Plan/Procedures • Fire extinguishers **Competent Person: Site Superintendent and/or SSHO**	• Daily inspection of hand and power tools with replacement of damaged items. • Annual and monthly inspection of fire extinguishers • Weekly inspection of first aid kits/eyewash

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Activity/Work Task: **Well Installation, Maintenance and Abandonment**	Overall Risk Assessment Code (RAC) (Use highest code): **L**
Project Location: **Redstone Arsenal (RSA), Alabama (AL)**	
Contract Number: **W9124J-18-D-0004/ W9124J-22-F045**	
Date Prepared / Revised: **01 June 2023**	
Prepared by (Name/Title): **Courtney Bigelow, Associate Scientist**	
Reviewed by (Name/Title): **Kym Edelman, CIH, CSP / Site and Health Manager**	
Competent Person (Name/Title): **Aaron Glad, Site Superintendent**	
Notes: (Field Notes, Review Comments, etc.)	

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- E = Extremely High Risk
- H = High Risk
- M = Moderate Risk
- L = Low Risk

JOB STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS **Consider People, Equipment, Materials and Environment** *(Note: Standard PPE required for this activity includes Hard Hat, Safety glasses with side protection, and safety-toe footwear. Additional PPE requirements are listed in this column depending on the hazard. This constitutes the Workplace Hazard Assessment per 29 CFR 1910.132. Additional assessments and PPE selection when needed will be documented on a daily briefing sign-in form and signed by the SSHS in accordance with ECC SOP ESQ 6.1. Hazard assessment and respirator selection for inhalation hazards are documented in the site Respiratory Protection Plan if respirators are part of PPE.)*	RAC
Mobilization		General Safety - To minimize potential hazards all personnel shall attend site orientation prior to start of work activities in addition to daily Safety Tailgate meetings to familiarize themselves to hazards, emergency procedures, operational aspects & heavy equipment use, and change(s) in site work conditions. Daily housekeeping will be implemented during and at the ends of each workday. Equipment vehicles must be set up with a fire extinguisher (min 10:BC & a FA Kit). Drinking water must be stored in a cooler clearly marked "Food & Drink Only – No Samples". • Level D PPE will be worn inside the designated EZ. Any PPE upgrade will be in accordance with APP guidelines. Hearing protection shall be worn if noise survey results above TWA of 85 dBA	L

Direct Push Technology (DPT), Hollow Stem Auger (HSA), Air Rotary Activities	Contact with Underground and Overhead Utility Lines – Electrocutions, Fires/underground utilities	• Before work begins, survey the site for overhead power lines. LOOK UP! Equipment will not be used that is able to reach overhead power lines. • If work must be conducted closer to utilities than guidelines allow, the utility company must be contacted. • An observer/spotter shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. This shall be the ONLY job the observer is performing when an observer is required. • Keep all personnel well away from the equipment whenever it is close to power lines. • If intrusive activities, Alabama 811 shall be notified prior to with sufficient time allowed for white-lining and utility marking. — Excavation Permit Procedure: Mark the area for the requested clearance and then submit an excavation permit with RSA DPW. Alabama 811 is contacted 48 hours prior to activity start. • ECC personnel will "white-line" or otherwise mark the area where the wells are to be installed, prior to utility marking. • Intrusive soil activities conducted within a five foot "Buffer Zone" (horizontal or vertical, as measured from the outside edge of the utility) of any utility (electric, gas, high pressure, chemical storage tanks, pipelines, sewers, etc.) may require the use of non-aggressive excavation methods such as hand excavation using non-conductive hand tools, use of an air spade, hydro-excavation, or similar means (some jurisdictions require more stringent buffer zones). Spotter will assist the operator/workers to identify unknown conditions during drilling. • If a previously unknown utility line is identified, uncovered, or disturbed during intrusive activities, stop immediately and project management notified. Intrusive operations shall not recommence until the line has been evaluated, identified, and the appropriate utility notified. Most utilities and marking services utilize the American Public Works Association Uniform Color Code for marking out utilities. All personnel involved in excavation projects will be familiar with this code. Before derrick is raised a thorough walkthrough of surrounding area is required to ensure there are no overhead utilities within 100 feet horizontally. If overhead utilities are within 100 ft horizontally of the derrick, consult local utility company and refer to EM 385-1-1 Table 11-1 before commencing operations.	L
	Equipment Malfunction	• Rig operators must be qualified and designated. • All operations must be conducted in accordance with manufacturer's operations manual. Ensure equipment manual is on site at all times and contents of the manual, specifically related to safe operations, have been reviewed will all employees engaged in activities. Ensure this review is documented. • Complete inspections and maintenance of the rig in accordance with the manufacturer's operations manual.	L

DPT, HSA, Air Rotary Activities (CONTINUED)	Cuts/Lacerations	• A cutting device designed for cutting acetate liners (procured through Geoprobe) shall be used. If a safety utility knife is used, snubbed nose blades are required and the user must wear Kevlar gloves under leather gloves. Non-retractable utility knives are prohibited. Blades must be secured when not in use. • Utilize proper cutting technique and ensure cuts are made away from the body, keep hands clear. • Utilize leather work gloves or other cut resistant work gloves at all times when handling equipment. Ensure gloves are appropriate for potential laceration hazard if sharp edges are encountered.	L
	Lifting Strains/Sprains	• No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting are for lifting objects over the 50-pound limit. Materials shall be inspected for sharp edges prior to being handled and avoid pinch point hazards. • While handling direct push rods and filled acetate liners, make sure proper lifting techniques are used.	L
	Struck by or caught in drill rig equipment	• Only qualified personnel shall be permitted to operate equipment. The equipment shall be inspected daily using an ECC inspection form specific for the equipment in use. Equipment must have functioning safety devices as installed by the manufacturer. Deficiencies in equipment shall be corrected prior to operating. Equipment found to be unsafe shall not be used. Fire extinguishers of the appropriate size will be available on the equipment. All equipment shall have back up enunciators. • Only personnel essential to drill rig operation will be permitted in area directly surrounding drill rig. All personnel not directly contributing to drill rig operations will be required to stay a minimum of 25' away. • Check all safety devices, emergency shut-down switches daily or at the start of drilling shift. Drilling will not be permitted until all emergency shut-down switches and warning systems are working properly. • Drill rig operator is required to do a daily equipment checklist to ensure equipment is in safe working condition. ○ Personnel need to be cognizant of surroundings and keep clear of cuttings discharge point. Eye protection will be worn at all times. ○ Personnel need to remain away from air compressor and air hose unless a specific task requires work in close proximity. ○ Do not operate compressed air system with broken or inoperable safety controls. ○ Inspect airline safety cables to verify they are in good working condition. • If augers are used during drilling operations, auger guards will be required. • All work areas on and around the drill rig operation will be required to be kept clear of unnecessary equipment and materials. Ongoing housekeeping throughout the day will keep work areas free of slip, trip and fall hazards.	L
	Struck by Traffic	When working adjacent to or on active roadways adequate traffic control devices must be installed to establish a safe work zone. Adequate signage must be established to identify the work zone. All personnel entering and working in an established work zone must wear the classification of reflective vests (appropriate based on speed of vehicles).	L

DPT, HSA, Air Rotary Activities (CONTINUED)	Struck-By / Pinch Points	• All personnel will wear ANSI Type 2 high-visibility traffic safety vests. Operators shall maintain a constant awareness of personnel and equipment in the work areas. • Moving heavy equipment must have properly functioning back-up alarms. • Spotters on the ground will assist operators in manipulating vehicles and equipment into tight or confined spaces. • Getting off or on any equipment while it is in motion is prohibited. • Three points of contact shall be maintained when getting on or off equipment. • Seats will be provided for each occupant of the equipment. • The operator shall use safety belts while equipment is in use. • All original manufacturer-installed safety equipment such as lights, guards, brakes, horn, etc. must be functional at all times. • Whenever equipment is parked, the parking brake shall be set, and wheels chocked when on an incline • Heavy equipment operators shall inform their Supervisor(s) of any prescribed medication that they are taking that would impair their judgment and/or vision • Never walk or work directly in back of or to the side of heavy equipment without the operator's knowledge and approval.	L
		• Personnel will stay out of equipment swing areas and pinch-points. When dumping a load from a bed equipped with a tailgate, a spotter must be positioned a safe distance from the vehicle, such that they can observe the bed to notify the operator if an obstruction occurs	L
	Excessive Noise Exposure	• Wear hearing protective devices (Ear muffs/plugs) when working, when using or near high noise producing equipment, or when directed by ECC SSHO in response to noise monitoring. • Ensure adequate maintenance on equipment. • Conduct periodic sound level surveys.	L
	Inhalation of materials containing crystalline silica	• Review SDS for grout/concrete and other materials utilized to install wells to determine silica content. If silica is present, adhere to controls in APP. Work upwind, avoid dust clouds, keep materials wet, avoid dry sweeping	L
	Heat/Cold Stress (applies to all steps in this AHA)	• Monitor weather conditions and implement controls in accordance with Heat/Cold Stress Prevention Plan in APP. • Stay hydrated. • Stop and rest in cool shaded area if heat strain symptoms occur and when instructed by SSHO. — Report all signs and symptoms of heat strain immediately to SSHO.	L
	Severe weather (applies to all steps in this AHA)	• Shut down operations during severe storms, heavy rain, high wind, and lightning episodes. Evacuate the project site and take shelter at the designated shelter location. • All personnel shall be trained on the project Emergencies Response procedures.	L

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Welding/Cutting	Fire	• Personnel that weld or cut will be required to wear proper PPE including flame resistant gloves, aprons, safety shoes, welding helmets, goggles, and shaded glasses. • Fire extinguisher must be present. • Hot work permit must be obtained before any welding or cutting begins. • Verify that no combustible materials are within work area. • Fire watch must continue for 30 minutes after any welding or cutting concludes. • Protective caps must be used when moving cylinders. • Cylinders must be stored properly.	L
Equipment Decontamination	Chemical Contamination Exposure	• All personnel assigned to drilling operations will operate inside a designated EZ. • All PPE will be removed properly prior to exiting the CRZ. • Air monitoring will be performed. All equipment and hand tools will be decontaminated in accordance with the established procedure. • Air monitoring will be conducted for combustible gas, oxygen levels, and toxic gas exposure during drilling and well abandonment.	L

Stop work and notify the Team Leader if you are not sure how to perform your task safely!	***Stop work and notify the Team Leader if you are not sure how to perform your task safely!***	***Stop work and notify the Team Leader if you are not sure how to perform your task safely!***
Equipment to be Used	**Training Requirements**	**Inspection Requirements**
1. Support Vehicles 2. Drill Rig 3. Hand Tools 4. Air Monitoring Equipment (Multi-RAE Plus or equivalent) <u>Support Zone</u> • Cell phone or radio communication • Eyewash station • Fire extinguishers • First aid kit • Drinking water • 911 air horn • Spill containment supplies • Air monitoring equipment, if needed • Emergency decontamination supplies • GFCI • Hand and power tools. **PPE: Level D (hardhat, steel toe boots, work gloves, Class 2 hi-viz safety garment, safety glasses, and hearing protection as needed), unless noted otherwise in this AHA**	• Only qualified operators permitted to operate mobile equipment • Operators of DPT and HSA rig will be a licensed driller. • Operators of forklifts will have recent certification / training in safe forklift operation (20 CFR 1910, Subpart N – Powered Industrial Trucks) • First Aid/Cardiopulmonary Resuscitation training (at least two individuals onsite) • Initial Safety Orientation • Daily Safety Tailgate Meetings • Emergency Response Plan/Procedures • Fire extinguishers. **Competent Person: Site Superintendent and/or SSHO** **Designated Drill Rig Operator:**	• SSHO daily site inspection • Equipment – Receipt and inspected by SSHO • Competent person will inspect equipment daily prior to each use. No equipment will be placed in service until all deficiencies are corrected • Complete daily equipment inspection form will be completed by the operator • Weekly inspection of first aid kits • Monthly inspection of fire extinguishers • GFCIs (at least monthly) • Air monitoring equipment will be calibrated at least monthly and bump tested daily before each shift and as often as necessary. Equipment that cannot pass bump test criteria will be recalibrated or replaced. • Drill rig and associated equipment in accordance with manufacturer's requirements.

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Activity/Work Task: **Land Use Control (LUC) Inspection and Geophysical Survey**	Overall Risk Assessment Code (RAC) (Use highest code) **L**
Project Location: **Redstone Arsenal (RSA), Alabama (AL)**	
Contract Number: **W9124J-18-D-0004/ W9124J-20-F-0020**	
Date Prepared: **4 February 2021**	
Prepared by (Name/Title): **Lauren Sparkman/ Environmental Engineer**	
Reviewed by (Name/Title): **Kym Edelman, CIH, CSP / Site and Health Manager**	
Competent Person (Name/Title): **Aaron Glad, Site Superintendent**	
Notes: (Field Notes, Review Comments, etc.)	

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

JOB STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS **Consider People, Equipment, Materials and Environment** *(Note: Standard PPE required for this activity includes Hard Hat, Safety glasses with side protection, and safety-toe footwear. Additional PPE requirements are listed in this column depending on the hazard. This constitutes the Workplace Hazard Assessment per 29 CFR 1910.132. Additional assessments and PPE selection when needed will be documented on a daily briefing sign-in form and signed by the SSHS in accordance with ECC SOP ESQ 6.1. Hazard assessment and respirator selection for inhalation hazards are documented in the site Respiratory Protection Plan if respirators are part of PPE.)*	RAC
LUC Inspection	Slips & Trips	General Safety - To minimize potential hazards all personnel shall attend site orientation prior to start of work activities in addition to daily Safety Tailgate meetings to familiarize themselves to hazards, emergency procedures and equipment, operational aspects & heavy equipment use, and change(s) in site/work conditions. Daily housekeeping will be implemented at the end of each workday. Equipment vehicles must be set up with a fire extinguisher (min 10:BC & a FA Kit). Drinking water must be stored in a cooler clearly marked "Food & Drink Only – No Samples". • Wear high traction safety-toe footwear. • Keep loads manageable to not obstruct vision.	L

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

LUC Inspection (CONTINUED)	Lifting Strains & Sprains	• No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting are for lifting objects over the 50-pound limit. Materials shall be inspected for sharp edges prior to being handled, and avoid pinch point hazards.	L
	Exposure to excessive Noise levels	• Hearing protection shall be worn around heavy equipment of other noise generating equipment or when noise levels exceed TWA of 85 dBA.	L
	Using damaged / malfunctioning power tools	• Prior to use all tools must be inspected. Any damaged or defective tools will tagged and removed from service for repair and/or discarded. • Proper PPE shall be worn when operating power tools. At a minimum, Level "D" will be required.	L
	Caught in or between equipment	• Only qualified personnel shall be permitted to operate equipment. Operators will have constant communication with ground support crews and will be aware of activities around their piece of equipment during operation. • Mobile equipment shall be inspected daily. Deficiencies in equipment shall be noted on the inspection form. Equipment found to be unsafe shall not be used. • Fire extinguishers of the appropriate size will be available in the operators of all heavy equipment. • All equipment shall have backing alarms. • All equipment will be properly secured / rigged prior to transportation off site. All rigging equipment shall be inspected prior to use.	L
	Contact with stinging or biting insects	• Personnel shall wear light colored clothing and apply insect repellent (i.e., DEET) to outer pants legs; Body checks should be performed at the end of the workday. • Any individual who has a known or has a potential for allergic reaction to insect stings shall notify the SSHS and an Epi-Pen shall be readily available.	L
	Contact with poisonous plants (e.g. poison ivy)	• Inspect area for known plants before starting field activities • Wear long sleeve shirts, tuck sleeves and pant legs. If there is heavy growth, wear disposable coveralls and use barrier cream, e.g. Ivy Block. • Have TecNu or other poison ivy cleanser on hand and wash immediately after contact.	L
	Scrapes and cuts	• Wear safety glasses, gloves and long sleeves.	L

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

LUC Inspection (CONTINUED)	Heat/Cold Stress (applies to all steps in this AHA)	• Monitor weather conditions and implement controls in accordance with Heat/Cold Stress Prevention Plan in APP. • Stay hydrated. • Stop and rest in cool shaded area if heat strain symptoms occur and when instructed by SSHO. • Report all signs and symptoms of heat strain immediately to SSHO.	L
	Severe weather (applies to all steps in this AHA)	• Shut down operations during severe storms, heavy rain, high wind, and lightning episodes. Evacuate the project site and take shelter at the designated shelter location. • All personnel shall be trained on the project Emergencies Response procedures.	L
Stop work and notify your supervisor if you are not sure how to perform your task safely!	***Stop work and notify your supervisor if you are not sure how to perform your task safely!***	***Stop work and notify your supervisor if you are not sure how to perform your task safely!***	

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
• Hand and Portable power tools <u>Support Zone</u> • Cell phone or Radio communication • Eyewash station • Fire extinguishers • First aid kit • drinking water • 911 Air horn • Spill containment supplies • PDR and PID air monitors • Emergency decontamination supplies • Hand tools **PPE: Level D (hardhat, steel toe boots, work gloves, orange safety vest, safety glasses, and hearing protection as needed)**	• Initial Safety Orientation • Daily Safety Tailgate Meetings • Emergency Response Plan • First Aid/Cardiopulmonary Resuscitation training (at least two individuals onsite) **Competent Person: Site Superintendent and/or SSHO**	• Documented daily equipment inspections by operator are to be conducted and recorded on ECC inspection checklist form. • Competent person will inspect equipment daily prior to each use. No equipment will be placed in service until all deficiencies are corrected • Weekly inspection of first aid kits • Monthly inspection of fire extinguishers

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Activity/Work Task: **Equipment Decontamination, Demobilization, and Site Restoration**	Overall Risk Assessment Code (RAC) (Use highest code)	**L**
Project Location: **Redstone Arsenal (RSA), Alabama (AL)**	**Risk Assessment Code (RAC) Matrix**	
Contract Number: **W9124J-18-D-0004/ W9124J-22-F045**		
Date Prepared / Revised: **01 June 2023**		
Prepared by (Name/Title): **Courtney Bigelow, Associate Scientist**		
Reviewed by (Name/Title): **Kym Edelman, CIH, CSP / Site and Health Manager**		
Competent Person (Name/Title): **Aaron Glad, Site Superintendent**		
Notes: (Field Notes, Review Comments, etc.)		

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

JOB STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS Consider People, Equipment, Materials and Environment *(Note: Standard PPE required for this activity includes Hard Hat, Safety glasses with side protection, and safety-toe footwear. Additional PPE requirements are listed in this column depending on the hazard. This constitutes the Workplace Hazard Assessment per 29 CFR 1910.132. Additional assessments and PPE selection when needed will be documented on a daily briefing sign-in form and signed by the SSHO in accordance with WE SOP ESQ 6.1. Hazard assessment and respirator selection for inhalation hazards are documented in the site Respiratory Protection Plan if respirators are part of PPE.)*	RAC
Decontamination of equipment Dry Decontamination with hand tools • Use hand tools to remove excess soil or debris from equipment Site Restoration/Demob	Slip and Trip Hazards	General Safety - To minimize potential hazards all personnel shall attend site orientation prior to start of work activities in addition to daily Safety Tailgate meetings to familiarize themselves to hazards, emergency procedures and equipment, operational aspects & equipment use, and change(s) in site/work conditions. Daily housekeeping will be implemented at the end of each workday. Equipment vehicles must be set up with a fire extinguisher (min 10:BC & a FA Kit w/ eye wash). Drinking water must be stored in a cooler clearly marked "Food & Drink Only – No Samples". • Practice good housekeeping. • Use care when walking on surface tarp, especially when wet. • Clean all spills immediately. • Proper PPE to include shoes which allow for good footing. • Be aware of physical hazards – watch for uneven ground, rocks, dirt clods, etc.	L
	Overhead Hazards	• Before work begins, survey the site for overhead power lines. LOOK UP! Equipment will not be used that is able to reach overhead power lines.	L

Decontamination of equipment Dry Decontamination with hand tools • Use hand tools to remove excess soil or debris from equipment Site Restoration/Demob (CONTINUED)	Manual Lifting/Backs/Ergonomic	• Train/Utilize correct lift techniques. • Personnel will not lift more than 50 lb. • Use Buddy System. • Position equipment as to eliminate over stretching/ergonomic concerns.	L
	Splash hazards (skin/eyes / face)	• Avoid direct exposure to potential eye hazards. • Wear ANSI approved safety glasses at all times. • Utilize face shield/goggles if potential for flying debris/splash hazards. • Wear rain suit or poly coated Tyvek, waterproof boots or boot covers	L
	Severe Weather	• Shut down operations during severe electrical storms, heavy rain, high wind and evacuate site/take cover. • Train employees on Emergencies Response. • Monitor weather systems.	L
	Noise	• Wear hearing protective devices (earmuffs/plugs) inside the exclusion zone, when using or near high noise producing equipment, or when directed by ECC's SSHS in response to noise monitoring. • Ensure adequate maintenance on thermal/heavy equipment.	L
	Struck By/Against Heavy Equipment	• Maintain radio/verbal communication. • Eye contact with operators will be made before approaching trucks. • Equipment will not be approached on blind sides. • Personnel will understand and review hand signals. • All machines will be equipped with backup alarms and lighting. • Always set emergency brake on equipment. • Equipment will properly Locked Out prior to decontamination (i.e., key removed from ignition) • Engage all equipment-supplied safety equipment (i.e., locking arms, chocks) on equipment parts that are suspended. DO NOT place yourself between unprotected/unsecured parts of the equipment.	L
	Chemical Exposure	• Protective clothing/PPE (steel toe boots, ANSI approved safety glasses, chemical gloves). • Decontaminate equipment away from intrusive activities and upwind.	L
	Scrapes and cuts	• Wear safety glasses, gloves and long sleeves.	L
	Heat/Cold Stress	• Monitor weather conditions and implement controls in accordance with Heat/Cold Stress Prevention Plan in APP. • Stay hydrated. • Stop and rest in cool shaded area if heat strain symptoms occur, when instructed by SSHO. • Report all signs and symptoms of heat strain immediately to SSHO.	L
Wet Decontamination with use of water • Use hose or pressure washer to remove soil or debris from equipment	High pressure washer operation	• The lance must always be pointed at the work area and away from other site personnel. Non-operators must remain a safe distance from the operator. The distance must be a minimum of 25 feet in every direction • Only trained authorized personnel will be allowed to use the equipment. • The operating pressure should never exceed what is necessary to complete the job. • **The trigger should never be tied down.**	L

Environmental Chemical Corporation
Activity Hazard Analysis (AHA)

Wet Decontamination with use of water • Use hose or pressure washer to remove soil or debris from equipment (CONTINUED)	Equipment malfunction	• No unauthorized attachment may be connected to the unit. • Equipment should be cleaned after every use to avoid oil or dirt build-up especially around the trigger and guard area. • **Do not modify the lance.** The lance barrel, from trigger block to the tip, should not be less than 48 inches as recommended by manufacturers of hydroblasting equipment. • All users and assistants must be trained in emergency shut down procedures and general equipment maintenance.	L
	Slips, trips, and falls	• Proper PPE to include shoes which allow for good footing.	L

Stop work and notify the Team Leader if you are not sure how to perform your task safely!	***Stop work and notify the Team Leader if you are not sure how to perform your task safely!***	***Stop work and notify the Team Leader if you are not sure how to perform your task safely!***
Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
1. Hand Tools 2. Skid Steer 3. Pressure washer unit and hoses 4. Support Vehicles <u>Support Zone</u> • Cell phone or Radio communication • Eyewash station • Fire extinguishers • First aid kit • Drinking water • 911 Air horn • Spill containment supplies • Air Monitoring equipment, if needed • Emergency decontamination supplies • GFCI • Hand and Power Tools **PPE: Modified Level D (Face shield, hardhat, steel toe boots, chemical gloves, orange safety vest, safety glasses (face shield if needed) and hearing protection, as needed)**	• Only qualified operators permitted to operate mobile equipment • Operators of forklifts will have recent certification / training in safe forklift operation (20 CFR 1910, Subpart N – Powered Industrial Trucks) • First Aid/Cardiopulmonary Resuscitation training (at least two individuals onsite) • Initial Safety Orientation • Daily Safety Tailgate Meetings • Emergency Response Plan/Procedures • Fire extinguishers. **Competent Person: Site Superintendent and/or SSHO**	• SSHO daily site inspection • Equipment – Receipt and inspected by SSHO • Competent person will inspect equipment daily prior to each use. No equipment will be placed in service until all deficiencies are corrected • Complete daily equipment inspection form will be completed by the operator • Weekly inspection of first aid kits • Monthly and annual inspection of fire extinguishers • GFCIs (at least monthly).

Vision Integrity Results	**ECC**	**DAILY SAFETY MEETING SIGN-IN SHEET**

Date: _____ Project Name/Location: Redstone Arsenal

Company: ECC Person Conducting Briefing: _____

1. AWARENESS (e.g., Hazards, special EHS concerns, pollution prevention, recent incidents, etc.):

2. OTHER ISSUES (HASP changes, new AHAs, attendee comments, etc.):

3. DISCUSSION OF DAILY ACTIVITIES/TASKS AND SAFETY (PPE) MEASURES TO BE USED:

4. Hospital Information

Name: Huntsville Hospital

Address: 101 Sivley Rd SW

Phone: 256 – 265-1000

Directions: Exit Arsenal via Rideout Road. Merge onto -565 East. Take exit 19C for Jefferson St NW towards downtown (0.3 mi). Continue on Jefferson St. North (0.2 mi). Turn Right onto Monroe St NW(0.5 mi). Turn left onto Church St (0.5 mi). Turn left onto Williams Ave SW (0.2 mi). Turn right onto Madison St SE (0.5 mi), Turn Right into Hospital.

5. ATTENDEES (Print Name):

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.

WORKER ACKNOWLEDGEMENT OF THE SITE SAFETY AND HEALTH PLAN AND SITE ORIENTATION

I have read or been trained to the contents of this Site Safety and Health Plan (SSHP). I understand the contents, and I agree to abide by its requirements. I understand that failure to comply with the provisions of this plan can lead to disciplinary action and possible termination from the project. Documentation of worker acknowledgment will be placed in the Project Records.

APP/Site Safety and Health Plan (SSHP)/Site Orientation Acknowledgment Form

Printed Name	Signature	Date

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ATTACHMENT 2A
EMERGENCY ACTION PLAN
AND
ATTACHMENT 2B
FIRE PREVENTION AND PROTECTION PLAN

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ATTACHMENT 2A
EMERGENCY ACTION PLAN

1.0 PROJECT

Contract Number: W9124J-18-D-0004
Delivery Order W9124J-22-F-045
Project Name: Environmental Remediation Services
Location: Redstone Arsenal (RSA), Alabama

2.0 PRE-EMERGENCY PLANNING

This section includes information needed for pre-planning for emergencies.

2.1 Emergency Contact List

Table A2A-1 EMERGENCY CALL LIST AND PROJECT ORGANIZATION

Name or Organization	Title	Phone number(s)
Fire/Ambulance/Police/ Emergency Redstone Arsenal (RSA)		For all emergencies: 911 For non-emergency RSA police/fire: (256) 876-2222
Hospital	Huntsville Hospital	(256) 265-1000
Clinic	Huntsville Hospital Urgent Care	(256) 539-0781
Occupational Medicine	Peter Greaney, MD / WorkCare, or US HealthWorks	(800) 455-6155 (714) 288-8303
Poison Control	Poison Control	(800) 256-9822
Jennifer Graham	Contracting Officer's Representative (COR)	Office: (210) 466-1406
Clint Howard	Army – RSA Branch Chief-Environmental Restoration	Office (256) 8423702
Pam Foti, Certified Hazardous Materials Manager (CHMM) Project Management Professional (PMP)	Project Manager (PM)	Mobile: (508) 274-3084
Carol Canada, Professional Geologist (PG)	Assistant PM	Mobile: (615) 693-9915
Kym Edelman, Certified Safety Professional (CSP), Certified Industrial Hygienist (CIH)	Safety and Health Manager (SHM)	Mobile: (757) 496-5622
Brian Kateley	Site Safety and Health Officer (SSHO) (Primary) (first aid/ Cardiopulmonary Resuscitation [CPR] provider)	Mobile: (410) 671-2970
Aaron Glad	Site Superintendent – alternate (first aid/ CPR provider)	Mobile: (508) 229-2270
First Aid/CPR providers	SSHOs	See above
ECC HOTLINE	ECC	650-347-7512 Ext 111

KEY PROJECT PERSONNEL ARE TO HAVE A COPY OF THIS LIST READILY AVAILABLE AT ALL TIMES

2.2 Coordination with Local Emergency Agencies

Local authorities and emergency services will be contacted prior to initiation of work. The work objectives and on-site capabilities will be explained, as well as the most likely emergencies. Preferred contact procedures will be established and the response capabilities of local responders will be determined. Environmental Chemical Corporation (ECC) will ensure there is good coordination between our emergency plan and local requirements. The Site Safety and Health Officer (SSHO) will document this meeting in the project files.

3.0 PERSONNEL ROLES AND LINES OF AUTHORITY

During all emergencies, the SSHO will serve as the SSHO. He will work to abate and/or contain the emergency.

4.0 EMERGENCY RECOGNITION AND PREVENTION

Conditions that may lead to an emergency situation during field activities will be addressed in specific Activity Hazard Analyses (AHAs) as tasks are identified or the **Attachment 1**. These conditions include:

- Incident involving a serious injury
- Fire
- Environmental release
- Severe weather

Before daily work assignments, regular "tailgate/toolbox" safety meetings should be held. Discussions should include, but not limited to:

- Specific task to be performed (Plan of the Day)
- Weather conditions (if severe weather is anticipated, evacuation routes/rally points will be discussed)
- Time Constraints (e.g. rest breaks, tide restrictions, 24-hour operations)
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals
- Near misses from the previous day's work
- Emergency Procedures

5.0 SAFE DISTANCES AND SAFE ZONES

If severe weather is anticipated, places of refuge and rally points will be discussed at the daily tailgate meeting.

For releases of hazardous material, the SSHO will monitor the rally point to ensure exposure to hazardous materials is not likely to occur. The evacuation routes and rally points during a fire or environmental release may be modified during the response due to wind direction and potential exposure situations. Personnel must remain alert for changes to alternate routes and rally locations.

6.0 SITE SECURITY AND CONTROL

Site control procedures for this project will include the establishment of Work Zones in order to provide site security by avoiding unauthorized access and to secure work locations between shifts. On this project, work zones may be established by using appropriate work area signage in combination with warning or danger tape, barricades, or other measures selected for the sites, if deemed necessary.

The SSHO, as well as employees, will stay alert for any unauthorized entry and take necessary actions to control the work area.

Authorized site visitors may visit the site upon meeting the following conditions:

- Receiving site hazard and safety instructions from the SSHO; to include Emergency Response procedures briefing
- Reviewing and complying with the essential elements of the Accident Prevention Plan (APP)

- Using their own, or provided Personal Protective Equipment (PPE), to enter regulated work areas per the APP
- Reporting any observed unsafe act and/or condition at, or affecting, the work site

Visitors will be evacuated from the incident location, or from the site, during emergency activities.

7.0 EVACUATION ROUTES AND PROCEDURES

Evacuation routes and procedures will be reviewed and discussed regularly during tailgate meetings.

8.0 EMERGENCY MEDICAL TREATMENT (FIRST AID/CPR/AED)

At least two employees certified in both First Aid, Cardiopulmonary Resuscitation (CPR), and Automated External Defibrillator (AED) use be on the project at all times. A First Aid kit must be maintained on site and checked weekly (EM 385-1-1 section 03.B.02). First aid kit will be maintained by the SSHO. A log of First Aid treatment and materials used will also be maintained by SSHO.

If an injury or illness requires more than First Aid, but is not an emergency, the employee will be taken to Huntsville Hospital Urgent Care for examination or observation, after contacting the ECC Corporate Medical Provider, Dr. Greaney, or his alternate at WorkCare (1-800-455-6155). The Huntsville Hospital Urgent Care route can be found in **Figure A2A-1**.

If the injury or illness is considered an emergency, call 911 and an installation ambulance service will be contacted to transport the victim to the Huntsville Hospital. The route can be found in **Figure A2A-2**.

9.0 RESCUE OPERATIONS

Where employees are engaged in one of the following activities or environments, a rescue plan will be incorporated into the AHA or appropriate site-specific plan:

- Working at elevations – not anticipated
- Using personal fall arrest systems – not anticipated
- Working alone – not anticipated
- Confined spaces, or potentially immediately dangerous to life and health atmospheres – not anticipated

10.0 EMERGENCY ALERTING AND RESPONSE NOTIFICATION

An employee alarm system will consist of the use of verbal instructions, either directly or via radio.

Cellphone of telephones will be used to contact emergency responders. **Table A2A-1** of this Plan will be kept in site vehicles. The following information will be communicated:

- Name of the person reporting the emergency
- Telephone number at the location of the person making the call
- Name of the injured person, if known
- Description of the emergency
- Exact location of the emergency
- Actions already taken
- What assistance is needed

Although not anticipated, if an employee is working alone in remote area, he/she will have either two-way radios or cell phones. The employee will be required to check in/check out with the SSHO with an agreed upon frequency before employee leaves for the remote work.

11.0 PERSONAL PROTECTIVE EQUIPMENT AND EMERGENCY EQUIPMENT

Each field team will have quick access to a First Aid kit, cell phone, bloodborne pathogen prevention PPE, and fire extinguisher.

12.0 SITE LAYOUT AND PREVAILING WEATHER CONDITIONS

See **Attachment 3** for hospital and clinic routes; due to the numerous sites for this project, the rally points and procedures will be discussed regularly during the daily tailgate meetings.

13.0 REPORTING PROCEDURES

All emergencies will be immediately communicated to the SSHO who will initiate emergency response procedures and notify the Contracting Officer's Representative (COR) and appropriate response personnel.

After the response, ECC will prepare an Incident Report. It will include such things as a chronological history of the emergency facts, actions taken, personnel present, sample results (if taken), summary of injuries, and possible exposures. For spills and releases it will also include:

- Description of material spilled, including identity, quantity, and a copy of the Safety Data Sheet (SDS) or waste disposal manifest
- Exact time and location of the spill, and the description of the area involved
- Containment procedures utilized
- Description of the cleanup procedure employed at the site, including disposal of spill residue
- Summary of the communications ECC had with other agencies.

This report will be given to the Army within 24 hours of the incident along with immediate verbal notification.

The report will also contain a critique of the response and modifications to this plan will be made if necessary, to adequately address subsequent emergencies.

14.0 TRAINING

The Emergency Response Plan will be discussed during initial site training and discussed regularly during the Daily Tailgate Safety Meetings. Due to the short timeframes of field events drill test will not be necessary.

15.0 PROCEDURES

Emergency Action Procedures - Injury and Medical Emergency

Prevention:

Wear proper PPE at all times. Implement precautions in AHA. Follow standard operating procedures (SOPs). Avoid pinch points, struck by hazards and exposures to falls from elevation. Report all hazards, injuries and illnesses to your supervisor SSHO immediately. Follow instructions on all prescription medications. Stay hydrated.

Recognition and Reporting:

If an injury, illness or medical condition arises, notify your nearest co-worker immediately. Have them call the SSHO or your supervisor.

All First Aid Providers will be contacted immediately and will report to location of the injured person. See **Table 2A1-1** contact list.

Actions:

1. First Aid Providers will do an immediate area and victim assessment in accordance with their training.
2. Call 911 or local emergency notification number immediately if any of the following situations exist:
    a. Unconscious
    b. Severe bleeding
    c. Head or spine injury is suspected
    d. Seizures
    e. No pulse
    f. No breathing
    g. Overdose situation possible
    h. Situation requires rescue/medical evacuation (fire, airborne release, workplace violence, trapped)
    i. Any other situation where the condition of the patient is in question. If in doubt contact 911.
3. Establish clear area or have ambulatory patient move to a safe location.
4. Apply Universal Precautions per Bloodborne Pathogens Exposure Control Plan (Attachment 6 of APP) and training, and don PPE (disposable gloves, CPR mask, etc.).
5. Provide appropriate First Aid/CPR/AED consistent with training and certification.
6. Provide complete information to emergency medical technicians, if necessary.
7. Clean area and contain potentially contaminated materials and articles in labeled bag per Bloodborne Pathogens Exposure Control Plan (Attachment 6 of APP).
8. Participate in incident investigation, provide for and monitor medical follow up if necessary.

Emergency Action Procedures - Fire

Prevention:

See Fire Prevention and Protection Plan, **Attachment 2B**.

Recognition and Reporting:

Call designated base emergency services number upon observation of any uncontrolled fire or smoke.

Actions:

1. Always alert the emergency management system first, regardless of the size of the fire
2. Use fire extinguisher if:
    a. You have been trained
    b. You have an escape route behind you
    c. The fire is small (incipient stage) and can likely be put out with one extinguisher in about 10 seconds.

3. If the fire cannot be controlled with a fire extinguisher:
    a. Notify Site Superintendent or SSHO and initiate evacuation procedure immediately.
    b. The SSHO will notify site personnel and client representatives of evacuation order.
    c. The SSHO will ensure evacuation alarms are sounded, and evacuation proceeds in accordance with Evacuation Plan.
4. If the fire is controlled by a fire extinguisher:
    a. Call for another fire extinguisher for stand by
    b. Remove potential sources of fuel and ignition
    c. Stay at the location until relieved by the SSHO or Fire Department to watch for re-ignition.
5. Participate in incident investigation.

Emergency Action Procedures - Evacuation

Prevention:

Most emergency evacuations can be prevented by following the APP and by practicing safe behaviors. Report all hazards and suspicious activities immediately.

Recognition and Reporting:

Emergency evacuation of the site may be prompted by various situations, including but not limited to the following:

- Fires
- Hazardous material releases
- Sudden severe weather events
- Workplace violence or terrorism
- Utility damage
- Off-site emergency that may impact site operations.

Report potential emergency conditions immediately to your Supervisor or the SSHO. Call 911. See **Table A2A-1** contact list.

Actions:

1. In the event of an emergency, the SSHO may initiate evacuation of the site by sounding the evacuation alert - one long blast on the air horn or make verbal contact
2. Call local 911 or emergency notification number
3. The SSHO will notify and coordinate with client representatives, RSA personnel, and emergency responders
4. Upon arrival of emergency response personnel, the SSHO will report to and assist the Incident Commander (lead from local emergency response team)
5. The SSHO will retrieve the daily sign in logs and proceed to the rally point
6. All personnel, upon hearing the evacuation alert, or receiving verbal instructions to evacuate will immediately proceed along the designated route to the rally point which will be discussed at each daily tailgate meeting
7. In the event of a fire or release of airborne toxic chemical, check local wind indicators. Evacuate in a direction perpendicular to the wind direction if possible
8. Be attentive for instructions on changes in rally location based on site conditions

9. In some cases, a shelter-in-place order may be given. In that case, close doors and windows and shut off ventilation system
10. Report to your Supervisor at the rally point
11. Supervisors will report on the presence of crew members to SSHO for accountability purposes.
12. Look around for friends and co-workers. Report anyone missing to the SSHO
13. Critical plant operations – there are no critical plant operations on this project. Upon hearing the evacuation alert, all personnel will shut off power tools and equipment and proceed immediately to the rally point
14. Rescue procedures are included in the Fall Prevention and Protection Plan or Confined Space Entry Plan, if applicable. Once an evacuation order is given, rescue activities will be turned over to off-site emergency responders
15. Site First Aid Providers will render First Aid and support to injured personnel at the rally point. In an evacuation, the local Emergency Medical Service will be notified and will take charge of medical support
16. The SSHO will report the status of evacuated personnel to the Incident Commander, including the name, description and last known location of any unaccounted for individuals
17. Site(s) may be re-entered when the SSHO gives the "all clear" order. An incident investigation will begin immediately, led by the SSHO.

Emergency Action Procedures - Severe Weather

Prevention:

The SSHO will monitor the weather at least twice daily. Weather monitoring will become continuous when the National Weather Service issues a severe weather Watch or Warning.

Recognition and Reporting:

A Watch means that a weather emergency is possible. It means Be Prepared. On issuance of a Watch, the SSHO will determine what site preparations will be made to secure the site, shut down, evacuate or call off a scheduled work shift.

A Warning means that a weather emergency is in the area. It means Take Action. Upon issuance of a Warning, the SSHO will implement emergency shut down procedures.

Actions:

1. Thunderstorm, Lightning, Tornado
    a. Remove loose or stacked materials from roofs, or open floor decks
    b. Remove from site or secure stacks of materials at ground level
    c. Lightning - Stop outdoor activities involving load handling equipment, roofing, working on elevating platforms and scaffolds, tree trimming, or work in open areas upon hearing thunder or seeing lightning. Seek indoor shelter. Stay indoors for 30 minutes after the last audible thunder or visible flash of light
    d. Proceed to pre-determined tornado shelter upon issuance of a Warning. The SSHO will work with RSA personnel or local emergency agencies to identify shelters during mobilization.

Emergency Action Procedures - Spills and Releases of Hazardous Materials

Prevention:

Supervisors will review the hazards of chemicals with their work crews, and SDS and labels will be maintained in accordance with the Hazard Communication Program.

- **Avoid mixing chemicals**, even common household products. Some combinations, such as ammonia and bleach, can create toxic gases. When in doubt, consult the SDS or the SSHO.
- **Always read and follow the directions** when using a new product. Some products should not be used in small, confined spaces to avoid inhaling dangerous vapors. Other products should not be used without gloves and eye protection to help prevent the chemical from touching your body.
- **Store chemical products properly.** Non-food products should be stored tightly closed in their original containers so you can always identify the contents of each container and how to properly use the product. Containers of flammable and combustible liquids will be stored in flammable liquid storage cabinets or removed from the site at the end of the day. Bulk storage of fuels or other hazardous materials will have secondary containment, and containment around transfer valves, spigots and hoses.
- **Report and Clean up any spills immediately** with some rags, being careful to protect your eyes and skin.
- **Follow operating procedures**. Implement procedures designed to limit open containers, excess pressure, surface area of contaminated environmental media, drum and container handling, etc.
- **Implement the Storm Water Pollution Prevention Plan** if one is required on the site, or general good chemical handling practices to keep materials from flowing off-site with stormwater.

Recognition and Reporting:

Notify your Supervisor or the SSHO of any spill or airborne release of hazardous materials. The SSHO will investigate and determine if an emergency should be declared and will issue an alert to evacuate or shelter-in-place if necessary. The SSHO will call the RSA emergency services if an emergency is declared.

The SSHO will notify the client representative immediately of any spill or release. Where reporting to installation and regulatory agencies is required, the reporting will be done in accordance with the communications plan approved by the Contracting Officer. See Contact List **Table A2A-1**.

Actions:

The actions to be taken will depend on the nature and extent of the release. Only personnel trained in the procedures and PPE required to handle the spill or release should be involved in containing, stabilizing, and cleaning up the material.

1. If a release from an on-site or off-site source results in a shelter-in-place order:
    a. Proceed to the nearest designated shelter
    b. Shut doors and windows
    c. Turn off ventilation system.
    d. If possible, seal gaps around doors and window with tape, wet towels or other items
2. Take immediate measures to control and contain the release (e.g. shut off pumps, close valves).
3. Contact local emergency service providers.
4. Don protective equipment as specified by the SSHO.
5. If exposure to individuals causes injury/health effects, make sure the area is safe before attempting rescue or First Aid. If safe to do so, move them to fresh air and apply appropriate First Aid. Notify the Emergency Medical Service of the nature of injury.
6. Isolate and contain hazardous release areas.
7. Deny entry to the spill area to unauthorized personnel.
8. Do not allow anyone to touch spilled material.
9. Stay upwind, keep out of low areas.

10. Keep combustible materials away from the spilled material.
11. Use water spray or foam to reduce dust or vapors as needed.
12. Collect samples for analysis to determine that cleanup is adequate.
13. If the release is from tanks, prevent the discharge from traveling beyond site boundaries.
14. Containerize materials and arrange for proper disposal.
15. Take caution when handling drums and containers (opening, sampling, and over packing).

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ATTACHMENT 2B
FIRE PREVENTION AND PROTECTION PLAN

1.0 PROJECT

Contract Number:	W9124J-18-D-0004
Delivery Order	W9124J-22-F-045
Project Name:	Environmental Remediation Services
Location:	Redstone Arsenal (RSA), Alabama

2.0 SCOPE

This Plan applies to all activities, including subcontractor activities for the project identified above.

3.0 LIST OF MAJOR WORKPLACE FIRE HAZARDS

On this project, the major workplace fire hazards will include:

- Normal combustibles including transmitter building, trash, construction materials, vegetation and waste piles. Good housekeeping will be maintained. Trash will be collected daily and placed in a designated receptacle.
- Combustible and flammable liquids used as fuels in site vehicles, mobile construction equipment and power tools.
    - Gasoline will be kept in labeled five-gallon metal safety cans with flame arrestor and spring-loaded lid, or in Underwriters Laboratories (UL) approved one to two-gallon plastic cans.
    - Diesel fuel will be kept in labeled UL approved containers.
    - A temporary Diesel fuel tank will be protected with barriers and secondary containment.
    - The refueling area is shown on the Site Layout.

4.0 CONTROL OF IGNITION SOURCES

- Smoking is prohibited inside vehicles and buildings. A designated smoking area will be established during mobilization and supplied with a self-extinguishing ash tray stand.
- Temporary fuel storage tanks will be protected from accidental impact by vehicles and equipment.
- Storage tanks will be double-walled or have other secondary containment measures which will have a capacity of at least the tank volume +10 percent (%). Secondary containment will be inspected regularly and kept free of accumulation of liquids, including rainwater to ensure sufficient free board at all times.
- Tanks, pumps and hoses will be rated/approved and listed for the service and will include appropriate bonding to control static sparks.
- Hose nozzles used to fill equipment from the temporary tank will be automatic closing and will not be equipped with a latch-open device. All filling and transfer operations will be attended.
- Normal combustibles, including high vegetation will be kept at least 25 feet from the refueling area.
- Sources of ignition will be prohibited within 25 feet of the refueling area.
- Equipment with small engines will not be fueled while hot.
- The refueling area will be posted with signs, including “No Smoking”, “No Hot Work”, and “Do not fuel hot equipment.”
- A Fire Extinguisher rated at least 40 B:C will be placed in a fixed and visibly labeled location within 100 feet of the refueling area.
- Tanks will have appropriate hazard warning labels.
- A spill kit suitable for minor spills and leaks of petroleum products will be stationed at the refueling area.

- The refueling area, equipment, and emergency supplies will be inspected as needed.
- Small portable containers of flammable liquids will be stored out of direct sunlight and in a designated location. A Flammable liquid storage cabinet will be used if more than two containers of flammable liquids are stored on site. The cabinet will include a "No Smoking" label.

See **Section 9.0** below for Hot Work requirements.

5.0 TYPES OF FIRE SUPPRESSION EQUIPMENT

Portable fire extinguishers will be selected and distributed as follows:

- Fire extinguishers rated to 1-A:10-B:C or higher, will be in all work vehicles, mobile construction equipment, and in the immediate vicinity of stored flammable materials.
- 40-B:C extinguisher in the refueling area.
- 4-A: 60-B:C (10-pound agent minimum) at each hot work location.
- Not anticipated, but if in buildings under construction, alteration or demolition, at least one 4-A:6-0B:C extinguisher will be located per every 6,000 square feet of floor space, on each floor. Extinguishers shall not require a travel distance of more than 75 feet, and one extinguisher on each floor should be placed close to the stairways. Note: If unusual fire hazards exist, consult National Fire Protection Association (NFPA) 10 for additional selection and distribution information.
- The equipment will not be removed except for inspection and/or use in an emergency.
- The Site Safety and Health Officer (SSHO) will provide training on the use of the fire extinguisher during the pre-entry briefing.
- Fire extinguishers will be visually inspected monthly.

6.0 RESPONSIBILITIES FOR MAINTAINING EQUIPMENT AND SYSTEMS

The SSHO will be responsible for inspection of work areas on a daily basis, and inspection of fire extinguishers on a monthly basis.

Fixed systems in buildings under construction, alteration or demolition will be inspected by, or under the direction of the Authority Having Jurisdiction.

7.0 PERSONNEL RESPONSIBLE FOR CONTROLLING FUEL SOURCE HAZARDS

The SSHO is responsible for controlling fuel source hazards, in accordance with this Plan. This includes regular inspections of areas and equipment, maintaining adequate freeboard in secondary containment, limiting combustibles around fuel storage and dispensing operations, and ensuring control of ignition sources in these areas.

8.0 HOUSEKEEPING PROCEDURES

Trash will not be permitted to accumulate. Receptacles with lids or roll off boxes will be used to contain trash. Work areas will be cleaned up each day, as often as necessary to maintain a safe job site.

Waste piles will be limited in size, segregated and removed from site as soon as possible.

Spills of flammable and combustible materials will be contained and cleaned up as soon as possible. See Emergency Action Plan, **Attachment 2A** of the Site Safety and Health Plan (SSHP).

9.0 HOT WORK PERMITS

Hot work is defined as any process that produces open flames, heat or sparks, including, but not limited to: burning, cutting, welding, soldering, brazing, torch applied roofing, and the use of temporary heating devices involving an open flame or exposed heating elements.

Before any hot work is performed, ECC personnel shall obtain a Hot Work Permit from the U.S. Army local authority. A hot work site will have a designated fire watch. This person's sole responsibility shall be to monitor the hot work and have immediate access to the fire extinguisher located at each hot work site (a portable fire extinguisher [A:B:C] will be readily available). The fire watch shall remain at his/her designated watch for 30 minutes from the conclusion of hot work activities.

It is the responsibility of the SSHO to work with the Army or local authority/permit issuing group to establish the requirements, definitions, and regulations. In general, a hot work permit is required from the local hosting facility when the hot work is being performed on a pre-existing building/structure or new attachment to an existing structure. If the hot work is solely on a new building/structure not connected to a preexisting structure and has not been handed over to client or end user, then an ECC Hot Work permit can be used. This should be communicated prior to the start of any hot work activities.

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ATTACHMENT 3

MEDICAL SUPPORT PLAN

ATTACHMENT 3
MEDICAL SUPPORT PLAN

1.0 PROJECT

Contract Number:	W9124J-18-D-0004
Delivery Order	W9124J-22-F-045
Project Name:	Environmental Remediation Services
Location:	Redstone Arsenal (RSA), Alabama

2.0 SCOPE

This plan provides information for medical support for all operations at the project identified above.

3.0 COMMUNICATION

The site will have ready communications to medical support facilities via cell phone. Phone numbers are listed on the Emergency Contact List (Emergency Action Plan, **Attachment 2A**, **Table A2A1-1**) and the list will be kept in all site vehicles.

4.0 FIRST AID AND MEDICAL FACILITIES

Minor injuries will be treated on-site by certified First Aid Providers (see Emergency Contact List). If additional care is needed, the local facility, Huntsville Hospital Urgent Care**,** will be used. **Figure A3-1** shows the route map to the facility.

If an incident results in a major injury, call 911 for ambulance. Environmental Chemical Corporation (ECC) will not transport non-ambulatory, unconscious or shock risk patients. **Figure A3-2** is the route map to Huntsville Hospital. Copies of the route maps will be kept in all site vehicles.

Medical consultation can be obtained from ECC's occupational medical consultant, Dr. Greaney or his associates at WorkCare, Inc. WorkCare should be called before transporting any minor injury to the local clinic or emergency room.

At least one First Aid kit for every 25 employees will be kept on-site. The First Aid kits will comply with American National Standards Institute (ANSI) Z308.1. All kits will contain bloodborne pathogen prevention personal protective equipment (PPE) including surgical gloves and resuscitator mask or shield.

At least two individuals with current certification in First Aid and Cardiopulmonary Resuscitation (CPR) will available on each shift.

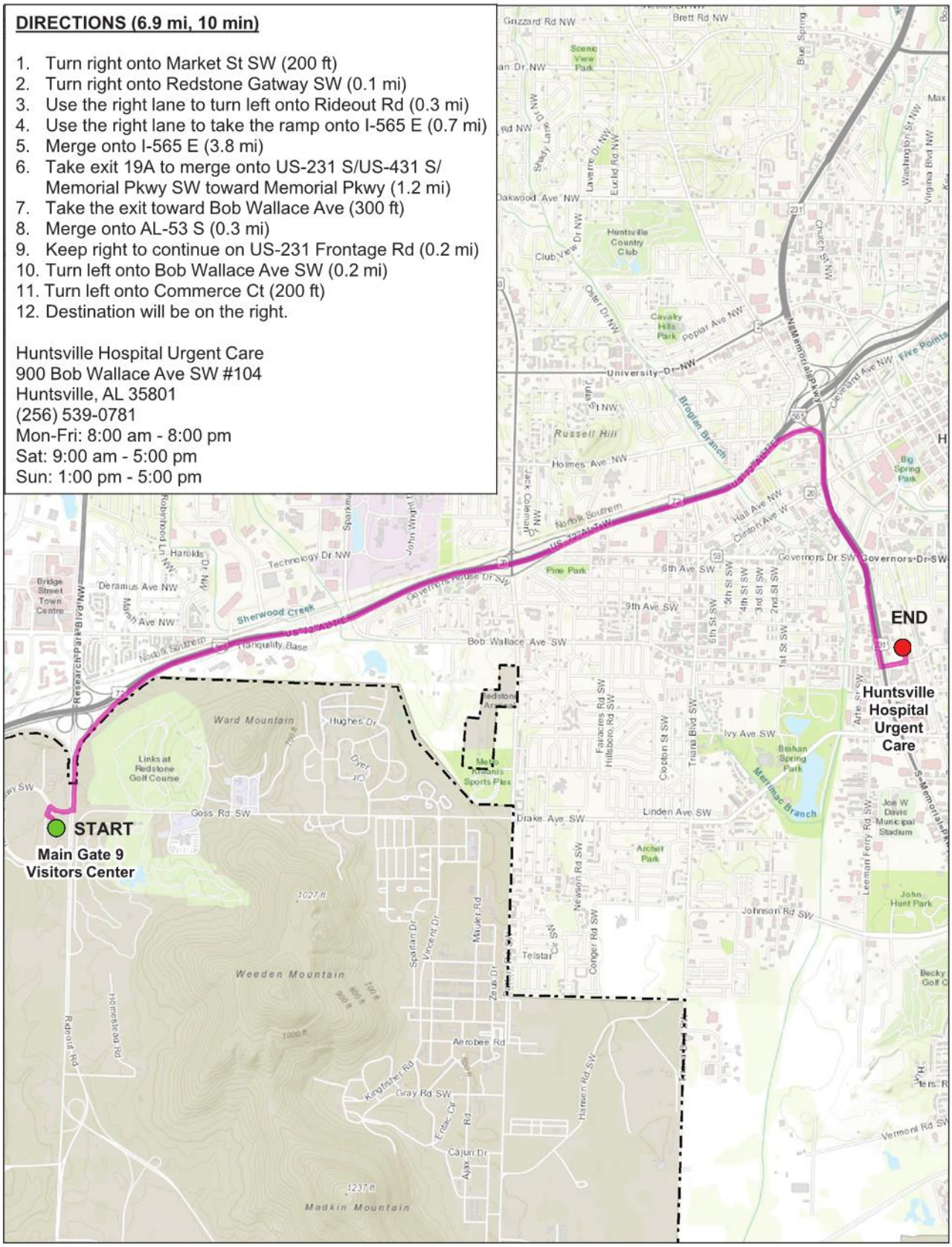
Each will have current certification in First Aid and CPR from the American Red Cross, the American Heart Association, or from an organization whose training adheres to the standards of the International Liaison Committee on Resuscitation (as stated in writing), or from a Licensed Physician. Certification courses will have hands-on component that cannot be taken on-line. Retraining will occur every two years.

First Aid Providers on this project include the Site Safety and Health Officers (SSHOs) Mr. Brian Kateley and Mr. Aaron Glad. They are First Aid and CPR trained; are qualified to administer First Aid and CPR; and have completed Bloodborne Pathogen training in accordance with 29 Code of Federal Regulations (CFR) 1910.1030. Their duties are to provide First Aid/CPR in accordance with their training.

DIRECTIONS (6.9 mi, 10 min)

1. Turn right onto Market St SW (200 ft)
2. Turn right onto Redstone Gatway SW (0.1 mi)
3. Use the right lane to turn left onto Rideout Rd (0.3 mi)
4. Use the right lane to take the ramp onto I-565 E (0.7 mi)
5. Merge onto I-565 E (3.8 mi)
6. Take exit 19A to merge onto US-231 S/US-431 S/ Memorial Pkwy SW toward Memorial Pkwy (1.2 mi)
7. Take the exit toward Bob Wallace Ave (300 ft)
8. Merge onto AL-53 S (0.3 mi)
9. Keep right to continue on US-231 Frontage Rd (0.2 mi)
10. Turn left onto Bob Wallace Ave SW (0.2 mi)
11. Turn left onto Commerce Ct (200 ft)
12. Destination will be on the right.

Huntsville Hospital Urgent Care
900 Bob Wallace Ave SW #104
Huntsville, AL 35801
(256) 539-0781
Mon-Fri: 8:00 am - 8:00 pm
Sat: 9:00 am - 5:00 pm
Sun: 1:00 pm - 5:00 pm



LEGEND

- Clinic Route
- Redstone Arsenal



NOTES
1. Coordinate System: NAD83 State Plane Alabama East, US Feet (FIPS 0101)
2. Basemap data from IGI&S Office at Redstone Arsenal
3. Map Size: B-size (17" x11")
4. Revision Date: 2/8/2021

Figure A3-1

Clinic Route Map
Redstone Arsenal
Madison County, Alabama

0 3,500 7,000 Feet

1 inch = 2,778 feet

Mission & Installation Contracting Command (MICC)
U.S. Army Garrison-Redstone

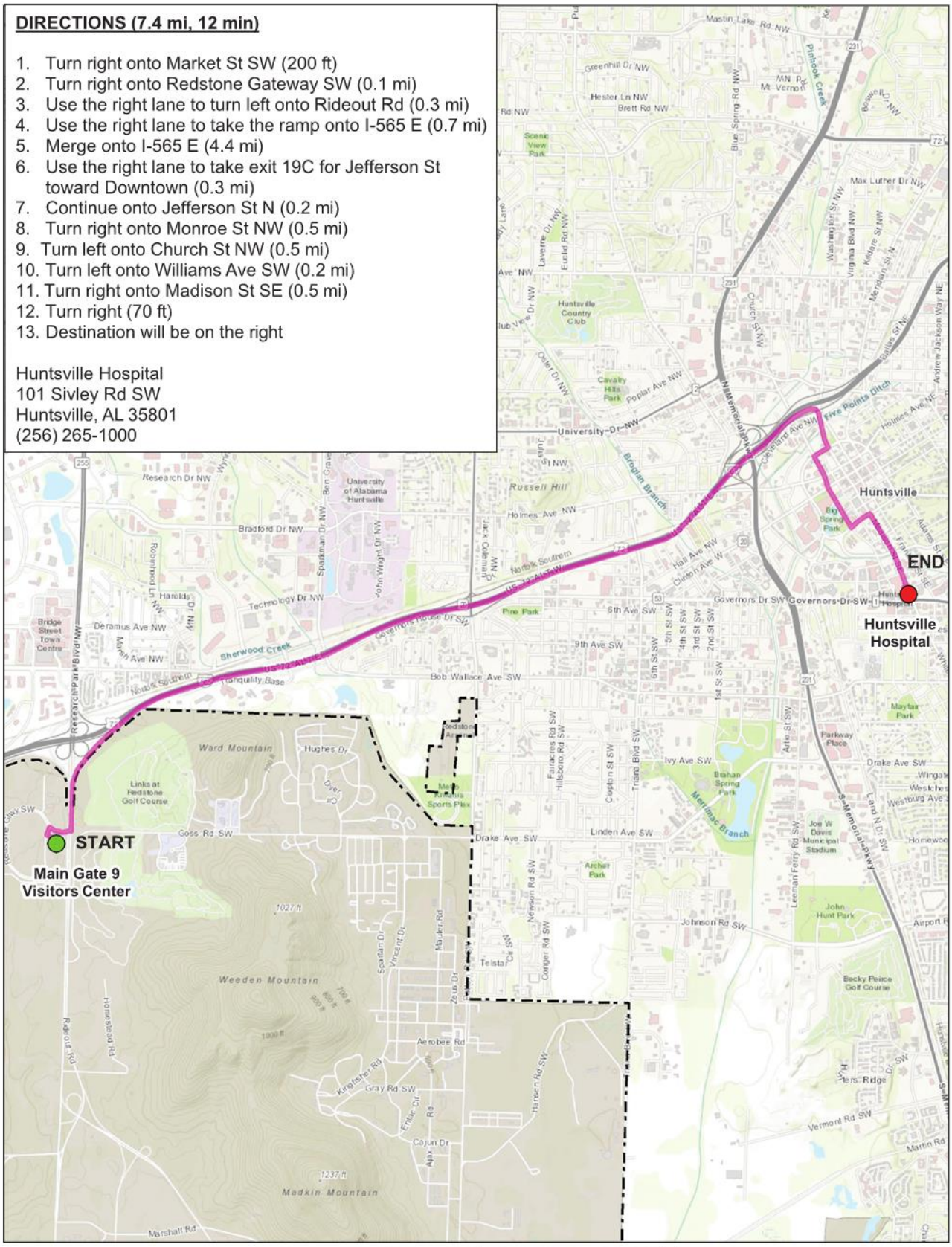
DISCLAIMER- The data represent the results of data collection/processing for a specific Redstone Arsenal activity and indicates the general existing conditions. As such, it is only valid for its intended use, content, time, and accuracy specifications. The user is responsible for the results of any application of the data for other than its intended purpose.

ECC GIS Server: E:\Projects\RedstoneMapDocument\APP\FigA3-1_RSA_APP_ClinicMap.mxd

DIRECTIONS (7.4 mi, 12 min)

1. Turn right onto Market St SW (200 ft)
2. Turn right onto Redstone Gateway SW (0.1 mi)
3. Use the right lane to turn left onto Rideout Rd (0.3 mi)
4. Use the right lane to take the ramp onto I-565 E (0.7 mi)
5. Merge onto I-565 E (4.4 mi)
6. Use the right lane to take exit 19C for Jefferson St toward Downtown (0.3 mi)
7. Continue onto Jefferson St N (0.2 mi)
8. Turn right onto Monroe St NW (0.5 mi)
9. Turn left onto Church St NW (0.5 mi)
10. Turn left onto Williams Ave SW (0.2 mi)
11. Turn right onto Madison St SE (0.5 mi)
12. Turn right (70 ft)
13. Destination will be on the right

Huntsville Hospital
101 Sivley Rd SW
Huntsville, AL 35801
(256) 265-1000



LEGEND

- Hospital Route
- Redstone Arsenal



NOTES
1. Coordinate System: NAD83 State Plane Alabama East, US Feet (FIPS 0101)
2. Basemap data from IGI&S Office at Redstone Arsenal
3. Map Size: B-size (17" x11")
4. Revision Date: 2/8/2021

Figure A3-2

Hospital Route Map
Redstone Arsenal
Madison County, Alabama

0 4,000 8,000 Feet

1 inch = 3,045 feet

Mission & Installation Contracting Command (MICC)
U.S. Army Garrison-Redstone

DISCLAIMER- The data represent the results of data collection/processing for a specific Redstone Arsenal activity and indicates the general existing conditions. As such, it is only valid for its intended use, content, time, and accuracy specifications. The user is responsible for the results of any application of the data for other than its intended purpose.

ECC GIS Server: E:\Projects\RedstoneMapDocument\APP\Fig\A3-2_RSA_APP_HospitalMap.mxd

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ATTACHMENT 4A
HEAT STRESS MONITORING PLAN
AND
ATTACHMENT 4B
COLD STRESS MONITORING PLAN

ATTACHMENT 4A
HEAT STRESS MONITORING PLAN

1.0 PROJECT

Contract Number: W9124J-18-D-0004
Delivery Order W9124J-22-F-045
Project Name: Environmental Remediation Services
Location: Redstone Arsenal (RSA), Alabama

2.0 SCOPE

This Plan applies to the project identified above and will be incorporated into the Site Safety and Health Plan (SSHP). Subcontractors are required to comply with this program by virtual of their coverage under the Accident Prevention Plan (APP).

3.0 PROCEDURES

3.1 Heat Stress And Heat Strain

Heat stress is the net heat load to which a worker may be exposed from the combined contributions of metabolic cost of work, environmental factors and clothing requirements. Heat stress is a hazard during warm weather or when personnel are wearing Personal Protective Equipment (PPE) that aggravates the heat stress hazard. Heat stress can occur even when temperatures are moderate if the body's physiological processes fail to maintain a normal body temperature.

Heat strain is the overall physiological response resulting from heat stress. The resulting physical reactions that occur are fatigue, irritability, anxiety, and a decrease in concentration, dexterity, and/or movement. Onset of signs and symptoms of exposure can occur rapidly, and may progress to a medical emergency (i.e., heat stroke) without intervention. In extreme cases, death can result if the patient is not given immediate treatment.

3.1.1 Symptoms of Heat Exhaustion

Heat exhaustion occurs when your body cannot sweat enough to cool you off. It generally happens when you are working or exercising in hot weather. Symptoms include:

- Fatigue, weakness, dizziness, or nausea
- Cool, clammy, pale, red, or flushed skin
- Heavy sweating

First Aid for Heat Exhaustion

- Get the person out of the sun and into a shady or air-conditioned location
- Lay the person down and elevate the legs and feet slightly
- Loosen or remove the person's clothing
- Have the person drink cool water, not iced, or a sports drink containing electrolytes
- Cool the person by spraying or sponging him or her with cool water and fanning
- Monitor the person carefully. Heat exhaustion can quickly become heatstroke. If fever greater than 102 degrees Fahrenheit (ºF), fainting, confusion or seizures occur, call for emergency medical assistance.

3.1.2 Symptoms of Heat Stoke

Heat exhaustion can sometimes lead to a heat stroke. Heat stoke requires emergency treatment. It happens when your body stops sweating but the body temperature continues to rise, often to 105°F or higher. Symptoms include the following:

- Cessation of sweating
- Confusion, delirium, or unconsciousness
- Hot, dry, red or flushed skin, even under the arm pits
- Rapid and shallow breathing
- Chills
- Irritability
- Malaise
- Disorientation or confusion

First Aid for Heat Stroke

- It is vital to lower a heat stroke victim's body temperature. Seconds count.
- Call emergency medical assistance and get an ambulance on the way as soon as possible.
- Move the person out of the sun and into a shady or air-conditioned space.
- Pour water on them, fan them, apply cold packs.

3.2 CONTROL MEASURES

Where monitoring indicates a possible heat stress hazard the following safety procedures shall be implemented:

General Controls

- Review signs and symptoms of heat strain, as well as controls and First Aid measures with site personnel.
- Encourage employees to eat a normal diet and get proper rest.
- Encourage employees to refrain from consuming diuretics, including caffeine from coffee and tea beverages, or any form of alcohol. (*Note: Consumption of alcohol is prohibited during working hours*). Counsel and monitor workers on medications that may affect blood pressure, sweating, body temperature regulation, or kidney function.
- Adjust expectations of those returning to work after absence from heat exposure situations and encourage them to eat salty foods (with approval of physician for those on salt-restricted diets).
- Provide potable drinking water and encourage workers to about one cup every 20 minutes.
- Permit self-limitation of exposures and plan frequent rest breaks.
- Encourage workers to report signs and symptoms of heat strain and not to try to work through it.
- Encourage the buddy system to detect signs and symptoms in co-workers.
- Provide shade (i.e., fixed or portable canopy) and/or cool rest areas.

Job-Specific Controls

Where the screening or physiological monitoring discussed below exceed the criteria, the job-specific controls for this project will include the following:

- Engineering controls to reduce workload, (e.g., mechanical vs. manual material handling where possible).
- Mobile construction equipment will have functioning air conditions and be operated with the doors/windows closed.
- Office trailer and vehicles will have functional air conditioning to provide cool rest locations during breaks.
- Wear breathable polypropylene disposable coveralls over modesty clothing for activities requiring Modified Level C.
- Use heat reducing PPE, such as cool vests, head bands, wrist bands, etc.
- Modify work schedule to take advantage of the cooler parts of the day.
- Establish work/rest regimens to reduce exposure times, when physiological monitoring indicates heat strain conditions.

3.3 Heat Stress and Heat Strain Monitoring

Heat stress and heat strain monitoring shall begin when ambient conditions exceed 85°F when working in Level D and 70°F when working in Modified Level C and above. For clear weather conditions (i.e., 100 percent [%] sunshine) ambient temperatures shall be decreased by 5°F (i.e., 65°F and 80°F, respectively) to determine when to begin monitoring. Ambient conditions shall be determined by maintaining a properly calibrated outdoor thermometer in the shade at each workstation, or by monitoring local weather reports throughout each work shift.

3.3.1 Environmental Monitoring

Use a Wet Bulb – Globe Temperature (WBGT) monitor to perform heat stress screening in accordance with the **Tables A4A-1** (Acclimatized Workers) and **Table A4A2-2** (Unacclimatized Workers) below. Clothing adjustment factors are included in **Table A4A-3**.

If the WBGT levels (corrected for clothing ensemble) for the particular workload and work/rest cycle are exceeded, then implement the General Controls and either perform physiological monitoring as described below or implement Job Specific Controls such as those listed in **Section 3.2**.

Table A4A-1 - WBGT Screening Criteria for Acclimatized Workers

Allocation of Work in a Cycle of Work and Recovery	Light	Moderate	Heavy	Very Heavy
75% - 100%	88°F 31°C	82.5°F 28°C	-	-
50% - 75%	88°F 31°C	84°F 29°C	81.5°F 27.5°C	-
25% - 50%	89.5°F 32°C	86°F 30°C	84°F 29°C	82.5°F 28°C
0%-25%	90.5°F 32.5°C	88.5°F 31.5°C	87°F 30.5°C	86°F 30°C

From ACGIH Threshold Limit Values (TLVs)® and BEIs® 2014.
Note: Light moderate work includes operating heavy equipment. Heavy work includes hand shoveling or other manual labor activities.
°C – degrees Celsius °F – degrees Fahrenheit

Table A4A-2 - WBGT Screening Criteria for Unacclimatized Workers

Allocation of Work in a Cycle of Work and Recovery	Light	Moderate	Heavy	Very Heavy
75% - 100%	86°F 28°C	77°F 25°C	-	-
50% - 75%	83.5°F 28.5°C	79°F 26°C	75°F 24°C	-
25% - 50%	85°F 29.5°C	80.5°F 27°C	78°F 25.5°C	76.1°F 24.5°C
0%-25%	86°F 30°C	84°F 29°C	82°F 28°C	80.5°F 27°C

From ACGIH TLVs® and BEIs® 2015.
°C – degrees Celsius °F – degrees Fahrenheit

Table A4A-3 – Clothing-Adjustment Factors for Some Clothing Ensembles*

Clothing Type	Addition to WBGT (°C)
Work clothes (long sleeve shirt and pants)	0
Cloth (woven material) coveralls	0
Double-layer woven clothing	3
SMS polypropylene coveralls	0.5
Polyolefin coveralls	1
Limited-use vapor barrier coveralls	11

*These values must not be used for completely encapsulating suits, often called Level A. Clothing Adjustment Factors cannot be added for multiple layers. The coveralls assume that only modesty clothing is worn underneath, not a second layer of clothing.
From ACGIH TLVs® and BEIs® 2014.
°C – degrees Celsius

3.3.2 Alternate Environmental Monitoring Procedures

Where permitted by the client, ECC may use the Occupational Safety and Health Administration (OSHA) Heat Tool mobile app for monitoring environmental conditions based on the HEAT INDEX. Precautions recommended for the different Heat Index levels should be followed and are consistent with the General Controls and Job Specific Controls listed above. Where the HEAT INDEX level falls in the High or Very High to Extreme categories, implement physiological monitoring in addition to Job Specific Controls. The Heat Tool app can be accessed in OSHA's Heat Stress prevention topic section at https://www.osha.gov/SLTC/heatillness/heat_index/heat_app.html

3.3.3 Physiological Monitoring

For site personnel wearing vapor barrier clothing and for site personnel where Job-Specific Controls may not be sufficient to control heat strain, physiological monitoring will be performed. Physiological monitoring will also be performed when workers report signs and symptoms of heat strain.

Select workers whose exposure is most extreme or who are probably the least heat tolerant. Heat tolerance may be affected by acclimatization, body size, general health and physical fitness, medications, and age.

Heat strain should be evaluated by monitoring the heart rate and temperature.

Where an individual's pulse rate or temperature exceeds the criteria below, action should be taken to limit the individual's heat exposure. However, where a pattern develops among workers of exceeding the criteria, then additional Job-Specific Controls shall be implemented for the work group.

Pulse Rate

The radial pulse should be taken for 30 seconds one minute after beginning to rest (i.e., at the beginning of a rest break). This rate is multiplied by two to determine the heart rate at initial rest. This rest should not exceed 110 beats per minute (bpm). If the resting heart rate exceeds 110 bpm, then modify the work rest schedule for the individual by decreasing the work period and increasing the rest period.

Heart rate monitoring should be recorded on an Exposure Monitoring Log. Monitoring should begin at the first break. The first rest break should be taken within the first hour of work when ambient conditions exceed the screening criteria of **Table A4A-1**if working in Level D, and within the first 30 minutes if ambient conditions exceed 70°F if working in Modified Level C.

Oral Temperature

Use a digital oral thermometer with disposal plastic sleeves or similar device (e.g. aural thermometer) to measure the oral temperature at the end of the work period (before drinking).

If an individual's temperature exceeds 99.6°F (or 37.6 degrees Celsius [°C]), adjust the work rest cycle.

Do not permit a worker to wear semipermeable or impermeable clothing when his/her oral temperature exceeds 100.6 °F (or 38.1 °C).

- Never ignore signs and symptoms of heat-related disorders -

4.0 TRAINING

Workers on project sites will be trained by the SSHO at site orientation, or during special tailgate meetings. The training will include the elements of this program, and in particular:

- Heat related disorders and First Aid measures
- Environmental factors and workload impacts on heat strain
- Personal factors impacting heat strain including health status, caffeine, alcohol and drugs
- Reporting Signs and Symptoms of exposure
- Monitoring measures to be employed on the project
- General and Job-Specific Controls to reduce exposure
- Emergency Response

5.0 DOCUMENTATION

The SSHO will record periodic environmental monitoring results in the Logbook, if needed. Physiological monitoring will be recorded on the Physiological Monitoring Form, if needed. Records will be maintained on the job site and will be archived with the project files at the end of the job.

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ATTACHMENT 4B
COLD STRESS MONITORING PLAN

1.0 PROJECT

Contract Number: W9124J-18-D-0004
Delivery Order W9124J-22-F-045
Project Name: Environmental Remediation Services
Location: Redstone Arsenal (RSA), Alabama

2.0 COLD STRESS

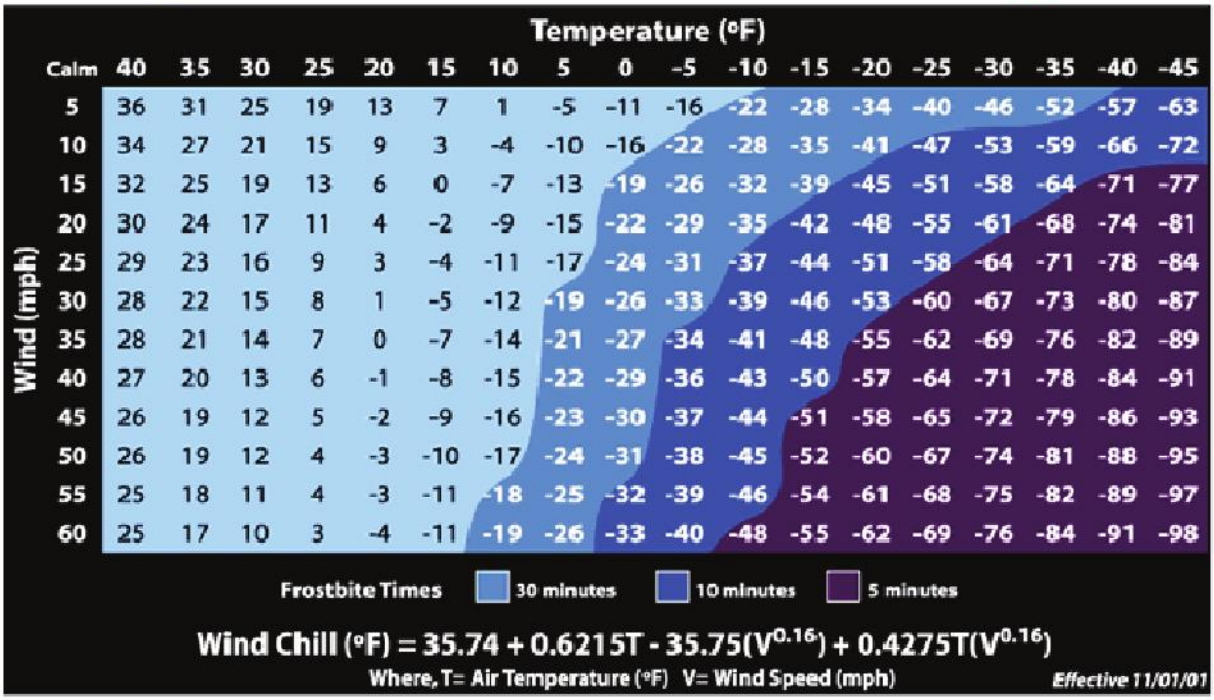
Cold stress hazards are most likely to occur at low temperatures or low wind chill factors, with wet, windy conditions contributing to risk. Where cold stress is a potential hazard (temperatures less than 40 degrees Fahrenheit [ºF]) workers will be trained on the information in the attached Cold Weather Fact Sheet.

As a precautionary measure, employees will wear layers of loose-fitting clothing including insulated coveralls, head cover (perhaps a liner beneath a hard hat), and boots when temperatures fall below 40°F, including wind chill. Protection of the hands, feet, and head is particularly important because these are likely to be injured first by cold. However, actual injury to hands, feet, and head is not likely to occur without prior development of early signs of hypothermia, such as numbing and shivering. Bare skin contact with cold surfaces (below 32°F) will be avoided.

The wind chill factor is the cooling effect of any combination of temperature and wind velocity or air movement. An anemometer can be used to measure wind velocity. The wind chill index (below) should be consulted when planning for exposure to low temperatures and wind. The Site Safety and Health Officer (SSHO) will monitor weather forecasts and determine wind chills at least every four hours when the temperature drops below 20ºF. The wind chill index does not take into account the specific part of the body exposed to cold, the level of activity that affects body heat production, or the amount of clothing being worn.

Like with heat strain, employees are permitted and encouraged to self-limit outdoor work activities when symptoms of cold stress are experienced. The buddy system is also encouraged to ensure that employees frequently check on co-workers in temperature extremes. A temperature-dependent work regimen limiting lengthy periods of outdoor activity may be necessary. If required, this will be developed by the SSHO in coordination with the Project Safety and Health Manager (SHM).

Wind Chill Index



3.0 REFERENCES

National Weather Service http://www.nws.noaa.gov/om/winter/windchill.shtml

OSHA's Campaign to Prevent Heat Illness in Outdoor Workers.
https://www.osha.gov/SLTC/heatillness/index.html

USAPHC

Injury Prevention: Fact vs Fiction

Cold Weather Injuries

FACT SHEET 12-004-0415

What causes Cold Weather Injuries?

Cold weather injuries (CWIs) can occur due to an imbalance of body temperature regulation, where heat loss is greater in an area of the body (or the body core) than heat production. There are 4 primary types of cold injuries: hypothermia, frostbite, non-freezing cold injuries, and injuries related to cold exposure. **Tables 1-4** provide details on these injuries.[1]

Why are CWIs a concern to the Army?



CWIs are preventable, yet if early signs and symptoms go unrecognized or preventive measures are not taken, these injuries may result in permanent injury and even death. A typical CWI casualty is a 20 year-old male at the rank of E-4 and below and often from a warm climate. However, anyone can become a CWI casualty.[2]

How can Soldiers protect themselves from a CWI?

Soldiers should be aware of risk factors and increase resilience by consuming a healthy diet with plenty of fluids, maintaining fitness levels according to Army standards, and getting quality sleep each night. Dressing properly for the weather conditions in a way to easily adjust (layers), and balancing the time and amount of activity spent in cold weather conditions will reduce risks.[1,3,4,5]

Prevention of Cold Weather Injuries

Clothing
- ❖ Wear uniform properly (layers worn loosely).
- ❖ Keep socks & clothes dry (use sock liners and foot powder).
- ❖ Remember the acronym C-O-L-D
  - Keep it CLEAN
  - Avoid OVERHEATING
  - Wear clothing LOOSE and in LAYERS
  - Keep clothing DRY

Eyes
- ❖ Wear dark UV protective glasses
- ❖ If no sun glasses – improvise with cut slits in cardboard/cloth; or use tape over regular eyeglasses

Skin
- ❖ Keep your skin clean, covered, & dry
- ❖ Use sunscreen and lip balm
- ❖ Use gloves to handle all equipment and fuel products

Hydration
- ❖ Drink warm liquids
- ❖ Monitor urine color for dehydration

Environment
- ❖ Use warming tents when needed
- ❖ Monitor conditions, especially the wind chill index
- ❖ Use anti-slip shoe gear if outside extensively

Other
- Conduct NCO checks and look after your battle buddy

What factors increase the risk of having a CWI?

All Soldiers regardless of rank are susceptible to a CWI in the right conditions. However, surveillance data from the Army and other Services indicate that rates of cold injuries appear higher among African Americans, women, Service members under 20 years old, and enlisted personnel[2] Additional risk factors are discussed below[1-7]:

✚ *Prior cold injury or medical conditions*

Soldiers who have had a cold injury in the past are much more likely to develop a new cold injury sooner or one of more severe nature in the future. Existing medical conditions may predispose an individual to a CWI. For example, Raynaud's Disease is a disorder that causes blood vessel constriction in cold temperatures or during emotional distress, resulting in reduced blood flow to the extremities (e.g., fingers & toes).[6] Other conditions, such as anemia, diabetes, sickle cell disease, hypotension, and atherosclerosis, may also increase susceptibility to frostbite and injuries related to cold exposure.[1]

✚ *Dehydration*

Inadequate fluid intake affects the body's ability to sustain physical activity, which in turn affects thermoregulation (i.e., the balance between heat production and loss). In cold environments sensitivity to thirst declines, which can increase the risk of dehydration during strenuous activity, where fluid loss often exceeds intake.[1, 4, 5]

✚ *Over- and Under- Activity*

Vigorous exercise/activity induces sweating, which leads to wet clothing and subsequent increased heat loss. Conversely, under-activity results in low heat production, which may lower the body's core temperature.[1, 4, 5]

✚ *Tight clothing*

Close-fitting clothing reduces insulation and may restrict movement, resulting in heat loss. Clothing should be worn loosely and layered to allow adjustments as physical activity levels and environmental conditions change.[1, 4, 5]

✚ *Inadequate nutrition*

Underfeeding can cause low blood sugar (hypoglycemia) which impairs shivering, thereby making it difficult to generate body heat. Low carbohydrates stores also limit the ability to maintain physical activity.

✚ *Alcohol & nicotine*

Alcohol imparts a sense of warmth and causes dilation of skin blood vessels which increases heat loss to the environment. It may also impair the senses and judgment, making it difficult for a Soldier to detect signs and symptoms of a CWI. Tobacco use (smoking or chewing) causes increased constriction of skin blood vessels, which increases the risk for frostbite.[1, 4, 5]

✚ *Medications*

Some medications may affect thermoregulation by impairing vasoconstriction. These include benzodiazepines, tricyclic antidepressants, barbiturates, and general anesthetics.[1, 4, 5]

U.S. Army Public Health Command - Injury Prevention Program
usarmy.apg.medcom-phc.mbx.injuryprevention@mail.mil ***410-436-4655/DSN 584-4655***
5158 Blackhawk Road, APG, MD 21010-5403
Approved for Public Release, Distribution Unlimited

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ATTACHMENT 5

RESUMES

Kym Edelman, CIH, CSP *757-435-5384*
EHS Manager

Experience Summary

Highly accomplished Certified Industrial Hygienist and Certified Safety Professional with over 27 years of on-site and project management expertise to provide oversight, review, reporting, training, and control of employee H&S processes on multiple construction/environmental sites.
Comprehensive knowledge of regulatory compliance requirements under OSHA, DOE, CERCLA, RCRA, USACE, EPA, and other federal/state regulatory programs.
Hands-on experience in compliance monitoring, development and implementation of policies and procedures, accident investigation, and worker's compensation issues.
Proven record of retaining minute detail with excellent recall regarding safety regulations and contractual language to make on-the-spot independent decisions.
Well respected with reputation for using excellent interpersonal communication skills to collaborate with staff, all levels of management, and clients.
Consistently commended for outstanding leadership skills, producing quality work product, developing proactive initiatives, and commitment to achieving optimum project safety expectations to ensure client satisfaction while adhering to corporate policy and procedures.

Education

BS (Bachelor of Science), Environmental Health, Industrial Hygiene Concentration, Old Dominion University, Norfolk, VA

Registrations/Certifications

Certified Industrial Hygienist
Certified Safety Professional

Training

40-Hour OSHA Hazardous Waste Health and Safety Training – 1989
40-Hour EM 385 1-1 Awareness Course- 2018
30-Hour OSHA Construction Safety Course- 2004
Shipyard Competent Person- 2019

Experience

Program Health and Safety Manager, April 2020-Present
ECC, Jacksonville, NC

Responsible for assisting in overall management of the safety programs for ECC.

- Monitor overall safety compliance, assistance, and oversight of multiple task orders for Federal as well as commercial client project sites:
- Assist in preparation and review of project work plans in relation to site specific safety program documents.
- Assist in implementation of safety processes on active project sites.
- Provided technical guidance to project and program employees as well as clients.
- Revise and develop programs and procedures

EHS Manager, September 2018-April 2020
APTIM, Norfolk, VA
Responsible for assisting the EHS Lead in overall management of safety programs for APTIM's Government operations.

- Monitor overall safety compliance, assistance, and oversight of multiple task orders for Federal as well as commercial client project sites:
- Assist in preparation and review of project work plans in relation to site specific safety program documents.
- Assist in implementation of safety processes and manage safety staffing on active project sites.
- Provided technical guidance to project and program employees as well as clients.
- Manage injuries and illnesses, and related worker's compensation claims.
- Assist in safety council, award programs, and employee involvement initiatives.
- Conduct periodic reviews and audits of project sites to determine compliance with applicable regulations, standards, and internal procedures.

Director, EHS June 2018-September 2018
Tetra Tech EC, Inc., Virginia Beach, VA
Responsible for overall management of environmental health and safety programs and employees for Tt EC operations.

- Serves as program Certified Industrial Hygienist for the Atlantic Division Remedial Activities Contract, Naval Facilities Engineering Command.
- Provides technical support for programs and projects, including proposal review and support.
- Manages site safety and health professionals on projects and ensures safety staff assignments to meet project and client needs.
- Injury case management and worker's compensation claim management.
- Writes or reviews and approves site-specific health and safety plans.
- Conduct program reviews and audits for compliance and continual improvement.

EHS Manager of Eastern Operations, September 2015-June 2018
Tetra Tech EC, Inc., Virginia Beach, Virginia
Responsible for assisting the Tetra Tech EC Director in overall management of safety programs for Tt EC's operations.

- Monitor overall safety compliance, assistance, and oversight of multiple task orders for Federal as well as commercial client project sites:
- Assist in preparation and review of project work plans in relation to site specific safety program documents.
- Assist in implementation of safety processes and manage safety staffing on active project sites.
- Provided technical guidance to project and program employees as well as clients.
- Manage injuries and illnesses, and related worker's compensation claims.
- Facilitated implementation of LANT RAC program safety council, award programs, and employee involvement initiatives.
- Conduct periodic reviews and audits of project sites to determine compliance with applicable regulations, standards, and internal procedures.

- Program CIH for LANT RAC VI Navy contract.

ES&H Manager, August 2012 – September 2015
CB&I AREVA MOX Project, DOE, CB&I (formerly Shaw) Project Services Group, Aiken, SC
Manage all safety aspects of the project, including sub-contractors. The project has exceeded 21 million man-hours without a lost work day case.
Responsible for management of the on-site medical clinic, fitness center, production facility safety staff, and all field safety engineers.
Interface between high level construction management, client, and filed construction employees, to ensure clear communication of expectations to continue to promote a positive safety environment that has yielded exemplary employee safety performance.
Technical resource for all project staff, as well as client.

August 2002 – August 2012, SHAW E&I, Norfolk, VA
Ten years of progressive experience and achievement as safety project management/ site safety coordinator

Program Safety Manger, May 2008 – August 2011
IHNC, USACE, New Orleans,
Accountable for establishment and initial/continued implementation of project safety programs for this high profile $1.1B project involving design and construction of the New Orleans Hurricane and Storm Damage Risk Reduction System.
Successfully managed the safety program for the largest civil works design-build project ever undertaken by the USACE. The project, during this timeframe, concluded with "no lost work days" for Shaw.
Staffed project, developed project safety initiatives, organized the Accident Prevention and Hurricane Preparedness Plans, coordinated training, conducted subcontractor reviews, and acted as overall technical consultant regarding project safety issues, and compliance monitoring of the safety process.

Program Safety Manager, November 2007 – August 2012
Global Contingency and Construction Contract (GCCC), NAVFAC (Naval Facilities) Worldwide
Serves as Health and Safety Manager for this $335M US Navy contract. Directed safety programs for all construction projects under the GCCC contract. Implemented safety processes, managed staffing, developed H&S and Accident Prevention Plans, managed worker's compensation claims, and provided technical oversight to staff and management on all projects.Developed documents and programs to ensure training, programs, and procedures were translated into local languages and worked with third country nationals to establish safety cultures where previously non-existent.Monitored and ensured the implementation of corporate policies and procedures, conducted incident investigations, and maintained proactive safety programs.Ensured compliance with applicable laws/regulations, and provided safety support/consultation to Shaw management, as well as client companies and governmental entities.

Program Safety Manager, May 2008 – 2012
LANTDIV RAC V Program, NAVFAC Atlantic Division, Norfolk, VA
Directed overall program safety on this $150M Navy contract, including safety program implementation and oversight of multiple task orders under the contract.

- Instrumental in team accomplishing 4,000 days with a record of "no lost work days."
- Implemented safety processes, managed staffing, developed health and safety, and accident prevention plans.
- Provided technical guidance to project and program employees as well as clients.
- Managed injuries and illnesses, and related worker's compensation claims.
- Facilitated program safety council, award programs, and employee involvement initiatives.

Program Safety Manager, December 2002 – August 2012
Served as Program Safety Manager leading a staff of field safety professionals in the development and implementation of safe work practices on multiple individual task orders. Also, functioned as Site Safety Coordinator for several individual projects at multiple locations conducted under the LANTDIV RAC IV program.

These projects included UXO demilling activities, active range clearance activities, "Clean" site closures, installation of treatment systems, storage tank removals, bio-remediation, landfill excavation/repairs/capping, soils excavation and removal of hazardous materials.

- 2000 Day President's Award for no lost work days on one project.
- Target Zero achieved for 2 Project Sites.
- RAC Program achieved Zero Lost Work Days, Recordable Incidents or Chargeable Vehicle Incidents within Fiscal Year 2008.
- Successfully adapted to EHS organizational changes, and positioned to advance within group.

Environmental Health and Safety Manager, October 2000 – April 2002
Flextronics Enclosures, Kingston, PA
Responsible for the development, implementation, and monitoring of Flextronics Enclosures, Inc. Environmental Health and Safety program.

- Conducted initial audits, assessments, and industrial hygiene sampling, to determine environmental, safety, and industrial hygiene compliance issues.
- Developed plans and procedures necessary to attain compliance with water permitting, waste disposal, safety and industrial hygiene issues.
- Developed programs to decrease employee injuries as well as reduce incident rates and worker's compensation costs.
- Worked with local occupational health clinic to better manage accidents and injuries, to keep employees at work, and ensure best care possible.
- Responsible for maintaining OSHA 200 logs.
- Conducted and facilitated training sessions for managers and technicians to ensure understand and compliance with new company safety programs.
- Monitored effectiveness of new EHS Program and continually improved upon programs implemented.
- Developed and implemented an Environmental Management System to be compliant with ISO-14001.

Environmental Scientist, January 1996 – April 1997
Maxim Technologies (formerly Huntingdon Chen-Northern), Denver, CO
Assigned to USEPA Superfund Technical Assistance and Response Team, sub-contracted to the primary USEPA contractor.

- Conducted hazardous waste and emergency response operations, including delineation of contamination, site control, and contamination monitoring and reporting.
- Provided on-site technical support to EPA and oversight of contractors for EPA.
- Provided assistance to EPA regarding sampling, management, and disposal of hazardous and mixed wastes.
- Conducted preliminary site investigations to determine presence and extent of contamination on sites.

- Assisted in development of work plans and provided assistance to EPA for subsequent remediation of contaminated sites and abandoned industrial facilities.
- Conducted hazardous materials training as required by OSHA for hazardous waste site work and emergency response, as well as the hazard communication standard.
- Assisted EPA in conducting public information meetings pertaining to remedial sites.

Health and Safety Manager, August 1994 – January 1996
Maxim Technologies (formerly Huntingdon Chen-Northern), Denver, CO
Responsible for the overall management of Maxim's regional health and safety program.

- Developed and implemented corporate health and safety procedures throughout the Northwest Region.
- Managed accidents and injuries as well as required documentation on OSHA 200 logs.
- Responsible for compliance, documentation, and disposal of hazardous materials generated by the regional offices.
- Assisted environmental groups in conducting Phase I site assessments.
- Conducted training for Hazardous Waste Site Work, Hazard Communication, Asbestos Awareness, Instrumentation, and Air Monitoring.
- Conducted accident investigations and management of workers' compensation claims.
- Developed site specific health and safety plans for hazardous waste site work.
- Provided technical support in the areas of industrial hygiene and health and safety.

Site Safety Supervisor, October 1992 – June 1994
OHM Corporation, Findlay, OH
Responsible for the implementation, and management of site specific environmental, industrial hygiene, health, and safety programs, in accordance with site specific health and safety plans.

- Conducted initial site hazard assessments.
- Assisted in completing and maintaining documentation related to hazardous waste storage and disposal.
- Monitored compliance of site operations with respect to OSHA, EPA, and state regulations, such as, RCRA, TSCA, AHERA, HAZWOPER, and HAZCOM.
- Implemented appropriate means to control hazardous materials exposure.
- Monitored the effectiveness of on-site industrial hygiene and safety programs.
- Initiated safety awareness programs.
- Conducted training as required by 29 CFR 1910.120 and the Hazard Communication Standard.
- Liaison between client representatives and OHM in regard to environmental, industrial hygiene, and health and safety issues.

Division Safety Coordinator, October 1989 – October 1992
MAECORP Inc., Columbus, OH
Responsible for the implementation and compliance monitoring of company safety policies in addition to Federal and State OSHA and EPA regulations, on hazardous waste project sites in USEPA Region V.

- Conducted site safety audits and prepared appropriate reports.
- Conducted air monitoring for personal exposures in addition to environmental air sampling.
- Conducted annual refresher training for hazardous waste site operation.
- Developed site specific health and safety plans in accordance with the requirements 29 CFR 1910.120.

- Conducted building inspections for asbestos.
- Maintained appropriate documentation in regard to medical monitoring requirements, training certificates, and hazard communication.
- Conducted accident investigations.
- Managed work related injuries.

References available upon request

HST

CERTIFICATE OF TRAINING

THIS CERTIFIES THAT

Kym Mohrman

has successfully completed 40 hours of instruction in

WASTE SITE WORKER PROTECTION

Prepared and conducted by
Hygiene, Safety and Training Inc.
to comply with OSHA 1910.120(e)(2)

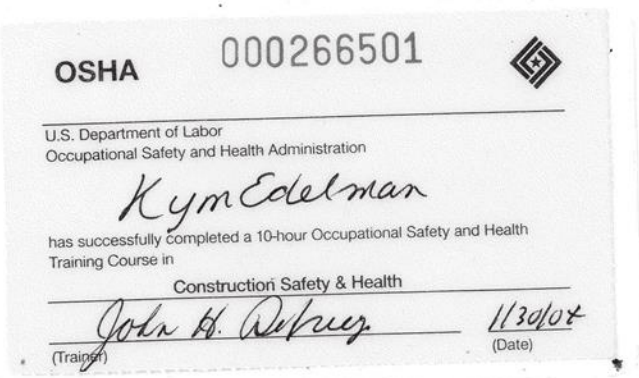
Jack M. Peterson
CSP, CIH

November 10, 1989
Date of Completion

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OSHA 000266501

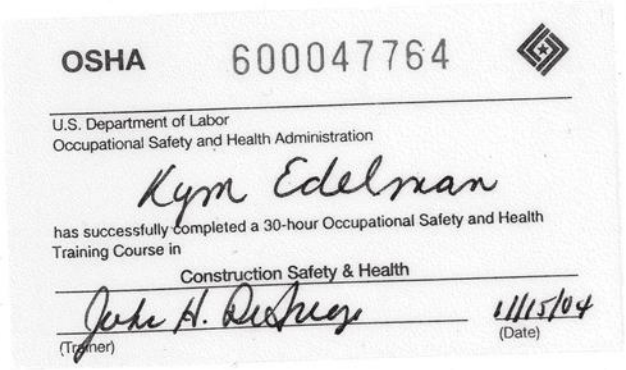
U.S. Department of Labor
Occupational Safety and Health Administration

Kym Edelman

has successfully completed a 10-hour Occupational Safety and Health Training Course in

Construction Safety & Health

John H. DeBruyn — 11/30/04
(Trainer) (Date)



OSHA 600047764

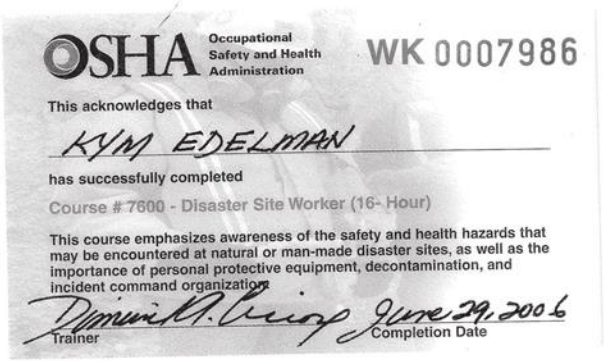
U.S. Department of Labor
Occupational Safety and Health Administration

Kym Edelman

has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety & Health

John H. DeBruyn — 11/15/04
(Trainer) (Date)



OSHA Occupational Safety and Health Administration WK 0007986

This acknowledges that

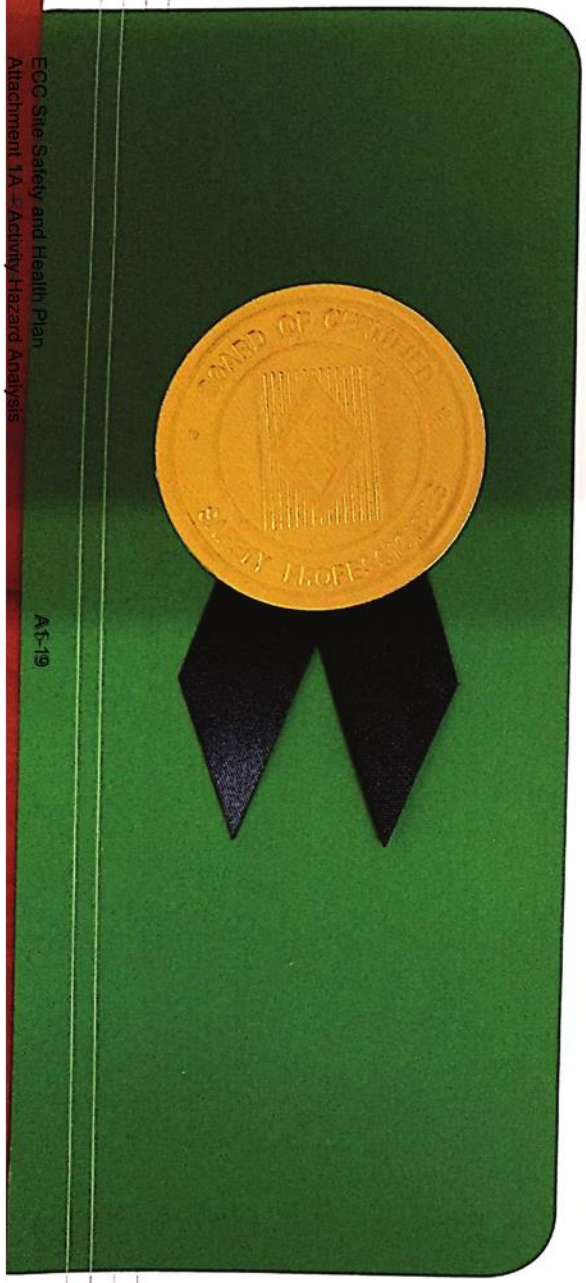
KYM EDELMAN

has successfully completed

Course # 7600 - Disaster Site Worker (16- Hour)

This course emphasizes awareness of the safety and health hazards that may be encountered at natural or man-made disaster sites, as well as the importance of personal protective equipment, decontamination, and incident command organization.

Trainer — June 29, 2006 Completion Date



BOARD OF CERTIFIED SAFETY PROFESSIONALS

affirms that

Kym Y Edelman

Has applied for, met qualifications, and passed required examination(s) and is hereby authorized to use the designation

Certified Safety Professional®

in Comprehensive Practice

So long as this certificate is not suspended or revoked and the certificant renews this authorization annually and meets Continuance of Certification requirements.

Board of Examiners in witness whereof we have here unto set our hands and affixed the Seal of the Board this 21st Day of December, 2006

Larry W. Jones — President

Glenn M. Overly — Secretary

19423 — CSP No.

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american board of industrial hygiene®

6015 West St. Joseph, Suite 102 Lansing, Michigan 48917 **P:** (517) 321-2638 **F:** (517) 321-4624 **E:** abih@abih.org

November 02, 2016

Kym Y. Edelman, CIH
4900 Fennell Lane
Suffolk VA 23435

Dear Ms. Edelman,

It is my pleasure to congratulate you. With the combination of education, experience and your performance on the CIH® examination, the American Board of Industrial Hygiene® finds you qualified for professional certification in the Comprehensive Practice of Industrial Hygiene. You may now use the designation "Certified Industrial Hygienist®," and the corresponding "CIH®".

This is a significant career milestone. Many industrial hygienists strive for the CIH® certification but it's attained by only a few. Your certification says a lot about you as a professional. It is a mark of distinction that indicates not only your knowledge and skills but also your personal motivation to successfully undertake the challenge. This is recognized by peers, employers and clients.

We will be publishing your name on the ABIH® website so that everyone may see this great accomplishment.

Now that you've attained the CIH®, you'll want to make every effort to retain it. The best place to start is with the CM Primer which is available in the Documents Library section of the ABIH website. It provides an easy-to-read summary of the basic program along with some useful tips. As you review the CM Primer, note that you are on a 60 month CM Cycle that runs from January 1, 2017 to December 31, 2021.

Please use the ID Number listed below to access the My Account section of the ABIH website where you can update your contact information, pay fees and locate other CIHs in the private roster.

ID Number: **11689**

On behalf of ABIH®, I personally congratulate you on your achievement. Welcome to an elite group of professionals!

Ron Drafta

Ron Drafta, CIH
Certification Program Manager, ABIH
rdrafta@abih.org

Enclosure

Certificate Of Completion

American Safety Council

KYM EDELMAN

Has diligently and with merit completed the

40-Hour EM 385-1-1 on 7/6/2018

Director: **Jeff Pairan**

ECC Site Safety and Health Plan
Attachment 5A - Activity Hazard Analysis
A1-21

ABIH®

american board of industrial hygiene®

organized to improve the practice of industrial hygiene
proclaims that

Kym Y. Edelman

having met all requirements of
education, experience and examination,
is hereby certified in the

COMPREHENSIVE PRACTICE
of
INDUSTRIAL HYGIENE

and has the right to use the designations

CERTIFIED INDUSTRIAL HYGIENIST

CIH

Certificate Number	**11090 CP**
Awarded:	**October 26, 2016**
Expiration Date:	**June 1, 2022**

Chair, ABIH

Chief Executive Officer, ABIH

The Compliance Edge Online Institute

Certificate of Completion

Kym Edelman

has met the online course completion requirements for

HAZWOPER 8-Hour Refresher

in accordance with 29 CFR 1910.120 and 1926.65

Certificate ID 1724619-328
Continuing Education Units 0.8
AdvanceOnline Solutions, Inc. offers 0.8 CEUs for this program.

AdvanceOnline, Inc. is authorized to issue the ICSR CEU.

ICSR CEU

Date 7/28/2020 8:09:00 AM
Time Online 08:38:52
AdvanceOnline Solutions, Inc.
1811 Bering Drive, Suite 430
Houston, Texas 77057
www.advanceonline.com
(713) 621-1100

AdvanceOnline SOLUTIONS

BRIAN KATELEY

Years' Experience: 17

With Current Firm: 9.5

Current Professional Registration:

Security Clearance:

Aberdeen Proving Ground

Education:

- BS, Environmental Science & Policy Program, University of Maryland, 2003
- Environmental Technology Certificate, Harford Community College, 1999

Other Professional Qualifications/Training:

- OSHA 40-hour HAZWOPER, 1999 and 2006; 8-hr HAZWOPER Refresher, 2021
- OSHA 8-hour Excavation Safety; 2006
- OSHA 8-hr Supervisor, 2008
- OSHA 30-hour Construction Safety and Health, 2011 – renewal in progress
- First Aid/CPR/AED/BBP, 2017 – renewal in progress

Summary of Experience:

Mr. Kateley is experienced in environmental characterization techniques such as groundwater sampling, soil sampling, lithologic characterization, surface media sampling, direct-push technology, investigations, and monitoring well installation. He is also skilled in groundwater remediation system implementation and operation and maintenance, including monitored natural attenuation, pump and treat systems, in situ bioremediation, and product recovery systems.

Mr. Kateley has been in a Site Supervisor and SSHO role since March of 2014. His responsibilities have included assisting with managing project safety and health programs. Providing safety consultation to the project management team in the planning and execution of project tasks. Providing site orientation for new employees, subcontractors, vendors, and visitors. Performing multi-media sampling to determine appropriate levels of PPE and assigning PPE to team members. Conducting daily safety and workplan tailgate meetings. Conducting daily, weekly, monthly, and annual site inspections. Ensured all employees, including subcontractors, performed daily activities safely and assured compliance with APP/SSHP, AHAs, and workplans while enforcing all site safety and health procedures.

Roles & Responsibilities: Environmental Scientist, Site Supervisor and SSHO since 03/14.

ECC Project Experience

Project Title and Location: Aberdeen Proving Ground Remedial Action (Optimization), Maryland

Dates on Project Start/End: 11/11 to present

Project Start/End Dates: 06/11 to present

Roles & Responsibilities: Environmental Scientist, Site Supervisor and SSHO

Mr. Kateley currently serves as the Site Supervisor and SSHO for the operations, maintenance, and performance monitoring of enhanced in-situ bioremediation systems for the remediation of chlorinated solvents in groundwater at six sites within the Aberdeen Area of APG, Buildings 3327, 525, M600, 361, 507 and Defense Reutilization and Marketing Office Metal Scrap Yard. Systems include active groundwater recirculation systems for the addition of groundwater amendments and passive biobarriers for the treatment of downgradient areas. He is responsible for operations and technical support, including:

tracking weekly groundwater elevation data to determine the status of hydraulic containment; scheduling and overseeing long-term monitoring (LTM) groundwater sampling on a semi-annual schedule; maintaining the project groundwater analytical database; managing and interpreting all of the groundwater elevation and chemical sampling data; and, preparation of quarterly performance and annual operations and performance monitoring technical reports. Mr. Kateley also assists the Project Manager in the oversight of field lab pack technicians and the inventory, tracking, and disposal of solid and liquids wastes generated from the project activities.

Mr. Kateley also supports operations at the Canal Creek and O-Field Groundwater Treatment Facilities under this project and has held an Operator in Training Industrial Wastewater License with the Maryland Department of the Environment (MDE).

Project Title and Location: Site Delineation and Characterization of Phillips Landfill, Western Boundary OU2, Ecological Soil Removal at Fire Training Area, and Achieve Site Closure at CCAPG04031, Aberdeen Proving Ground, Maryland

Dates on Project Start/End: 09/14 to 09/19

Project Start/End Dates: 09/14 to 09/19

Roles & Responsibilities: Environmental Scientist, Site Supervisor and SSHO

Mr. Kateley directed environmental sampling in support of a data-gap investigation at six landfill areas identified within the Phillips Army Airfield Landfill (PAALF) to evaluate potential Feasibility Study response actions for the areas under CERCLA. Specific tasks included the delineation of the presence/absence and horizontal extent of fill material within each landfill area through the use of 171 test pits; existing soil cover thickness assessments of each area, soil and solid waste sampling to characterization of contaminates and waste streams; groundwater sampling of the entire PAALF monitoring well network. Mr. Kateley assisted the Project Manager in the implementation of a non-time-critical removal action (NTCRA) at the Aberdeen Fire Training Area (AFTA), located in the Western Boundary Study Area (WBSA) of the Aberdeen Area of APG involving shallow soil excavation/removal of polycyclic aromatic hydrocarbons (PAHs) and metals-contaminated soil; achieving negotiated cleanup levels. He also supported the implementation of the Closure Plan for the former Aberdeen Area Building 4031 Underground Storage Tank (UST) Site regulated under the State of Maryland's Oil Control Program. Mr. Kateley was responsible for the oversight of well abandonments, decommissioning of the in-active SVE system, construction and operation of an on-site treatment cell for DRO/GRO contaminated soils, excavation and treatment of DRO/GRO contaminated soil from the footprint of the former 4031 Building, liquid phase hydrocarbons (LPH) recovery and groundwater treatment, confirmation sampling and analysis, excavation backfilling, and site restoration. He also supervised lab pack technicians in the performance of post-closure monthly gauging of water levels and removal of free-product from two wells, as well as quarterly groundwater sampling of the well field at the former Building 4031 UST site. Supported preparation of the site project workplans, health safety plans, and closure documentation and coordinated with the DPW Environmental Division Hazardous Waste Branch to provide all documentation necessary to remove waste and IDW from APG. Responsibilities for all project work included oversight of the field sampling teams; inventory and tracking of chemical data and waste generated from investigation and remediation activities; data reporting; and maintaining strict adherence to the health and safety plans and compliance with associated federal, state, local, and APG regulations and guidance governing all CERCLA and RCRA work at APG.

Project Title and Location: Canal Creek Study Area Sites RI/FS PBA, Aberdeen Proving Ground, Maryland

Dates on Project Start/End: 03/14 to 09/17

Project Start/End Dates: 03/14 to 09/19

Role & Responsibilities: Environmental Scientist, Site Supervisor and SSHO

Mr. Kateley supported the environmental sampling tasks associated with the RI work at the Canal Creek Study Area (CCSA) at APG as part of the Installation Restoration Program under CERCLA. This contract covered the completion of the remedial investigations (RIs) (including risk assessments and final RI Reports) for 10 East and 12 West CCSA sites, plus an investigation of the Buried Legacy Chemical Sewer Lines throughout the CCSA. The remedial investigations include site inspections, test digs, and media sampling (i.e., soil, sediment, sludge, and groundwater). Responsibilities included development and production of RI Work Plans, field activity reports, and final RI Reports, overseeing team subcontractors, field sampling events, evaluation of analytical data, inventory and tracking of waste generated from RI activities, and maintaining strict adherence to the health and safety plans and standard operating procedures (SOPs) governing all CERCLA work at APG.

Project Title and Location: Other Miscellaneous DoD and Former DoD Sites in the United States Mid-Atlantic area.

Dates on Project Start/End: 01/12 to present

Role & Responsibilities: Environmental Scientist, Site Supervisor and SSHO

Mr. Kateley has supported other similar projects in the Mid-Atlantic on shorter terms including:

- Joint Base McGuire-Dix-Lakehurst – Burlington County, NJ
- Atlantic City Air National Guard Site – Atlantic County, NJ
- Fort Meade – Anne Arundel County, MD
- Picatinny Arsenal – Morris County, NJ
- Former Griffiss Air Force Base – Oneida County, NY

Work Prior to ECC

Scientist II, EA Engineering, Science, and Technology, Inc. (01/06-10/11).
Project Manager, Aberdeen Proving Ground Edgewood Area Munitions Response Site Remedial Investigation, Aberdeen Proving Ground; Army Environmental Command (2011). Fixed price remedial investigation assessment for munitions and explosives of concern and munitions constituents for 12 Munitions Response Sites at Aberdeen Proving Ground, which total 3,500 acres. Responsible for Technical Project Planning and Restoration Advisory Board support, munitions constituents assessments, providing Unexploded Ordnance Quality Control Officer and Unexploded Ordnance Safety Officer support, Geographic Information System database management, DGM support to include brush clearing, ERIS uploads, and document support. Project includes the re-acquirement and evaluation of over 20 years of Installation Restoration Program data (including geophysics and Installation Restoration Program chemical sampling) to support the Military Munitions Response Site remedial investigation efforts.

Environmental Scientist, Suburban Propane, Reisterstown, Maryland (2010). Responsible for field activities during DPT chemical-oxidation injections including assurance of proper injection depths, volumes, and geochemical sampling from surrounding monitoring wells.

Environmental Scientist, Department of Public Works Parcel B, C, D Remedial Action Plan, National Aquarium of Baltimore, Baltimore, Maryland (2010). Responsible for construction quality assurance and air monitoring of perimeter and work zone at site utilizing dust and mercury vapor meters. Also responsible for the creation of an environmental monitoring plan for environmental hazards during the voluntary cleanup program remedial action plan implementation.

Environmental Scientist, New O-Field Groundwater Remediation; Aberdeen Proving Ground (2009-2010). Performed field activities required to determine contaminant distribution and hydraulic properties for the remedial system design. Responsible for design, installation, and implementation of a bio-barrier injection and monitoring well network to treat chlorinated solvents and metals in groundwater at the site.

Environmental Scientist, Constellation Power Generation Oil Control Program Compliance Support, Perryman and C. P. Crane Generating Stations (2008). Responsible for coordination and performance of field activities including site wide groundwater gauging and sampling events and light non-aqueous phase liquid recovery.

Environmental Scientist, Site 2 Old Dump at Swan Creek Soil, Aberdeen Proving Ground, Aberdeen, Maryland (2009). Conducted site clearing activities and the installation of geotextile for the reestablishment of landfill cap.

Environmental Scientist, Compliance Cleanup of 13 Sites, Aberdeen, Maryland; Aberdeen Proving Ground; Environmental Scientist (2008). Tasks include operation and maintenance of product recovery systems, groundwater monitoring, and reporting.

Environmental Scientist, Enhanced In Situ Bioremediation Systems, Buildings 3327, 525, M600, 361, 507 and Defense Reutilization and Marketing Office Metal Scrap Yard, Aberdeen Proving Ground, Maryland, Aberdeen Proving Ground (2006). Involved in the installation and responsible for the operation, maintenance, and performance monitoring for enhanced bioremediation systems for the remediation of chlorinated solvents in groundwater at six sites in the Aberdeen Area. Systems include active groundwater recirculation systems for the addition of groundwater amendments and passive biobarriers for the treatment of down gradient areas.

Environmental Scientist, Operations and Maintenance Soil Vapor Extraction/Free Product Recovery System, Building 4025, Aberdeen Proving Ground, Maryland (2006-2007). Responsible for operations and maintenance of the Building 4025 soil vapor extraction remediation system, which consists of a soil vapor extraction system that is designed to enhance the recovery of light non-aqueous phase liquids and biodegrade residual hydrocarbons. Also responsible for collection of monthly air sample for submission to laboratory for benzene, toluene, ethylbenzene, and xylene analysis, to ensure that air emissions for the system are in compliance with the Maryland Department of the Environment regulations. Additional responsibilities include preparation of comprehensive monthly progress reports for the system.

Environmental Scientist, Operation and Maintenance Soil Vapor Extraction System, Building 4031, Aberdeen Proving Ground, Maryland (2006-2007). Responsible for operations and maintenance of the Building 4031 soil vapor extraction/free product recovery system. Also responsible for collection of monthly air sample, for submission to laboratory for benzene, toluene, ethylbenzene, and xylene analysis, to ensure that air emissions for the system are in compliance with the Maryland Department of the

Environment regulations. Additional responsibilities include preparation of comprehensive monthly progress reports for the system.

Inspector/Technician, Monitoring and Maintenance 5 Installation Restoration Program Sites; Edgewood Area, Aberdeen Proving Ground, Maryland (2006). Responsible for quarterly inspections and subsequent maintenance of 5 Installation Restoration Program sites; Nike SW landfill, Cluster 5 test area, Old Bush River Road Dump, Graces Quarters, and Carroll Island. Monitoring tasks include sampling of monitoring wells and surface media (soil and sediment), maintenance inspection of landfill sites to ensure site stability and inspection of shoreline stabilization measures with unexploded ordnance sweeps at Grace's Quarters and Carroll Island. Maintenance tasks involve removal of unwanted vegetation, fence repair, and carbon filter replacements.

Environmental Scientist, Millsboro Groundwater Investigation (Trichloroethene); Millsboro, Delaware; Department of Natural Resources and Environmental Control (2006). Collected groundwater samples using direct-push technology in order to delineate the plume size of known trichloroethene contamination. Also collected soil, soil gas vapor, and air samples to define possible volatile organic compound occurrences outside of the groundwater.

Environmental Scientist, Uncle Ted's Trading Post, Millsboro, Delaware, Department of Natural Resources and Environmental Control (2006). Performed operations and maintenance on soil vapor extraction system. Installed upgraded aquifer air sparge and soil vapor extraction system. Sampled monitoring wells and potable wells surrounding the site.

Scientist, Absecon Island Shore Protection Project, Atlantic City, New Jersey; US Army Corps of Engineers (01/04-11/04). Employed on the dune restoration phase of the US Army Corp of Engineers Absecon Island Shore Protection Project. Project focus included sand fence and dune grass installation from Atlantic City to Ventnor City, New Jersey. Responsibilities included fence and planting layout, material storage, equipment maintenance, and communication with contractors. Gained experience in coastal ecology, winter field conditions and operating light machinery. Other projects with this firm included native species reforestation jobs for the Maryland State Highway Administration.

Carpenter's Assistant, Potts & Callahan Inc., Baltimore, Maryland (06/99-09/00). Assisted carpenters in the layout, building, and setting of concrete forms for stormwater management structures. Gained experience in reading blueprints and using instrument levels for grading and excavation. Learned heavy equipment safety procedures and the use of industrial power tools.

Intern/Scientist, Radford Army Ammunition Plant, Radford, Virginia (07/98-04/99). Worked on the environmental remedial investigation. Responsibilities included air, soil, surface water, and sediment sampling along with sampling documentation and transportation. Assisted in the compilation of the collective measures study by processing sampling results, preparing data spreadsheets and producing sampling maps from Global Positioning System data. Team involvement included site management during remediation phases.



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at

ALL AMERICAN SCHOOL OF OCCUPATIONAL SAFETY AND HEALTH
COLUMBIA, MARYLAND

January 9-13, 2006
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School Director

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FOR COMPLETION OF

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25 April 2008

Peter Garger

Peter Garger, CIH

OSHA Occupational Safety and Health Administration

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This card acknowledges that the recipient has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety and Health

Brian Kateley

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APPENDIX F

GROUNDWATER MONITORING PLAN

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Rev 2

GROUNDWATER MONITORING PLAN RSA-311, EXTERIOR SUMPS AND INTERIOR CONCRETE PITS AT BUILDING 7352, OPERABLE UNIT 9

U.S. ARMY GARRISON-REDSTONE MADISON COUNTY, ALABAMA

CONTRACT NUMBER W9124J-18-D-004
DELIVERY ORDER W9124J22F0045

Prepared for:

U.S. ARMY ENVIRONMENTAL COMMAND
Southeast-Environmental Service and Support Division
2450 Connell Road, Building 2264
Fort Sam Houston, TX 78234-7664

Prepared by:

January 2025

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per Liter
AAC	Alabama Administrative Code
ADEM	Alabama Department of Environmental Management
amsl	Above Mean Sea Level
APP	Accident Prevention Plan
Army	U.S. Army
bgs	Below Ground Surface
CG	Cleanup Goal
CLP	Contract Laboratory Program
CMI	Corrective Measures Implementation
CMO	Corrective Measures Objective
CMS	Corrective Measures Study
COC	Contaminant of Concern
DNB	Dinitrobenzene
DO	Dissolved Oxygen
EDD	Electronic Data Deliverable
FS	Feasibility Study
GWMP	Groundwater Monitoring Plan
HAL	Health Advisory Level
HI	Hazard Index
HAS	Huntsville Arsenal
IDW	Investigation Derived Waste
IW-QAPP	Installation Wide-Quality Assurance Program Plan
IWWP	Installation-Wide Work Plan
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
NTU	Nephelometric Turbidity Unit
ORP	Oxidation-Reduction Potential
OU	Operable Unit
PETN	Pentaerythritol Tetranitrate
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RDX	1,3,5-Trinitro-1,3,5-Triazine
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RSA	Redstone Arsenal
RSL	Regional Screening Levels
SOPP	Standard Operating Project Procedure
SPC	Specific Conductance
SVOC	Semivolatile Organic Compound
SW	Solid Waste
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TOC	Total Organic Carbon
UPL	Upper Prediction Limit
USEPA	U.S. Environmental Protection Agency
UTL	Upper Tolerance Limit
VC	Vinyl Chloride

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1.0 INTRODUCTION

This Groundwater Monitoring Plan (GWMP) has been developed in support of the Redstone Arsenal (RSA)-311 Corrective Measures Implementation (CMI) Work Plan. This document provides details for implementation of groundwater monitoring as a component of the corrective measures for RSA-311 contaminated groundwater in order to achieve the cleanup goals (CGs). The plan will include identification of wells scheduled for sampling, monitoring parameters, the monitoring period, analytical methods, reporting, and records maintenance. The corrective measure to be implemented at RSA-311 is monitored natural attenuation (MNA) to achieve the corrective measure objectives (CMOs) for groundwater at RSA-311.

1.1 OBJECTIVE AND SCOPE

The primary objective of the groundwater monitoring program for RSA-311 is to determine whether the corrective measures reduce concentrations of contaminants of concern (COCs) (trichloroethene [TCE], vinyl chloride [VC], perchlorate, 1,3,5-trinitro-1,3,5-triazine [RDX], and 2-nitrotoluene) in groundwater beneath the site to levels determined to be acceptable to human health (i.e., CGs or background). This plan is designed to be modified, if necessary, in response to new hydrologic or geochemical data or changes in remedial, hydrologic, technical, or land-use conditions. Recommendations for changes to the groundwater monitoring program will be documented in annual CMI effectiveness reports.

Groundwater contaminated with the COCs listed above will be monitored as part of the corrective measures for the site. This groundwater monitoring program is needed to track the progress of groundwater toward attaining the CGs so the site can be released for unrestricted use.

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2.0 DESCRIPTION OF RSA-311

2.1 OVERVIEW

RSA is located in the southwestern portion of Madison County, which is in the northern portion of Alabama (Figure 1 of the CMI Work Plan). RSA is a U.S. Army (Army) facility that encompasses approximately 38,300 acres and is approximately 10 miles long from north to south and 6 miles wide from east to west. The Army controls 36,459 acres of the total acreage, of which approximately 15,500 acres are woodlands, 5,360 acres are leased for agricultural use, and approximately 12,000 acres are managed as military test areas/ranges. Development within RSA has primarily centered on the historical production (and later disposal) of conventional and chemical munitions and, more recently, development and testing of missiles and rockets. These processes have produced chemical wastes since operations began in the early 1940s.

RSA-311 is located in the southeastern portion of RSA in an area designated as Industrial in the RSA Master Plan. The site occupies approximately 3,490 ft^2. RSA-311 consists of three exterior covered sumps and two interior concrete pits associated with Building 7352. Building 7352 was originally used as a bowl and wastewater cleanup facility for equipment and tools used in propellant mixing and casting operations at nearby facilities. Beginning in 2009, the southern bays were used for a missile recycling program Feasibility Study (FS). On May 10, 2010, an explosion occurred at Building 7352. Topography at the site is flat, with little relief, and lies at 566 feet above mean sea level (amsl). The native soils beneath RSA-311 consist predominantly of medium- to high-plasticity clay with trace to small amounts of silt and fine-grained sand. The thickness of the overburden ranges from approximately 8 to 28 feet below ground surface (bgs). The average depth to bedrock is approximately 14 feet bgs. Stormwater drainage at the site is controlled by ephemeral unlined ditches. No perennial surface water features are associated with the site. The site is within the 100-year floodplain. Groundwater beneath RSA-311 occurs in the unconsolidated overburden and the upper portion of the carbonate bedrock. The overburden and upper bedrock comprise a single interconnected, unconfined water table aquifer. Current land use at RSA-311 is designated as Manufacturing and Production and future land use has been designated as Research, Development, Testing, Evaluation, and Training.

The following investigations have been conducted at RSA-311:

- Phase I Environmental Baseline Study (Conestoga-Rovers & Associates 1996)
- RARE North Plant Phase II Environmental Baseline Survey (CH2M Hill 1998)
- Operable Unit (OU) 10 Phase II Field Investigations (IT 2002)
- Potential Source Area Investigation (Shaw 2005)
- The Alabama Department of Environmental Management (ADEM) Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (ADEM 2008)
- Solid waste management unit (SWMU) Assessment (Shaw 2009)
- Rev 1 RCRA Facility Investigation (RFI) for RSA-146 Groundwater Site (CB&I 2015)
- Rev 1 RFI for RSA-206, Propellent Mixing Facility #2 and Casting Facility (CB&I 2016)
- Rev 2 RFI for RSA-311 (CB&I 2017)
- Rev 4 RFI for RSA-311 (APTIM 2020).

Available analytical results indicate historical activities have led to localized contamination of groundwater by TCE, VC, perchlorate, RDX, 2,6-DNT, and 2-nitrotoluene. These constituents have been identified as COCs requiring further action.

For relevant COCs in groundwater with maximum contaminant levels (MCLs), the MCLs are selected as the CGs (TCE and VC). In the case of perchlorate, the health advisory level (HAL) of 15 micrograms per liter (µg/L) (DoD 2009) is used as the CG. For the other groundwater COCs requiring action, the CGs are based on risk, with the objective of achieving a cumulative cancer risk of 1E-05 and a cumulative hazard index (HI) of 1.0 or less.

No unacceptable risks/hazards were associated with 1,3-dinitrobenzene (DNB), 3-nitrotoluene, nitrobenzene, nitroglycerin, and pentaerythritol tetranitrate (PETN); however, the historical concentrations of these chemicals exceeded the ADEM regional screening levels (RSLs). Therefore, these chemicals are also included in the Corrective Measures Study (CMS) evaluation only for monitoring purposes.

The CGs for RSA-311 groundwater are summarized below:

Summary of Cleanup Goals – RSA-311

Groundwater COCs	CG (µg/L)	Basis
Perchlorate	15	HAL[a]
2,6-DNT	0.10	Risk[b]
2-Nitrotoluene	0.63	Risk[b]
RDX	1.93	Risk[b]
TCE	5.0	MCL
VC	2.0	MCL
Chemicals Requiring Monitoring Only	**MAG**	**Basis**
1,3-DNB	2.0	ADEM RSL[c]
3-Nitrotoluene	1.7	ADEM RSL
Nitrobenzene	0.14	ADEM RSL
Nitroglycerin	4.6	ADEM RSL
PETN	18	ADEM RSL

Notes:

[a]Health Advisory Level – Perchlorate Release Management Policy," Memorandum from Wayne Army to Deputy Assistant Secretaries of the Army, Navy and Air Force, April 4 (DoD 2009).
[b]See Table 5 in the CMI Work Plan.
[c]Monitoring acceptance goal is based on the May 2022 USEPA RSLs.

µg/L = Micrograms per Liter
CG = Cleanup Goal
COC = Chemical of Concern
DNB = Dinitrobenzene
DNT = Dinitrotoluene
HAL = Health Advisory Level
MAG = Monitoring Acceptance Goal
MCL = Maximum Contaminant Limit
PETN = Pentaerythritol Tetranitrate
Pentaerythritol Tetranitrate
RSL = Regional Screening Level
TCE = Trichloroethene
VC = Vinyl Chloride

The CMO for RSA-311 is to prevent human exposure via any exposure route (ingestion, inhalation, or dermal contact) to groundwater contaminated with any of the identified COCs at concentrations that exceed their respective groundwater CGs. Further information on RSA-311 can be obtained from the RFI Report (APTIM 2020). The RFI Report was completed in August 2020 and was approved by ADEM on February 2, 2021.

2.2 SITE HISTORY

Historically, RSA was used for agricultural purposes (production of cotton, peanuts, and livestock) prior to the construction of Huntsville Arsenal (HSA) in 1941. In 1941, the Army selected the Huntsville, Alabama, location to serve as an extension of the Edgewood Arsenal for the manufacture of toxic agents, smoke munitions, and incendiary munitions. In July 1941, construction of HSA was authorized, and the land was acquired. Manufacturing plants were constructed for the production of mustard gas, lewisite, phosgene, white phosphorus, iron carbonyl, white smoke munitions, incendiary munitions, and colored smoke munitions. In addition to the facilities needed to produce these munitions, support facilities included storage buildings, laboratories, maintenance and repair shops, offices, and housing. Utilities and support services such as roads and railroads were also needed for producing, storing, and shipping chemical munitions.

Building 7352 was originally constructed for use as a bowl and wastewater cleanup facility for equipment and tools used in propellant mixing and casting operations at nearby facilities. The three bays in the southern portion of the building were used for large component cleaning, small parts cleaning, and equipment storage between 1989 and 1995. The two interior trench drains in the southern portion of Building 7352 were designed to capture floor washings and spills from Bays 1 and 2. The trench drains are recessed into the floor and connected to the exterior captive sumps located on the eastern and western sides of the building (Figure 2).

Decontamination of Building 7352 began in 1995, and acceptance inspection was signed in April 1996. The building was inspected during the ADEM visual site inspection in 2008.

Beginning in 2009, the southern bays were used for a missile recycling program FS. The process used anhydrous ammonia to dissolve explosives, energetics, and propellants and to remove the materials from the missile housings. Wastes from operations were stored at RSA-136b. It is unknown if any releases of hazardous constituents from the trench or sump occurred.

On May 10, 2010, an explosion occurred at Building 7352 when workers were working on a new process to separate ammonium perchlorate from other components in the missile fuel. The explosion killed two workers and injured a third. The accident resulted in damage to Bay 1.

The RSA-136b treatment, storage, and disposal facility is located east of Building 7352 (Figure 2) and was used to store propellant wastes. ADEM recommended no further action in 2008.

Building 7352 and the associated sumps and pits were demolished from July to September 2019. Based on information provided by RSA personnel on April 14, 2020 (U.S. Army Garrison-Redstone 2020), operating equipment used in processes conducted in the former Building 7352 that were determined to have residual energetics were taken to the Open Burn/Open Detonation area for thermal treatment. Following removal of operating equipment, the building structure was reflashed to remove any potentially remaining energetics prior to demolition. Water in pits/sumps was pumped to the industrial sewer after sample results were non-detect for energetics and lead. Steel removed during demolition was taken to metal recyclers, and concrete (including sumps and pits) was taken to the Construction and Demolition Landfill for disposition.

2.3 SITE DESCRIPTION AND TOPOGRAPHY

General installation-wide environmental setting information is presented in Section 2.0 of the Installation-Wide Work Plan (IWWP) (IT 2002), which includes a discussion of regional stratigraphic and structural geology, surface and subsurface hydrology, and other physiographic and geographic features. Logs of soil borings advanced at the site were used to interpret the site-specific geology, which consists of a silty clay soil overlying limestone bedrock.

Topography at the site is flat, with little relief, and lies at 566 feet amsl. The native soils beneath RSA-311 consist predominantly of medium- to high-plasticity clay with trace to small amounts of silt and fine-grained sand. The thickness of the overburden ranges from approximately 8 to 28 feet bgs. The average depth to bedrock is approximately 14 feet bgs. Stormwater drainage at the site is controlled by ephemeral unlined ditches. No perennial surface water features are associated with the site. The site is within the 100-year floodplain.

2.4 GEOLOGY

A generalized installation-wide environmental setting is presented in Section 2.0 of the installation-wide work plan (IT 2002) and includes discussions on the regional stratigraphic and structural geology, surface and subsurface hydrology, and other physiographic and geographic topics. Logs of soil borings advanced at the site were used to interpret the site-specific geology, which consists of a low-permeability, clay-rich soil cover overlying limestone bedrock.

2.4.1 Bedrock

Depth to bedrock across this portion of RSA is variable over short distances due to solution weathering of the upper bedrock surface (epikarst). Lithologic data from bedrock wells installed across this portion of RSA indicate that the shallow bedrock first encountered correlates with middle to upper Tuscumbia Limestone and exhibits well-developed karst features. The Tuscumbia Formation beneath this area is characterized by thinly bedded to massive, fine to medium crystalline, stylolitic limestone with numerous chert nodules and chert lenses. The Tuscumbia is underlain by the Fort Payne Chert, which consists of thinly bedded, fossiliferous limestones interbedded with chert. The Fort Payne is underlain by the Chattanooga Shale, a dark gray to black, fissile shale.

2.4.2 Soil

Based on direct-push technology and auger refusal depths, thickness of the overburden at RSA-311 ranges from approximately 8 to 18 feet bgs. The average depth to bedrock is approximately 14 feet bgs. The lithological logs from soil and well borings indicate native soils consisting predominantly of medium- to high-plasticity clay with trace to small amounts of silt and fine-grained sand. Weathered limestone fragments were also observed in the soil borings together with traces of chert and manganese nodules.

The overburden or unconsolidated soil layer across most of RSA is called residuum because it formed from in situ chemical weathering of the underlying karstic limestone bedrock. This overburden layer primarily consists of clay and silty clay and includes varying amounts of residual chert fragments, which were present within the parent limestone and have resisted chemical weathering because of their siliceous composition. The chert can be found scattered within the clay matrix as nodules or concentrated locally as near-horizontal layers within the soil. Although little compositional variation is found within the overburden, the residuum does not transmit groundwater uniformly. Groundwater infiltration follows preferred pathways because zones of higher hydraulic conductivity developed during soil-forming processes. Preferred pathways within the overburden directly affect contaminant migration and distribution within the soil column.

Residual clay generally has low horizontal and vertical hydraulic conductivities. At a given location, a layer of chert within the clay may decrease vertical hydraulic conductivity and increase horizontal conductivity, while isolated nodules of chert may increase the vertical conductivity.

In addition, microfractures may be created within the clay during raveling, a process in which the clay slowly subsides as it is eroded and carried away by groundwater in bedrock fractures and conduits. Vertical movement of the soil caused by raveling or sloughing into fractures and conduits results in the development of microfractures in the overlying material. The microfractured clay soils have higher hydraulic conductivities than undisturbed clay and act as preferred groundwater flow pathways.

2.4.3 Hydrogeology

Groundwater beneath RSA-311 occurs in the unconsolidated overburden and the upper portion of the limestone bedrock. The overburden and upper bedrock comprise a single interconnected aquifer. At depth, groundwater occurs under semi-confined conditions, flowing along discrete joints and bedding-plane partings. As discussed in the Rev 4 RFI Report (APTIM 2020), the average depth to groundwater at the site is approximately 4.4 feet bgs. The groundwater surface elevation varies from approximately 557.95 to 563.84 feet amsl. Figure 3 shows the potentiometric surface for May 2014, and Figure 4 shows the potentiometric surface for January 2016. The potentiometric surface shows radial flow away from the building with the groundwater flow direction varying from northwest to south-southwest over this time, although overall regional shallow groundwater flow is generally directed to the northwest, toward Huntsville Spring Branch.

2.4.4 Surface Water Drainage

Wetlands are located north and northwest of RSA-311. Site drainage is controlled by ephemeral unlined ditches. No perennial surface water features are associated with the site. The site is within the 100-year floodplain of Huntsville Spring Branch.

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3.0 GROUNDWATER MONITORING PROGRAM

The groundwater monitoring program for RSA-311 specifies a network of 10 existing monitoring wells, sampling frequency and parameters, sampling procedures and analytical protocols, and quality assurance (QA)/quality control (QC) requirements. The laboratory-specific reference limits and evaluation tables are presented in **Table F-2**, Preliminary Screening Values (PSVs) and Laboratory Specific Limits. Well identifiers, sampling frequency and analytical parameters, sampling and analytical protocols, and QA/QC requirements are presented in **Tables F-4** through **F-6**. The monitoring well network is shown in Figure 7 of the CMI Work Plan. The duration of monitoring is estimated at 8 years for the RSA-311 site. Subject to ADEM approval, if COC concentrations for action in each of the 10 monitoring wells and 1 spring have reached CGs before that time, groundwater monitoring will be proposed for early termination. Modifications to the groundwater monitoring program may be adjusted in the recommendations section of each annual groundwater monitoring report.

3.1 SCOPE AND IMPLEMENTATION STRATEGY FOR THE GROUNDWATER MONITORING PROGRAM

Groundwater sampling will be performed to evaluate the effectiveness and permanence of the RSA-311 corrective measures of MNA.

The groundwater monitoring program is designed to maximize cost-effectiveness without compromising program and data quality using the following general strategies:

- Select and maintain an optimal number of sampling points and an appropriate analytical suite to evaluate the progress of MNA in groundwater
- Select wells that act as indicators of contaminant concentration changes or expansion
- Maintain an adequate frequency of conventional and/or mainstream sampling
- Where appropriate, use cost-effective analytical programs
- Initiate a streamlined data management and reporting information system.

3.2 APPLICABLE STANDARD OPERATING PROJECT PROCEDURES

Copies of the following applicable Standard Operating Project Procedures (SOPPs) to be applied at RSA-311 are presented in Volume II of the Installation-Wide Quality Assurance Program Plan (IW-QAPP) (HGL 2019):

- SOPP 1.0, Field Documentation
- SOPP 3.0, Field Equipment Decontamination
- SOPP 4.0, Investigation-Derived Waste (IDW)
- SOPP 7.0, Groundwater Sampling
- SOPP 11.0, Field Generated Records Management
- SOPP 12.0, Field Measurable Physical Characteristics
- SOPP 15.0, Non-Hazardous Sample Handling, Packaging, and Shipping
- SOPP 16.0, Groundwater Level Measurements
- SOPP 18.0, Surface Water Sampling
- SOPP 24.0, Field Equipment Calibration.

3.3 RSA-311 PROJECT SPECIFIC QAPP WORKSHEETS

The IW-QAPP (HGL 2019) requires project-specific worksheets that are not included in the generic IW-QAPP. **Tables F-1** through **F-12** provide the following RSA-311 project-specific QAPP worksheets:

- **Table F-1: Worksheet #12** Measurement of Performance Criteria
- **Table F-2: Worksheet #15** Preliminary Screening Values and Laboratory Specific Limits – Groundwater
- **Table F-3: Worksheet #17** Sampling Design and Rationale
- **Table F-4: Worksheet #18** Sample Locations, Analytical, and SOPP Requirements
- **Table F-5: Worksheet #19 & 30** Sample Containers, Preservation, and Hold Times
- **Table F-6: Worksheet #20** Field Quality Control Sample Summary
- **Table F-7: Worksheet #23** Analytical Laboratory Standard Operating Procedures
- **Table F-8: Worksheet #24** Analytical Instrument Calibration
- **Table F-9: Worksheet #25** Analytical Instrument and Equipment Maintenance, Testing, and Inspection
- **Table F-10: Worksheet #26** Sample Handling, Custody, and Disposal
- **Table F-11: Worksheet #28** Analytical Quality Control and Corrective Action
- **Table F-12: Worksheet #36** Data Validation Procedures.

Additional site-specific information can be found in the Project Management Plan (ECC 2021a) and the Quality Control Plan provided in Appendix D of the CMI Work Plan.

3.4 MONITORING WELLS AND SPRINGS PROPOSED FOR GROUNDWATER MONITORING

The following existing monitoring wells at RSA-311 are scheduled for groundwater monitoring:

Type	Location	Zone	Screen Intervals (ft bgs)		Installed Well Depth (ft bgs)	Rationale
			Top	Base		
Well	311-RS2396	OVB	5.3	10.3	10.7	Monitor MNA Effectiveness
Well	311-RS2397	OVB	4.4	14.4	14.8	Monitor MNA Effectiveness
Well	311-RS2398	OVB	7.2	12.2	12.6	Monitor MNA Effectiveness
Well	311-RS2399	OVB	5.1	15.1	15.5	Monitor MNA Effectiveness
Well	311-RS2636	OVB	7.6	12.6	13.0	Monitor MNA Effectiveness
Well	311-RS2789	OVB	18.6	28.6	29.0	Monitor MNA Effectiveness
Well	311-RS2790	OVB	7.4	17.4	17.8	Monitor MNA Effectiveness
Well	311-RS2795	OVB	9.0	19.0	19.7	Monitor MNA Effectiveness
Well	311-RS2853	OVB	8.7	13.7	13.7	Monitor MNA Effectiveness
Well	311-RS2854	OVB	4.6	14.6	15.0	Monitor MNA Effectiveness
Spring	RSP-1802	N/A	N/A	N/A	N/A	Monitor MNA Effectiveness

Notes:

bgs = Below Ground Surface
ft = Feet
MNA = Monitored Natural Attenuation
N/A = Not Applicable
OVB = Overburden

Well locations included in the groundwater monitoring program are presented in Figure 7 ofthe CMI Work Plan.

3.5 CONSTITUENT LIST AND SAMPLING FREQUENCY

The MNA program will include analysis of COCs identified for groundwater, in addition to the MNA parameters: pH, nitrate, sulfate, total organic carbon [TOC], alkalinity, and dissolved gases (methane, ethane, and ethene). Analysis of MNA parameters would be revised periodically and conducted for a limited period to verify intrinsic degradation is occurring. Water quality parameters monitored during groundwater sampling include pH, dissolved oxygen (DO), temperature, specific conductance (SPC), oxidation-reduction potential (ORP), and turbidity. In addition, water levels will be measured during each sampling event. This groundwater monitoring program will be used to evaluate progress toward meeting the CMOs for groundwater and the CGs. The analytical program will monitor for COCs for action to track the progress of the MNA. Groundwater MNA sampling and reporting will be completed as follows, pending decreasing data trends and ADEM approval of decreases in sampling frequency:

- Baseline sampling and reporting: Year 0
- Quarterly sampling and annual reporting: Year 1
- Semiannual sampling and annual reporting: Years 2 and 4
- Annual sampling and reporting: Years 5 through 8.

After 3 full years of semi-annual monitoring, the Army may request a permit modification to change to annual monitoring. ADEM will evaluate the request based on the sampling results presented in the Annual Effectiveness Report. Once the CGs have been met and ADEM concurs with the results, the program can be discontinued, and the 10 monitoring wells will be abandoned. In the approved Rev 4 RFI Report (APTIM 2020), it was concluded that explosives compounds exceedances in monitoring well 311-RS2902 are likely unrelated to RSA-311. Therefore, final closure of this well would defer to the RSA-146 groundwater unit.

As determined by an evaluation of previous monitoring results, annual groundwater sampling will be performed in the season most representative of groundwater quality for the site. The Army review of these data during this selection process will be completed in consultation with ADEM.

3.6 SAMPLING AND ANALYTICAL PROTOCOL

All data will be collected, stored, and managed in accordance with the requirements defined by the IW-QAPP (HGL 2019 or as updated based on submissions to ADEM) and the Installation Wide Accident Prevention Plan (APP) (ECC 2021b). Prior to sampling the wells, static water levels will be measured in all network wells. Water level measurements will be performed in accordance with SOPP No. 16.0, Groundwater Level Measurements. Groundwater sampling will be performed using a submersible pump for purging and low-flow sampling techniques in accordance with SOPP No. 7.0, Groundwater Sampling Rev 4.

The sampling technician will measure and record physical parameters of the groundwater during well purging to determine when the well has stabilized and is ready to be sampled. Complete and accurate records in the groundwater well development/purge log are necessary to ensure representative groundwater samples are being collected. Samples will be analyzed using U.S. Environmental Protection Agency (USEPA) Solid Waste (SW)-846 methods as presented in the IW-QAPP (HG, 2019 or most recent submission to ADEM), including updates resulting from modifications to USEPA and ADEM guidance documents.

Clean, dedicated bottleware will be provided by the analytical laboratory. Sample containers are purchased precleaned and treated according to USEPA specifications for each analytical method. Bottleware and other sampling containers are stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. The required sample containers for the analysis of constituents in groundwater at

RSA-311 are provided in **Table F-5**, along with sample volumes, preservation requirements, and holding times for the analytical methods performed on the groundwater samples. Sample preservation, packaging, and shipping will follow the procedures as specified in SOPP No. 15, Non-Hazardous Sampling Handling, Packaging, and Shipping, in the IW-QAPP (HGL 2019 or as updated based on submissions to ADEM).

Completed analysis request/chain-of-custody records will be secured and included with each shipment of coolers to the contracted laboratory.

Recommendations to modify the groundwater monitoring program will be made in the annual CMI effectiveness reports.

3.7 QUALITY ASSURANCE/QUALITY CONTROL

Groundwater media will be sampled and analyzed to meet the objectives of the groundwater monitoring program. QA/QC samples will be collected for all sampling events in accordance with requirements established in the IW-QAPP (HGL 2019 or as updated based on submissions to ADEM) to ensure long-term comparability of data. Samples will be analyzed by USEPA-approved SW-846 methods of analysis where applicable, comply with USEPA definitive data requirements, and be reported using both hard copy and electronic data packages.

The chemical data will be reported via hard-copy packages by the laboratory using Contract Laboratory Program (CLP)-like forms, in addition to electronic data deliverables (EDDs), and will include all raw analytical and QC data for each analysis.

All sample preparation and analysis shall be completed within the method-required holding times specified in **Table F-5**. The holding time of a sample begins at the time of sample collection. If holding times are exceeded and the analyses are performed, the results shall be flagged accordingly.

4.0 DATA EVALUATION AND REPORTING

4.1 DATA EVALUATION AND INTERPRETATION

During the baseline sampling event, groundwater samples will be collected from the 10 existing groundwater monitoring wells as shown in Figure 7 of the CMI Work Plan. The samples will be collected using low-flow purging and sampling techniques. The analyte list will remain the same for baseline, quarterly, semiannual, and annual sampling events. Quarterly sampling and analysis would be conducted in Year 1 and semiannual sampling and analysis would be conducted in Years 2 and 3. Annual sampling and analysis will begin in Year 4 and continue through Year 8.

The primary objective of the groundwater monitoring program for RSA-311 is to determine whether the corrective measures (MNA) reduce concentrations of COCs in groundwater beneath the site to levels determined to be acceptable to human health (i.e., CGs). This will be determined based on the results of a statistical test or other methods. Statistical analysis will follow Alabama Administrative Code (AAC) 335-14-5-.06(8)(h) and USEPA guidance for groundwater monitoring at RCRA facilities (USEPA 1989, USEPA 1992, USEPA 2009). Groundwater data collected during sampling events will be compared to the CGs. COCs that exceed these values may be subjected to additional analysis as allowed in AAC 335-14-5-.06(8)(h) (ADEM 2013). The additional analyses may include, for example, control charts, Wilcoxon rank sum tests, box plots, and/or temporal trend analysis, as appropriate. Specific evaluation techniques will depend upon detection frequencies and statistical distributions of each COC. For example, one COC concentration at a given well may exceed the site-specific upper tolerance limit (UTL) or upper prediction limit (UPL), and that may be either a random occurrence or indicative of an increasing trend. Trend analysis will indicate if a trend is present and whether it has statistical significance.

Monitoring well data sets that pass statistical comparison tests (i.e., wells that do not demonstrate statistically significant increases over baseline concentrations) for all COCs will be sampled in accordance with planned activities. Wells that fail statistical comparison tests for one or more COCs will be resampled. Following the collection of these additional data, statistical evaluation will again be performed and reported, along with recommendations for adjustment to sampling frequency, if appropriate.

The following non-statistical methods may also be used to characterize RSA-311 groundwater conditions:

- ***Hydrographs*:** Graphs of water levels versus time may be constructed to determine increases, decreases, seasonal, or man-made fluctuations in groundwater levels.
- ***Potentiometric Surface Maps*:** Depths to groundwater from multiple wells may be used to construct potentiometric surface contour maps to estimate flow directions.
- ***Concentration-versus-Time Plots*:** Graphs of COC concentration versus time at each well will be constructed for each data set subjected to trend analysis. This supports the identification of trends and helps determine if fluctuations in concentration are related to changes in water level, changes in groundwater flow directions, or natural attenuation.
- ***Plume Maps*:** Maps depicting the physical distribution of chemical constituents in the subsurface will aid in determining movement of plumes.

COCs will be evaluated for compliance with the CMO by comparison of groundwater monitoring results to the established CGs. After an actionable COC is present in a concentration below the CG for 3 consecutive years, the Army will petition ADEM to eliminate that constituent from the groundwater monitoring program.

4.2 REPORTING

Based on the proposed sampling schedule, an annual CMI effectiveness report will be prepared. Letter reports summarizing the activities and the analytical results for each sampling event will be issued following receipt of the analytical data. The annual report will present and summarize the analytical data from all sampling events completed in that calendar year and will include items such as well redevelopment records, completed well inspection checklist forms, well repair or closure records, and other pertinent information. The annual report will discuss the most recent sampling events and relate the findings as they pertain to the CGs for the groundwater contaminants. Recommendations for changes to the sampling frequency, wells sampled, and parameters for analysis, if appropriate, will be included in the reports. At a minimum, the annual report will include a discussion of sampling activities, tables, and maps to document contaminant concentrations in groundwater, an evaluation of the groundwater contaminant data, and all activities completed as part of the Monitoring Well Maintenance Plan. Other recommendations may include installation of additional monitoring wells and resampling for verification of sampling results. Recordkeeping for data and reports is described in the IW-QAPP (HGL 2019 or most recent submission to ADEM).

5.0 MONITORING WELL MAINTENANCE PLAN

For consistency in data quality and tracking contaminant concentrations and migration, the groundwater monitoring wells at RSA-311 will be maintained, repaired, and/or replaced, as necessary. Further details are presented in the IW-QAPP (HGL 2019 or as updated based on submissions to ADEM).

5.1 WELL REDEVELOPMENT

A well may be redeveloped prior to sampling if any of the following conditions are exhibited:

- Sediment accumulation in the well covers more than 5 percent of the total length of the well screen.
- Turbidity of groundwater is greater than 20 nephelometric turbidity units (NTUs) afterthe well has been purged prior to sampling.
- Recharge rate to the well has declined through time (e.g., recharge rates have declined to less than 60 percent of the recharge rate recorded in the initial development).

5.2 WELL REPLACEMENT OR CLOSURE

If the well does not meet the above requirements after two episodes of redevelopment, the well may be deemed nonfunctional and scheduled for replacement or closure. Consultation with RSA personnel and ADEM staff will be made to determine whether closure or replacement is appropriate. The procedures for well replacement and closure are outlined in the IW-QAPP (HGL 2019 or most recent submission to ADEM).

5.3 WELL INSPECTIONS

Site inspections will be performed to help ascertain the condition of monitoring wells and confirm the integrity of the monitoring wells has not been compromised. Wells will be inspected during each sampling event. At a minimum, all monitoring wells in the groundwater monitoring program will be inspected annually. The groundwater monitoring wells at the site will be inspected for the integrity of the following:

- Locks
- Locking cap
- Protective casing
- Bollards (stick-up wells only)
- Concrete pad.

Well redevelopment, replacement, or closure activities will be documented in the corresponding annual report. In addition, well inspection checklist forms for all pertinent site wells will be included. Deficiencies will be documented and corrected as soon as practical, but not less than annually. If a well cannot be properly repaired, it should be replaced or closed.

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TABLES

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Table F-1. Worksheet #12 Measurement Performance Criteria
Redstone Arsenal, Madison County, Alabama

Matrix	Aqueous
Analytical Group	VOCs, Explosives, and Perchlorate
Concentration Level	Low

Analytical Method & SOP	DQI	MPC	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for S, A or both (S&A)
SW8260C VOC-003	Precision	RPD from **Worksheet #28**	Laboratory duplicates and/or LCS/LCSD, if MS/MSD not performed	A
	Precision	Sampling per QAPP/SOP	Field duplicates and MS/MSD	S&A
	Accuracy/Bias	% Rec. from **Worksheet #28**	LCS	A
	Accuracy/Bias (contamination)	Acceptable blanks levels	MB	A
	Accuracy/Bias (contamination)	Sampling per QAPP/SOP	Equipment blanks and trip blanks	S&A
	Completeness	Laboratory analysis	>90%	S&A
	Representativeness	Sampling per QAPP/SOP	Blank samples and data usability assessment	S
	Comparability	Use of promulgated methodology	QAPP compliance, data review	A
	Sensitivity	LOQ or LOD to meet project objectives	ICAL level acceptable, MB acceptable	A
SW8330B	Precision	RPD from **Worksheet #28**	Laboratory duplicates and/or LCS/LCSD, if MS/MSD not performed	A
	Precision	Sampling per QAPP/SOP	Field duplicates and MS/MSD	S&A
	Accuracy/Bias	% Rec. from **Worksheet #28**	LCS	A
	Accuracy/Bias (contamination)	Acceptable blanks levels	MB	A
	Accuracy/Bias (contamination)	Sampling per QAPP/SOP	Equipment blanks	S&A
	Completeness	Laboratory analysis	>90%	S&A
	Representativeness	Sampling per QAPP/SOP	blank samples and data usability assessment	S
	Comparability	Use of promulgated methodology	QAPP compliance, data review	A
	Sensitivity	LOQ or LOD to meet project objectives	ICAL level acceptable, MB acceptable	A

Table F-1. Worksheet #12 Measurement Performance Criteria
Redstone Arsenal, Madison County, Alabama (Continued)

Analytical Method & SOP	DQI	MPC	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for S, A or both (S&A)
SW6850 Modified	Precision	RPD from **Worksheet #28**	Laboratory duplicates and/or LCS/LCSD, if MS/MSD not performed	A
	Precision	Sampling per QAPP/SOP	Field duplicates and MS/MSD	S&A
	Accuracy/Bias	% Rec. from **Worksheet #28**	LCS	A
	Accuracy/Bias (contamination)	Acceptable blanks levels	MB	A
	Accuracy/Bias (contamination)	Sampling per QAPP/SOP	Equipment blanks	S&A
	Completeness	Laboratory analysis	>90%	S&A
	Representativeness	Sampling per QAPP/SOP	Blank samples and data usability assessment	S
	Comparability	Use of promulgated methodology	QAPP compliance, data review	A
	Sensitivity	LOQ or LOD to meet project objectives	ICAL level acceptable, MB acceptable	A

Notes:

% Rec. = Percent Recovery
A = Analytical
DQI = Data Quality Indicator
ICAL = Initial Calibration
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOD = Limit of Detection
LOQ = Limit of Quantitation
MB = Method Blank
MPC = Measurement Performance Criteria
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QAPP = Quality Assurance Project Plan
QC = Quality Control
RPD = Relative Percent Difference
S = Sampling
SOP = Standard Operating Procedure
VOC = Volatile organic compound

Table F-2. Worksheet #15 Preliminary Screening Values and Laboratory Specific Limits – Groundwater
Redstone Arsenal, Madison County, Alabama

Hazardous Constituent	CAS Number	BSV	PSV*	CMO CG	Reference for CG	Reference for PSV	Laboratory Specific LOQ	Laboratory Specific LOD	Laboratory Specific DL
VOCs (µg/L) by SW8260C									
TCE	79-01-6	NA	5	5	MCL	MCL	1	0.5	0.25
Vinyl Chloride	75-01-4	NA	2	2	MCL	MCL	1	0.5	0.25
Explosives (µg/L) by SW8330B									
2-Nitrotoluene	88-72-2	NA	0.31	0.45	Risk	RSL	0.30	0.15	0.075
1,3,5 Trinitro-1,3,5-triazine	121-82-4	NA	0.24	0.34	Risk	RSL	0.30	0.15	0.075
2,6-Dinitrotoluene	606-20-2	NA	0.049	0.34	Risk	RSL	0.30	0.15	0.075
Perchlorate (µg/L) by SW6850/331.0									
Perchlorate	14797-73-0	NA	15	15	HAL	MCL	0.2	0.1	0.05
MNA Parameters (mg/L) by USEPA 300.0/310.1/SM9040									
Nitrate	14797-55-8	NA	NA	NA	NA	NA	0.8	0.4	0.2
Sulfate	14808-79-8	NA	NA	NA	NA	NA	8	4	2
pH	NA	NA	NA	NA	NA	NA	1	1	1
MNA TOC (mg/L) by USEPA 9060A									
TOC	7440-44-0	NA	> 20	NA	NA	MNA[a]	1	0.66	0.33
MNA Alkalinity (mg/L $CaCO_3$) by USEPA 310.1									
Alkalinity	STL00171	NA	NA	NA	NA	NA	5	5	5
MNA Dissolved Gases (µg/L) by RSK-175									
Ethane	74-84-0	NA	> 0.1	NA	NA	MNA[b]	0.00404	0.001347	0.000674
Ethene	74-85-1	NA	> 0.01	NA	NA	MNA[b]	0.00372	0.001242	0.000621
Methane	74-82-8	NA	< 0.5	NA	NA	MNA[b]	0.00215	0.000717	0.000358

Notes:

*PSV for groundwater based on the following hierarchy if not specified in the Permit: 1) MCL (2018 Edition of the Drinking Water Standards and Health Advisories, USEPA 822-S-12-001, Office of Water, Washington, DC, March, 2) Most recent USEPA Tap Water RSL Table using a Hazard Quotient of 0.1 and cancer risk of 1×10^{-6} shall be used (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).

µg/L = Micrograms per Liter
BSV = Background Screening Value
CAS = Chemical Abstracts Service
CG = Cleanup Goal
CMO = Corrective Measure Objective
DL = Detection Limit
HAL = Health Advisory Level
LOD = Limit of Detection
LOQ = Limit of Quantitation
MCL = Maximum Contaminant Level
mg/L = Milligrams per Liter
MNA = Monitored Natural Attenuation
NA = Not Applicable
PSV = Preliminary Screening Value
RSL = Regional Screening Level
SW = Solid Waste 846
TCE = Trichloroethene
TOC = Total Organic Carbon
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

Table F-3. Worksheet #17 Sampling Design and Rationale
Redstone Arsenal, Madison County, Alabama

Sample Location	Sample Media	Sample Location Rationale*
311-RS2396 311-RS2397 311-RS2398 311-RS2399 311-RS2636 311-RS2789 311-RS2790 311-RS2795 311-RS2853 311-RS2854 RSP-1802 (spring)	Groundwater and Spring Sampling	Groundwater sampling events (Year 0 through 8) will be used to evaluate the effectiveness and permanence of the RSA-311 corrective measure. Results from sampling events will be used to evaluate progress toward meeting the CMOs and CGs. The analytical program will monitor for COCs for action (TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate) to track the progress of MNA. The analytical program will also monitor for five explosive compounds (1,3-DNB, 3-nitrotoluene, nitroglycerin, nitrobenzene, and PETN) that are included in the CMI Work Plan for monitoring purpose only to compare to the MAGs. Groundwater samples are to be collected from the 10 monitoring wells and 1 spring (as presented in Figure 7 of the CMI Work Plan) and each groundwater sample will be analyzed for TCE, VC, 2-nitrotoluene, DNT, RDX, and perchlorate.

Notes:

*The frequency of sampling and/or analyte lists may be modified over the life of the project, based upon sampling results, if approved by ADEM. Permit modifications will be made in accordance with Permit Condition I.J.

ADEM = Alabama Department of Environmental Management
CG = Cleanup Goal
COC = Contaminant of Concern
CMI = Corrective Measures Implementation
CMO = Corrective Measures Objective
DNB = Dinitrobenzene
DNT = Dinitrotoluene
MAG = Monitoring Acceptance Goal
MNA = Monitored Natural Attenuation
PETN = Pentaerythritol Tetranitrate
RDX = 1,3,5-Trinitro-1,3,5-Triazine
TCE = Trichloroethene
VC = Vinyl Chloride

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
RSA-311 Sample Locations - Year 0						
RSP-1802	RSP-1802-SP-AGK-4000-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4001-REG	6.60 - 16.60		311-RS2396-GW-AGK-4001-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4002-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4003-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4004-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4005-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4006-REG	16.00 - 26.00	311-RS2789-GW-AGK-4007-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4008-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4009-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4010-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4011-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7000-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7001-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8000-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9000-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 1 (Quarterly 1)						
RSP-1802	RSP-1802-SP-AGK-4012-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4013-REG	6.60 - 16.60		311-RS2396-GW-AGK-4013-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4014-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4015-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4016-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4017-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4018-REG	16.00 - 26.00	311-RS2789-GW-AGK-4019-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4020-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4021-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4022-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4023-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7002-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7002-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8001-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9001-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 1 (Quarterly 2)						
RSP-1802	RSP-1802-SP-AGK-4024-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4025-REG	6.60 - 16.60		311-RS2396-GW-AGK-4025-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4026-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4027-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4028-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4029-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4030-REG	16.00 - 26.00	311-RS2789-GW-AGK-4031-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4032-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4033-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4034-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4035-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7003-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
RSA-311	RSA-311-WA-TB-7004-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8002-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9002-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 1 (Quarterly 3)						
RSP-1802	RSP-1802-SP-AGK-4036-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4037-REG	6.60 - 16.60		311-RS2396-GW-AGK-4037-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4038-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4039-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4040-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4041-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4042-REG	16.00 - 26.00	311-RS2789-GW-AGK-4043-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4044-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4045-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4046-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4047-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
Trip Blanks						
RSA-311	RSA-311-WA-TB-7005-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7006-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8003-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9003-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 1 (Quarterly 4)						
RSP-1802	RSP-1802-SP-AGK-4048-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4049-REG	6.60 - 16.60		311-RS2396-GW-AGK-4049-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4050-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4051-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4052-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4053-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4054-REG	16.00 - 26.00	311-RS2789-GW-AGK-4055-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4056-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4057-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4058-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
311-RS2854	311-RS2854-GW-AGK-4059-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7007-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7008-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8004-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9004-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 2 (Semiannual 1)						
RSP-1802	RSP-1802-SP-AGK-4060-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4061-REG	6.60 - 16.60		311-RS2396-GW-AGK-4061-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4062-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4063-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4064-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4065-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4066-REG	16.00 - 26.00	311-RS2789-GW-AGK-4067-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4068-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4069-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
311-RS2853	311-RS2853-GW-AGK-4070-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4071-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7009-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7010-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8005-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9005-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 2 (Semiannual 2)						
RSP-1802	RSP-1802-SP-AGK-4072-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4073-REG	6.60 - 16.60		311-RS2396-GW-AGK-4073-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4074-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4075-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4076-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4077-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4078-REG	16.00 - 26.00	311-RS2789-GW-AGK-4079-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4080-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
311-RS2795	311-RS2795-GW-AGK-4081-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4082-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4083-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7011-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7012-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8006-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9006-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 3 (Semiannual 1)						
RSP-1802	RSP-1802-SP-AGK-4084-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4085-REG	6.60 - 16.60		311-RS2396-GW-AGK-4085-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4086-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4087-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4088-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4089-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4090-REG	16.00 - 26.00	311-RS2789-GW-AGK-4091-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
311-RS2790	311-RS2790-GW-AGK-4092-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4093-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4094-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4095-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7013-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7014-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8007-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9007-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 3 (Semiannual 2)						
RSP-1802	RSP-1802-SP-AGK-4096-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4097-REG	6.60 - 16.60		311-RS2396-GW-AGK-4097-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4098-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4099-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4100-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4101-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
311-RS2789	311-RS2789-GW-AGK-4102-REG	16.00 - 26.00	311-RS2789-GW-AGK-4103-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4104-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4105-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4106-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4107-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7015-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7016-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8008-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9008-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 4 (Semiannual 1)						
RSP-1802	RSP-1802-SP-AGK-4108-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4109-REG	6.60 - 16.60		311-RS2396-GW-AGK-4109-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4110-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4111-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4112-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
311-RS2636	311-RS2636-GW-AGK-4113-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4114-REG	16.00 - 26.00	311-RS2789-GW-AGK-4115-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4116-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4117-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4118-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4119-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7016-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7017-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8009-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9009-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 4 (Semiannual 2)						
RSP-1802	RSP-1802-SP-AGK-4120-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4121-REG	6.60 - 16.60		311-RS2396-GW-AGK-4121-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4122-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2398	311-RS2398-GW-AGK-4123-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
311-RS2399	311-RS2399-GW-AGK-4124-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4125-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4126-REG	16.00 - 26.00	311-RS2789-GW-AGK-4127-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4128-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4129-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4130-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4131-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7018-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7019-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8010-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9010-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0
RSA-311 Sample Locations – Year 5 to 8 (Annual Template)						
RSP-1802	RSP-1802-SP-AGK-4132-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 18.0
311-RS2396	311-RS2396-GW-AGK-4133-REG	6.60 - 16.60		311-RS2396-GW-AGK-4133-MS/MSD	VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2397	311-RS2397-GW-AGK-4134-REG	60.00 - 70.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Sample Location	Sample Name[e]	Sample Depth	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
		(ft bgs)	FD	MS/MSD		
311-RS2398	311-RS2398-GW-AGK-4135-REG	38.50 - 48.50			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2399	311-RS2399-GW-AGK-4136-REG	38.00 - 48.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2636	311-RS2636-GW-AGK-4137-REG	59.00 - 69.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2789	311-RS2789-GW-AGK-4138-REG	16.00 - 26.00	311-RS2789-GW-AGK-4139-FD		VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2790	311-RS2790-GW-AGK-4140-REG	24.00 - 34.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2795	311-RS2795-GW-AGK-4141-REG	111.00 - 115.06			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2853	311-RS2853-GW-AGK-4142-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
311-RS2854	311-RS2854-GW-AGK-4143-REG	29.00 - 39.00			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 7.0
Trip Blanks						
RSA-311	RSA-311-WA-TB-7020-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
RSA-311	RSA-311-WA-TB-7021-TB	N/A			VOCs **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-311	RSA-311-BW-A-8011-ER	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-311	RSA-311-WA-A-9011-REG	N/A			VOCs, Explosives, Perchlorate, MNA **(Worksheet #15)**	SOPP 4.0

Table F-4. Worksheet #18 Sample Locations, Analytical, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Notes:

[a]The last four digits in the sample name are sequential.
[b]The MS/MSD and FD locations are subject to change due to field conditions.
[c]TBs are laboratory provided VOC vials filled with hazardous constituents-free water and no headspace. TBs accompany the VOC sample containers into the field during sample collection and during shipment to the laboratory. One TB per sample shipping cooler containing RSA-311 groundwater VOC samples.
[d]ERs are collected by pouring deionized water (obtained from the onsite deionized water treatment system) over non-dedicateddecontaminated sampling equipment. One ER will be collected per sampling event.
[e]Optionally, groundwater sample results may be used in place of IDW sampling, which is contingent upon receiving facility.

bgs = Below Ground Surface
ER = Equipment Rinsate
FD = Field Duplicate
GW = Groundwater
IDW = Investigation-Derived Waste
MNA = Monitored Natural Attenuation
MS = Matrix Spike
MSD = Matrix Spike Duplicate
MW = Monitoring Well
N/A = Not Applicable
QC = Quality Control
REG = Regular Sample
SOPP = Standard Operating Project Procedure
TB = Trip Blank
VOC = Volatile Organic Compound

Table F-5. Worksheet #19 & 30 Sample Containers, Preservation, and Hold Times
Redstone Arsenal, Madison County, Alabama

Analyte/Analyte Group[a]	Matrix	Analytical Method	Accreditation Expiration Date	Sample Container/Preservation Requirements[b]	Preservation/ Analytical Holding Time	Data Package Turnaround[c]
Groundwater Samples/Event						
VOCs	GW	8260C	July 31, 2025	3 × 40 mL vials; HCl to pH < 2	14 days	15 days
Perchlorate		6850 Modified		1 × 125 mL HDPE or PE (filter through 0.2-micron filter); headspace required	28 days	
Explosives		8330B		2 × 1 Liter amber glass	Extraction – 7 days Analysis – 40 days	
Nitrate/Sulfate		USEPA 300.0		1 × 1 Liter HDPE; < 6°C	Nitrate – 48 hours; Sulfate – 28 days	
TOC		SW9060A		1 × 250 mL amber glass; H_2SO_4 to pH< 2	28 days	
Alkalinity		USEPA Method 310.1		1 × 500 mL HDPE or PE	14 days	
Dissolved Gases (Ethane, Ethene, Methane)		RSK-175		3 × 40 mL vials	14 days	
IDW Water/Event						
VOCs	GW	8260C	July 31, 2025	3 × 40 mL vials; HCl to pH < 2	Preserved – 14 days Unpreserved – 7 days	15 days
Perchlorate		6850 Modified		125 mL HDPE or PE (filter through 0.2-micron filter); headspace required	28 days	
Explosives		8330B		2 × 1 Liter amber glass	Extraction – 7 days Analysis – 40 days	

Notes:

[a]See **Worksheet #15** for the analyte list per method.
[b]Sample deliverables should include a Level IV, Contract Laboratory Program (CLP)-like data package and Electronic Data Deliverable (EDD) for all samples with the exception of IDW samples that require certificates of analysis and EDD only.
[c]All samples should be cooled to 4 plus or minus (±) 2°C in conjunction with preservation requirements noted prior to shipment to the laboratory.

GW = Groundwater
H_2SO_4 = Sulfuric Acid
HCl = Hydrochloric Acid
HDPE = High-Density Polyethylene
IDW = Investigation-Derived Waste
PE = Polyethylene
TOC = Total Organic Carbon
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

Table F-5. Worksheet #19 & 30 Sample Containers, Preservation, and Hold Times
Redstone Arsenal, Madison County, Alabama (Continued)

Contract Laboratory Information

Laboratory	Shipping Address	Point of Contact
Advanced Environmental Laboratory, Inc. (AEL)	For shipments Monday through Thursday, ship to: Attn: Sample Receiving Advanced Environmental Laboratories, Inc. 6681 Southpoint Parkway Jacksonville, Florida 32216 904-363-9350 For shipments for Friday or Saturday delivery, there are specific instructions, they will be shipped and held for pickup at the following FedEx location across the street from the lab: Attn: AEL FedEx Shipping Center 3736 N Salisbury Rd Jacksonville, Florida 32216 800-463-3339	Mr. Craig Myers (AEL Client Services Manager) Voice: 904-363-9350 Ext. 202 FAX: 904-363-9354 After Hours/Emergency: 904-710-7158
GEL Laboratories, LLC	Ship all perchlorate samples to: GEL Laboratories, LLC 2040 Savage Road Charleston, South Carolina 29407 For Saturday shipments, contact laboratory for further instruction to ensure sample receipt in custody and with proper preservation.	Brielle Luthman Email: Brielle.Luthman@gel.com Phone: 843-556-8171

Table F-6. Worksheet #20 Field Quality Control Sample Summary
Redstone Arsenal, Madison County, Alabama

Parameters[a]	Analytical Method	Matrix	Total # of Samples	FD	MS	MSD	Equip. Rinsate (1/event)	Trip Blank (1/cooler)	TAT Needed[b]	Sample Container/Preservation Requirements	Holding Time[c]	Total Number of Containers
Groundwater Samples/Event												
VOCs	8260C SOP VOC-003	GW	11	1	1	1	1	3	Normal	3 × 40 mL vials w/septa; HCl to pH < 2	14 days	18
Perchlorate	6850 Modified		11	1	1	1	1	0	Normal	1 × 125 mL HDPE or PE (filter through 0.2-micron filter); headspace required	28 days	15
Explosives	8330B		11	1	1	1	1	0	Normal	2 × 1 Liter amber glass	Extraction – 7 days Analysis – 40 days	15
Nitrate/Sulfate	USEPA 300.0 SOP WC-054		11	1	1	1	1	0	Normal	1 × 1 Liter HDPE; < 6°C	Nitrate – 48 hours; Sulfate – 28 days	15
TOC	SW9060A		11	1	1	1	1	0	Normal	1 × 250 mL amber glass; H_2SO_4 to pH < 2	28 days	15
Alkalinity	USEPA Method 310.1		11	1	1	1	1	0	Normal	1 × 500 mL HDPE or PE	14 days	15
Dissolved Gases[e]	RSK-175		11	1	1	1	1	0	Normal	3 × 40 mL vials	14 days	15
IDW Water/Event[d]												
VOCs	8260C SOP VOC-003	Purge Water	1	0	0	0	0	1	Normal	3 × 40 mL vials w/septa; HCl to pH < 2	14 days	2
Perchlorate	6850 Modified		1	0	0	0	0	0	Normal	1 × 125 mL HDPE or PE (filter through 0.2-micron filter); headspace required	28 days	1
Explosives	8330B		1	0	0	0	0	0	Normal	2 × 1 Liter amber glass	Extraction – 7 days Analysis – 40 days	1

Notes:

[a]Sample deliverables should include a U.S. Department of Defense (DoD) Quality Systems Manual (QSM) Stage 3-4 data package and ECC Environmental Data Management System (EDMS) electronic data deliverable (EDD) for all groundwater samples. IDW samples require Level I/II data package and EDD.
[b]Trip Blanks (TBs) are filled containers and not counted as part of the empty container total. TBs must be ordered from the contract laboratory. IDW water will be analyzed for constituents as required by receiving facility.
[c]All samples should be cooled to 4°C for shipment to the laboratory.
[d]Purge water IDW contamination levels may be determined from groundwater laboratory results, based upon acceptance of IDW water receiving facility, instead of IDW water sampling.
[e]Dissolved gasses include ethane, ethene, and methane.

FD = Field Duplicate
GW = Groundwater
H_2SO_4 = Sulfuric Acid
HCl = Hydrochloric Acid
IDW = Investigation Derived Waste
HDPE = High-Density Polyethylene
MS = Matrix Spike
MSD = Matrix Spike Duplicate
PE = Polyethylene
SOP = Standard Operating Procedure
TAT = Turnaround Time
TOC = Total Organic Carbon
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

Table F-7. Worksheet #23 Analytical Laboratory Standard Operating Procedures
Redstone Arsenal, Madison County, Alabama

SOP Reference Number	Title, Revision, Date	Definitive or Screening Data	Analytical Group	Matrix	Instrument	Organization Performing Analysis	Modified for Project Work (Yes/No)?
GL-OE-E- 067	Definitive Low Level Perchlorate Analysis Utilizing (LC/MS/MS) by USEPA Method 6850 Modified	Definitive	Perchlorate	Water	LC/MS/MS	GEL Laboratory	No
GL-OA-E- 068	Sample Processing and Analysis of Nitroaromatics, Nitroamines, and Nitrate Esters by SW-846 8330B, 7/2020, Rev. 8.	Definitive	Explosives	Water	LC/MS/MS	AEL	No
VOC-003	Methods 8260B, C, & D: VOCs by GC/MS, Rev. 16, Eff. 2021-04-19	Definitive	VOCs	Water	GC/MS	AEL	No
GL-GC- E-093	Standard Operating Procedure for Total, Total Inorganic, and TOC	Definitive	MNA TOC	Water	Aurora TOC Analyzer	GEL Laboratory	No
WC-043	Method 310.1 / SM 2320 B-1997 Determination of Alkalinity Rev.14 Eff. 06/24/2020	Definitive	MNA Alkalinity	Water	Titration Module	AEL	No
WC-054	Method USEPA 300.0 and USEPA 9056A: Determination of Inorganic Anions by IC, Rev. 18, Eff. 2021-04-05	Definitive	MNA Anions (Sulfate and Nitrate)	Water	IC	AEL	No
VOC-013	Method RSK-175 Dissolved Gas Analysis in Water Samples by HS-GC with FID Rev. 02 Eff. 2021-02-03	Definitive	MNA Dissolved Gases	Water	HS-GC/FID	AEL	No

Notes:

AEL = Advanced Environmental Laboratories
Eff. = Effective
FID = Flame Ionization Detector
GC/MS = Gas chromatography/Mass spectrometry
HS-GC = Headspace-Gas Chromatography
IC = Ion Chromatography
LC/MS/MS = Liquid Chromatography with Tandem Mass Spectrometry
MNA = Monitored Natural Attenuation
Rev. = Revision
SOP = Standard Operating Procedure
SW = Solid Waste 846
TOC = Total Organic Carbon
USEPA = United States Environmental Protection Agency
VOC = Volatile Organic Compound

Table F-8. Worksheet #24 Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
Wet Chemistry IC	ICAL	5 to 200 mg/L for chloride and sulfate. All other analytes 0.5 to 5 mg/L.	6 months or sooner if quality control fails.	Correlation coefficient of ≥ 0.995.	Correct problem, rerun ICAL.	Analyst	WC-054, Section 12, 13
	ICV	25 mg/L for chloride and sulfate. All other analytes 1.0 mg/L.	Once after ICAL	All target elements ± 10% of true value.	Correct problem, rerun ICV. If that fails, repeat ICAL.		
	CCV	25 mg/L for chloride and sulfate. All other analytes 1.0 mg/L.	Every 10 field samples	All target elements ± 10% of true value.	Immediately analyze two additional CCVs. If both pass, samples can be reported. If either fails, repair problem, rerun samples with new passing CCV. May require new ICAL. If reanalysis not possible, data must be qualified with case narration.		
	IB/CCB	NA	Daily before analysis, every 10 samples, and end of analysis	No analytes detected > LOD.	Correct problem. Re-prepare and reanalyze CCB. All samples following the last acceptable CCB must be reanalyzed.		
VOCs GC/MS	Tune Check	Ion ratio verified	Every 12 hours and beginning of the analytical batch	Specific ion abundance criteria for BFB tune solution.	Retune instrument.	Analyst	VOC-003, Section 12.1
	ICAL	On instrument: 1 to 200 µg/L, 0.1 to 1.2 µg/L for SIM	At instrument set-up and after ICV or CCV failure, prior to sample analysis	Either RSD for each analyte ≤15% or linear least squares regression for each analyte ≥ 0.99.	Correct problem then repeat ICAL.		VOC-003, Sections 10, 13

Table F-8. Worksheet #24 Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama (Continued)

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
	RT Windows Verification	NA	At ICAL at midpoint and daily at beginning CCV	IS shift ≤ 10 seconds otherwise reset. Analytes reported within ± 0.06 RRT.	NA		VOC-003, Section 13
	ICV	At concentration level ± 25-50% of curve range	Once after ICAL	All target analytes within ± 20% of true value.	Correct problem. Rerun ICV. If fails, repeat ICAL		VOC-003, Sections 10, 13
	CCV	At concentration level ± 25-50% of curve range	Daily before sample analysis, every 12 hours thereafter, and close of analysis	All target analytes within ± 20% of true value. Closing CCV ± 50%.	Immediately analyze two additional CCVs. If both pass, samples can be reported. If either fails, repair problem, rerun samples with new passing CCV. May require new ICAL. If reanalysis not possible, data must be qualified with case narration.		VOC-003, Sections 12, 13
	IS	All QC and Samples	All QC and samples	RT within ± 10 seconds at ICAL midpoint or first daily CCV. Area Counts –50% to +100% midpoint standard.	Correct problem, reanalyze samples.		VOC-003, Sections 12, 13
Explosives LC/MS/MS	ICAL for all analytes (including surrogates)	25-2,500 µg/L	At instrument set-up and after ICV or CCV failure, prior to sample analysis	Option 1: RSD for all analytes is ≤ 15%; Option 2: linear least squares regression for each analyte: r2 ≥ 0.99; Option 3: non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99.	Correct problem, then repeat ICAL.	Analyst	HPLC02

Table F-8. Worksheet #24 Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama (Continued)

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
	ICV	1,000 µg/L or 100 µg/L	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analyte(s) and surrogates within ± 20% of true value.	Correct problem, rerun ICV. If problem persists, repeat ICAL.		
	CCV	500 µg/L	Before sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All reported analytes and surrogates within ± 20% of the true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs can't be run, perform CAs and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.		
Perchlorate by LC/ MS/MS	ICAL	0.1-10 µg/L	At instrument setup or after ICV or CCV failure, prior to sample analysis.	ICAL must meet one of the two options below: Option 1: RSD for each analyte ≤ 15%; Option 2: linear least squares regression for each analyte: r2 ≥ 0.995.	Correct problem, then repeat ICAL.	Analyst/ Supervisor	HPLC06

Table F-8. Worksheet #24 Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama (Continued)

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
	ICV	1.0 µg/L	Once after each ICAL.	Perchlorate concentration must be within ± 15% of its true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.		
	CCV	1.0 µg/L	On days an ICAL is performed, after every 10 field samples, and at the end of the analytical sequence. On days an ICAL is not performed, at the beginning of the sequence, after every 10 field samples, and at the end of the analytical sequence.	Perchlorate concentration must be within ± 15% of its true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.		
	Isotope Ratio 35Cl/37Cl	NA	Every sample, batch QC sample, and standard	Monitor for either the parent ion at masses 99/101 or the daughter ion at masses 83/85 depending on which ions are quantitated. Must fall within 2.3 to 3.8.	If criteria not met, the sample must be rerun. If the sample was not pretreated, the sample must be re-extracted using cleanup procedures. If, after cleanup, the ratio still fails, use alternative techniques to confirm presence of perchlorate, e.g., a post spike sample or dilution to reduce any interference.		

Table F-8. Worksheet #24 Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama (Continued)

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
	IS	5 µg/L O18-Perchlorate	Addition of 18O-labeled perchlorate to every sample, batch QC sample, standard, IB, and MB.	Addition of 18O-labeled perchlorate to every sample, batch QC sample, standard, IB, and MB.	Rerun the sample at increasing dilutions until the ± 50% acceptance criteria are met. If criteria cannot be met with dilution, the interference is suspected, and the sample must be re-prepped using additional pretreatment steps.		
	Interference Threshold Study	NA	At initial setup and when major changes occur in the method's operating procedures (e.g., addition of cleanup procedures, column changes, mobile phase changes).	Measure the threshold of common suppressors (chloride, sulfate, carbonate, bicarbonate) that can be present in the system without affecting the quantitation of perchlorate. The threshold is the concentration of the common suppressors where perchlorate recovery falls outside 80-120% window range.	NA		

Table F-8. Worksheet #24 Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama (Continued)

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
	Mass Calibration	Range must bracket ion masses of interest	Instrument must have a valid mass calibration prior to any sample analysis. The mass calibration is updated on as-needed basis (e.g., QC failures, ion masses show large deviations from known masses, major instrument maintenance is performed, or instrument is moved).	Ions should be within ± 0.3 m/z of masses 83, 85 and 89.	If the mass calibration fails, recalibrate. If it still fails, consult manufacturer instructions on corrective maintenance.		
	Tune Check	Range must bracket ion masses of interest	Prior to ICAL and after any mass calibration or maintenance is performed.	Tuning standards must span the mass range of the analytes of interest and meet acceptance criteria outlined in the laboratory SOP.	Retune instrument and verify. If the tune check will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone.		

Notes:

µg/L = Micrograms per Liter
BFB = Bromofluorobenzene
CA = Corrective Action
CCB = Continuing Calibration Blank
CCV = Continuing Calibration Verification
GC/MS = Gas Chromatography/Mass Spectrometry
IB = Instrument Blank
ICAL = Initial Calibration
ICV = Initial Calibration Verification
IS = Internal Standards
LC/MS/MS = Liquid Chromatography with Tandem Mass Spectrometry
LOD = Limit of Detection
mg/L = Milligram per Liter
m/z = Mass Divided by Charge Number
RRT = Relative Retention Time
RSD = Relative Standard Deviation
RT = Retention Time
SIM = Selected Ion Monitoring
SOP = Standard Operating Procedure
VOC = Volatile Organic Compound
NA = Not Applicable
QC = Quality Control

Table F-9. Worksheet #25 Analytical Instrument and Equipment Maintenance, Testing, and Inspection
Redstone Arsenal, Madison County, Alabama

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity/Preventive Maintenance	Frequency	Acceptance Criteria	CA	Title/ Position Responsible for CA	Reference
IC	Pump/tubing/ inline filters/ membrane filter	ICAL and CCVs	• Checked daily • Replaced weekly	As listed with inspection	MBs < DL, ICAL, ICV, CCV, peak shape, and LCS, as shown on **Worksheet #28**	Normal replacement	Analyst	WC-054
VOCs GC/MS	Column performance		• Shape and tailing of chromatographic peaks continuously • Monitor trending in surrogate and standard recoveries continuously • Changes in tuning daily • IB baselines continuously		MBs < DL, ICAL, ICV, CCV, peak shape, LCS, internal area counts, and surrogate limits, as shown on **Worksheet #28**	Trim or replace column		VOC-003
	Vacuum system		• Check level of oil in rotary pump quarterly • Replace oil in vacuum rotary pump annually		Levels within level check marks	Add or change oil		
	Ion source/ chamber		• Clean MS ion source, check pre-rods and lenses quarterly • Deep cleaning of MS including ion source, pre-rods and lenses semi-annually or as needed		Passing tune criteria	Clean and/or replace ion source parts		
	Filament		• Check filaments condition (filaments are replaced through the year as needed)		Passing tune criteria, passing QC, area counts and sensitivity	Clean and/or replace ion source parts		

Table F-9. Worksheet #25 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Redstone Arsenal, Madison County, Alabama (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity/Preventive Maintenance	Frequency	Acceptance Criteria	CA	Title/ Position Responsible for CA	Reference
Explosives LC/MS/MS	Daily maintenance items, such as solvent replenishment, etc.	SW846 Method 8330B	• Visual inspection of solvent levels	Maintenance ongoing/ performed as needed; preventative maintenance performed daily	Successful daily instrument calibration per requirements	Documentation of item addressed is located in the instrument's maintenance logbook; all instrument maintenance items are recorded	Analyst	GL-OA- E-068
Agilent 1100 or 1200HPLC	Filter samples/ guard column	Sample introduction	• Replace filters/guard column as needed to prevent flow restrictions	While in use	Acceptable calibration and ongoing verifications	Correct problems, reanalyze standard	Analyst/ Supervisor	HPLC02, HPLC03
	Monitor pressure	ICAL and CCVs	• Checked daily leaks, line restrictions, temperature and solvent fluctuation, and gas bubbles	Daily				
LC/MS/MS	Monitor pressure	ICAL and CCVs	• Checked daily leaks, line restrictions, temperature and solvent fluctuation, and gas bubbles	Daily				GL-OA-E_068
LC/MS/MS	Monitor and clean curtain plate and nebulizer tip, clean source of MS		• Curtain plate, nebulizer tip, MS source	As needed				HPLC06
			• Vacuum pump oil	Every 6 months				

Notes:

CA = Corrective Action
CCV = Continuing Calibration Verification
DL = Detection Limit
GC/MS = Gas Chromatography/Mass Spectrometry
IB = Instrument Blank
ICAL = Initial Calibration
ICV = Initial Calibration Verification
LCS = Laboratory Control Sample
LC/MS/MS = Liquid chromatography with tandem Mass Spectrometry
MB = Method Blank
MS = Mass Spectrometry
QC = Quality Control
VOC = Volatile Organic Compound

Table F-10. Worksheet #26 Sample Handling, Custody, and Disposal
Redstone Arsenal, Madison County, Alabama

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT (FIELD)
Sample Collection (Personnel/Organization): ECC Personnel TBD
Sample Packaging (Personnel/Organization): ECC Personnel TBD
Coordination of Shipment (Personnel/Organization): ECC Personnel TBD
Type of Shipment/Carrier: Cooler/Lab Courier, UPS
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): AEL
Sample Custody and Storage (Personnel/Organization): AEL
Sample Preparation (Personnel/Organization): AEL
Sample Determinative Analysis (Personnel/Organization): AEL
SAMPLE ARCHIVING
Field Sample Storage (number of days from sample collection): 60 days from receipt
Sample Extract/Digestate Storage (number of days from extraction/digestion): 3 months from sample extraction/digestion
Biological Sample Storage (number of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: AEL
Number of Days from Analysis: 30 days from submittal of Final report or 60 days from receipt, whichever is longer

Notes:

Post sample collection in the field will be conducted in accordance with Standard Operating Projected Procedure (SOPP) 15.0 *Non-Hazardous Sample Handling, Packaging, and Shipping*. This procedure is located in the Installation-Wide – Quality Assurance Project Plan (IW-QAPP), Volume II (HGL 2019).

Specific laboratory sample custody procedures (receipt of samples, archiving, and disposal) will be used for all post-sample handling. Coolers will be received and checked for proper temperature. A sample cooler receipt form will be completed to note the conditions and any discrepancies. The chain-of-custody will be checked against the sample containers for correctness. Samples will be logged into the data base and given a unique log number, which can be tracked through processing. The Project Chemist will be notified of any problems.

AEL = Advanced Environmental Laboratory
ECC = Environmental Chemical Corporation
NA = Not Applicable
TBD = To Be Determined
UPS = United Postal Service

Table F-11. Worksheet #28 Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	CA	Title of Person Responsible for CA	Project Specific MPC
Anions (Aqueous), USEPA 300.0 by WC-054/310.1 by WC-043					
MB	Once every prep/analytical batch of 20 or fewer samples.	No analyte detected equal to or above the DL or > 1/10 the regulatory limit, whichever is greater. (DoD: No analytes > ½ LOQ; common laboratory contaminants none detected > LOQ).	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank. If not enough sample volume to re-prep, data qualified with case narration.	Analyst with Department Supervisor and QA Officer review	MB detections used to qualify project samples per validation guidance
LCS	Once every prep/analytical batch of 20 or fewer samples.	QC limits set in QSM 5.4 LCS tables or in-house generated limits when DoD limits unavailable.	Correct problem. If required, reprep and reanalyze LCS and all QC samples and field samples processed in batch. If not enough sample volume to re-prep, data qualified with case narration.		Same as Method/SOP
MS	Once every prep/analytical batch of 10 or fewer samples.	QC limits set in QSM 5.4 LCS tables or in-house generated limits when DoD limits unavailable.	When outside limits examine project specific requirements and/or contact client. Flag data appropriately.	Analyst with Department Supervisor review	
MSD	Once every prep/analytical batch of 10 or fewer samples.	QC limits set in QSM 5.4 LCS tables or in-house generated limits when DoD limits unavailable. RPD of all target compounds ≤ 10% between MS and MSD.	When outside limits examine project specific requirements and/or contact client. Flag data appropriately.		
Sample Duplicate	Once every prep/analytical batch.	RPD < 20%	When outside limits examine project specific requirements and/or contact client. Flag data appropriately.	Analyst with Department Supervisor review	
Volatiles (Aqueous); USEPA 8260C by VOC-003					
MB	Once every prep/analytical batch of 20 or fewer samples.	No analyte detected equal to or above the DL or > 1/10 the regulatory limit, whichever is greater. (DoD: No analytes > ½ LOQ; common laboratory contaminants none detected > LOQ).	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank. If not enough sample volume to re-prep, data qualified with case narration.	Analyst with Department Supervisor and QA Officer review	MB detections used to qualify project samples per validation guidance

Table F-11. Worksheet #28 Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	CA	Title of Person Responsible for CA	Project Specific MPC
LCS	Once every prep/analytical batch of 20 or fewer samples.	QC limits set in QSM 5.3 LCS tables or in-house generated limits when DoD limits unavailable.	Correct problem. If required, reprep and reanalyze LCS and all QC samples and field samples processed in batch. If not enough sample volume to re-prep, data qualified with case narration.		Same as Method/SOP
LCSD or Laboratory Duplicate	Alternative means of determining laboratory precision is MS/MSD not performed; performed as needed.	RPD of all target compounds ≤ 20%.	No specific corrective action unless a stated project requirement. Flag accordingly.	Analyst with Department Supervisor review	Same as Method/SOP
MS	Once every prep/analytical batch of 20 or fewer samples.	QC limits set in QSM 5.3 LCS tables or in-house generated limits when DoD limits unavailable.	When outside limits examine project specific requirements and/or contact client. Flag data appropriately.		
MSD	Once every prep/analytical batch of 20 or fewer samples.	QC limits set in QSM 5.3 LCS tables or in-house generated limits when DoD limits unavailable. RPD of all target compounds ≤ 20% between MS and MSD.	When outside limits examine project specific requirements and/or contact client. Flag data appropriately.		
Surrogate Spike (Surr)	All samples and QC (except tune).	QC limits set in QSM 5.3 tables or in- house generated limits when DoD limits unavailable.	Action dependent upon type. If MB or LCS, correct problem and reprep and reanalyze all associated samples. If sample, examine matrix. If obvious chromatographic interferences, reanalysis may not be required. Qualify recovery data and notify and/or case narrate.		
Explosive Compounds (Aqueous); SW8330B by EXTNT01 & HPLC02					
MB	One per preparatory batch.	No analytes detected > 1/2 LOQ or > 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater.	Correct problem. If required, re-prep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Analyst/ Supervisor	MB detections used to qualify project samples per validation guidance

Table F-11. Worksheet #28 Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	CA	Title of Person Responsible for CA	Project Specific MPC
LCS	One per preparatory batch.	A laboratory must use the QSM 5.3 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for the failed reported analytes if sufficient sample material is available.		Same as Method/SOP
LCSD or Laboratory Duplicate	Alternative means of determining lab precision if MS/MSD is not performed; performed as needed.	RPD of all target compounds ≤ 30%.	No specific corrective actions. Flag accordingly.		
MS	One per preparatory batch.	A laboratory must use the QSM 5.3 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Analyst/ Supervisor	Same as Method/SOP
MSD	One per preparatory batch.	A laboratory must use the QSM 5.3 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified. RPD ≤30% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.		
Perchlorate (Aqueous); SW6850 by HPLC06					
LRB	Prior to calibration and at the end of the analytical sequence.	No perchlorate detected > ½ LOQ.	Reanalyze reagent blank (until no carryover is observed) and all samples processed since the contaminated blank.	Analyst/ Supervisor	LRB detections used to qualify project samples per validation guidance

Table F-11. Worksheet #28 Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	CA	Title of Person Responsible for CA	Project Specific MPC
MB	One per preparatory batch.	No analytes detected > ½ LOQ or > 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater.	Correct problem. If required, reprep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.		MB detections used to qualify project samples per validation guidance
LCS	One per preparatory batch.	A laboratory must use the QSM 5.3 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem. Reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.		Same as Method/SOP
MS	One per preparatory batch per matrix.	A laboratory must use the QSM 5.3 limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Examine the project specific requirements. Contact the client as to additional measures to be taken.		
ICS	One ICS is prepared with every batch of 20 samples and must undergo the same preparation and pretreatment steps as the samples in the batch. It verifies the method performance at the MCT. At least one ICS must be analyzed daily. The ICS shall be prepared at the LOQ.	Perchlorate concentration must be within± 20% of its true value.	Correct problem. Reanalyze all samples and QC samples in the batch. If poor recovery from the cleanup filters is suspected, a different lot of filters must be used to re-extract all samples in the batch. If column degradation is suspected, a new column must be calibrated before the samples can be reanalyzed.		

Table F-11. Worksheet #28 Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

Notes:

CA = Corrective Action
DL = Detection Limit
DoD = Department of Defense
HPLC = High Performance Liquid Chromatography
ICS = Interface Check Solutions
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOQ = Limit of Quantitation
LRB = Laboratory Reagent Blank
MB = Method Blank
MCT = Matrix Conductivity Threshold
MPC = Measurement Performance Criteria
MS = Matrix Spike
MSD = Matrix Spike Duplicate
QA = Quality Assurance
QC = Quality Control
QSM = Quality Systems Manual
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

Table F-12. Worksheet #36 Data Validation Procedures
Redstone Arsenal, Madison County, Alabama

Data validation is an analyte and sample-specific process for evaluating compliance with contract requirements, methods/standard operating procedures (SOPs), and measurement performance criteria (MPC).

All project field samples will undergo a Tier 1 Plus (U.S. Department of Defense [DoD] Quality Systems Manual [QSM] Stage 2B) data validation using laboratory limits as the MPC. Investigation-derived waste (IDW) samples will be reviewed for completeness only.

Data validation will be documented on Environmental Chemical Corporation (ECC) data validation worksheets (DVW). Electronic data deliverables (EDDs) (ECC Environmental Data Management System [EDMS] EDD and Environmental Remediation Information System [ERIS]) will be updated with Installation-wide Quality Assurance Project Plan (IW-QAPP) data validation qualifiers and rationale for validation qualifications provided in the DVW.

- U – Not detected by the laboratory or as a result of qualifying data due to cross contamination as determined by blank evaluation less than five times blank level) during data validation.
- UJ – Not detected with estimated reporting limits. Assigned due to data validation exceedance.
- R – Rejected data. Data determined to be unusable during data validation.

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator
IIa	Groundwater	All groups (site-specific volatile organic compounds [VOCs], perchlorate, and explosives)	Low/Medium	Laboratory Measurement Performance Criteria (MPC) evaluated in accordance with applicable U.S. Environmental Protection Agency (USEPA) National Functional Guidelines (NFG) as applicable to analytical methods listed in this groundwater monitoring plan).	ECC Project Chemist or designate

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ATTACHMENT 1

FIELD DOCUMENTATION

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Water Level Survey Log
RSA-311
Redstone Arsenal, Madison County, Alabama

Date: _____

Personnel: _____

Weather: _____

Other Comments: _____

Well ID	Headspace PID (ppm)	Time	Depth to Water (ft btoc)
311-RS2396			
311-RS2397			
311-RS2398			
311-RS2399			
311-RS2636			
311-RS2789			
311-RS2790			
311-RS2795			
311-RS2853			
311-RS2854			

Notes:

ft btoc = Feet Below Top of Casing
PID = Photoionization Detector
ppm = Parts per Million

Monitoring Well Sampling
Log RSA-311
Redstone Arsenal, Madison County, Alabama

Date:_____

Personnel: _____

Weather: _____

Other Comments:_____

Well ID	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Installed Well Depth (ft bgs)	Screened Interval (ft bgs)	Date Sampled	Time	Depth to Water (ft btoc)
311-RS2396	566.87	567.21	10.7	5.3-10.3			
311-RS2397	567.77	568.06	14.8	4.4-14.4			
311-RS2398	567.13	564.35	12.6	7.2-12.2			
311-RS2399	567.00	567.42	15.5	5.1-15.1			
311-RS2636	569.72	567.14	13.0	7.6-12.6			
311-RS2789	566.42	564.22	29.0	18.6-28.6			
311-RS2790	566.97	564.60	17.8	7.4-17.4			
311-RS2795	570.64	568.49	19.7	9.0-19.0			
311-RS2853	570.79	568.56	13.7	8.7-13.7			
311-RS2854	565.43	563.14	15.0	4.6-14.6			

Notes:

amsl = Above Mean Sea Level
bgs = Below Ground Surface
btoc = Below Top of Casing
ft = Feet
NA = Survey Data Not Available

GROUNDWATER PURGE FORM

Redstone Arsenal, Madison County, Alabama

Sheet 1 of ___

Site ID:_____ Sampling location ID:_____

Weather:_____ Sample Number:_____

Purge Equipment:_____ Collection Date/Time:_____

Pump Installation

Pump installation crew:_____ Installation date/beginning time:_____

PID/FID reading (well head/background):_____ Screen Interval (ft. bgs): _____ to _____

Casing diameter (inches):_____ Pump intake depth (ft btoc): _____

Measured Well Depth (ft. btoc):_____ Pre-installation DTW (ft btoc):_____

Discharge tube length (ft.):_____ Discharge tube diameter (3/8" or 1/4"):_____

Pneumatic Controller Tuning: Initial air pressure = H (ft.) X 0.43 = _____ psi

Purging

Purging/sampling crew:_____ Purge date/beginning time:_____

d_1 = screen diameter (inches) v_1 = screen volume (gallons) l_1 = screen length (feet)

d_2 = borehole diameter (inches) v_2 = filter pack volume (gallons) l_2 = filter pack length (feet)

V = purge volume (gallons or liters) p&t = pump and tubing volume (liters) t = tubing length (feet)

$v_1 = [(d_1)^2 \times 0.041] \times l_1$ $v_1 = [(____)^2 \times 0.041] \times ____ = ____$ gallons

$v_2 = [(d_2)^2 - (d_1)^2] \times 0.041 \times l_2 \times 0.3$ $v_2 = [(____)^2 - (____)^2] \times 0.041 \times ____ \times 0.3 = ____$ gallons

$V = (v_1 + v_2) \times 3.79$ $V = (____ + ____) \times 3.79 = ____$ liters

p&t = {[t x (multiplier)] + 500} /1000 p&t = [(_____ x _____) + 500] / 1000 = _____ liters

TOTAL PURGE VOLUME = V + required number of p&t volumes = _____ liters.

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)									
Refill Setting									
Discharge Setting									
Flow rate (mL/min)									

Water Quality Parameter Measurements

Time and Date	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Conductivity (mMhos/cm)	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)

Comments

Abbreviations: BTOC - Below top of casing; BGS - Below ground surface; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter; ft - feet; mL/min - milliliters per minute; degree C - degree Celsius; mMhos/cm - millimhos per centimeter; pH - hydrogen ion concentration; Eh - redox potential; mv - millivolts; DO - dissolved oxygen; mg/L - milligrams per liter; NTU - nephelometric turbidity unit; psi - pounds per square inch; PID/FID - photoionization detector/flame ionization detector

GROUNDWATER PURGE FORM

Continuation Sheet

Redstone Arsenal, Madison County, Alabama

Isampling location ID·

Sample Number·

Water Quality Parameter Measurements									
Time and Date	DTW (ft. BTOC)	Purge Rate (mUmin)	Cum11lative Volume Purged (L)	Temp. (degree C)	Conductivity (mMhos/cm)	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)

SAMPLE COLLECTION LOG

Site _____ **Project:** Redstone Arsenal

Location Code: _____ **Sample Date:** _____

Sample Number: _____ **Time:** _____

Sample Name: _____ **Sample Matrix:** _____

Well Depth: _____ **Depth to Water:** _____

Sampling Equipment: _____ **Sample Team (name/Company):** _____

QC Partners:

Trip Blanks: _____ Rinsate: _____ Field Blank _____

Containers:

Analytical Suite	FLT	Quantity	Size	Units	Type

Flt- Filtered (Y/N)

Purge Record (Last 3 readings for groundwater, single set of readings for any other water)

Date	Time	Depth to Water (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	DO (ppm)	Turbidity (NTU)	Temp (°C)	Purge Volume (gal)

ft – feet
mV – millivolts
SU – standard unit
mS/cm – microsiemens per centimeter
ppm – parts per million
NTU – nephelometric turbidity units
°C – degrees Celsius
gal – gallons

Logged By/Date _____ **Reviewed by/Date** _____

REDSTONE ARSENAL WELL INSPECTION CHECKLIST

WELL LOCATION		DATE INSPECTED	INSPECTION CREW
SITE #			
WELL #			

WELL TYPE	
WELL TYPE: (CIRCLE ONE)	OVERBURDEN BEDROCK PIEZOMETER EXTRACTION OTHER _____

WELL CONSTRUCTION		
(CIRCLE ONE)	FLUSH MOUNT	STICKUP

PHYSICAL APPEARANCE	
EXCELLENT	WELL INTEGRITY HAS NO DEFIENCIES
GOOD	MINOR DEFIENCIES - PAD CRACKED, NO LOCK, MISSING EXPANDABLE CAP
POOR	MAJOR DEFIENCIES - PAD DESTROYED, NO STENCILING, POST MISSING

	YES	NO	N/A	CONDITION	COMMENTS
CONCRETE PAD				EXCELLENT GOOD POOR	
PROTECTIVE POST				EXCELLENT GOOD POOR	
PROTECTIVE CASING				EXCELLENT GOOD POOR	
STENCILING				EXCELLENT GOOD POOR	
LOCK				EXCELLENT GOOD POOR	
EXPANDABLE CAP				EXCELLENT GOOD POOR	
ACCESSIBLE				EXCELLENT GOOD POOR	
REPAIRS NEEDED					

Notes: N/A - not applicable

DAILY SITE REPORT

Project Title: Redstone
Activity Name: _____
Location: U.S Army Garrison - Redstone
Contract No.: W9124J-18-D-0004, DO W9124JI8F0085

Weather	Sunny	Clear	Overcast	Rain	Snow
Temperature	< 32	32-50	50-70	70-85	> 85
Wind	Still	Moderate	High		
Humidity	Dry	Moderate	Humid		

Personnel On Site:

Name	Hrs.	Affiliation	Location/ Description of Work

Field Changes: YES _____ NO _____

If yes, filed Nonconformance and Corrective Action Report number (NCR No.):_____

Work Performed:	
Equipment Used:	
Health & Safety (Briefing held, PPE, injuries, near misses, etc.):	
Samples Collected/ Shipped:	
IDW Generated and Disposition:	
Verbal Instructions Received/Given:	
Changed Conditions/ Delays/ Conflicts Encountered or Resolved:	
Other Comments or Additional Information:	
Next Day's Planned Activities:	

Contractor Verification: On behalf of the contractor, ECC, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my know ledge, except as may be noted above.

_____ _____

Signature Date

Notes:

PPE - personal protective equipment

IDW - investigation derived waste

INSTRUMENT CALIBRATION LOG

Project: Redstone 5211.014 **Site:** _____ **Date**_____

Calibrated By_____ **Instrument** _____ **Serial Number**_____

_____ _____

Weather: _____

Parameters	Calibration	Calibration Temp	Post Calibration	Comments
Conductivity (mS/cm$_c$)				
pH (7)				
pH (4)				
pH (10)				
ORP (mV)				
Dissolved Oxygen (%)				
Barometric Pressure (mmHg)				
Turbidity	**<0.10 NTU**	**15.0 NTU**	**100 NTU**	**750 NTU**
PID		**Isobutylene / 100ppm**		

Notes: mS/cm - microsiemens per centimeter; pH - hydrogen ion concentration; ORP - oxidation-reduction potential; mV - millivolts; mmHg - millimeters of mercury; NTU - nephelometric turbidity unit; PID - photoionization detector; ppm - parts per million

PHOTOIONIZATION DETECTOR INSTRUMENT CALIBRATION LOG

Project/Site Name Redstone Arsenal **Calibrated By** _____

Instrument/Serial Number	Pre-calibration Reading	Post-calibration Reading	Calibration Gas/Concentration	Date
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	
			Isobuty lene / 100ppm	

Notes: ppm - parts per million

	ECC	**DAILY SAFETY MEETING SIGN-IN SHEET**

Date: _____ Project Name/Location: Redstone Arsenal
Company: ECC Person Conducting Briefing: _____

I. AWARENESS (e.g., Hazards, special EHS concerns, pollution prevention, recent incidents, etc.):

2. OTHER ISSUES (HASP changes, new AHAs, attendee comments, etc.):

3. DISCUSSION OF DAILY ACTIVITIES/TASKS AND SAFETY (PPE) MEASURES TO BE USED:

4. Hospital Information Name:
Address:
Phone:
Directions

5. ATTENDEES (Print Name):

1	2
3	4
5	6
7	8
9	10

Notes:
EHS - Environment, Health, and Safety HASP - Health and Safety Plan
AHA - Activity Hazard Analysis
PPE - Personal Protective Equipment
ECG-Never Compromising Safety

APPENDIX G

BUILDING 7352 DEMOLITION REPORT

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REQUEST FOR APPROVAL OF DISPOSAL OF BUILDINGS AND IMPROVEMENTS

For use of this form, see AR 405-90; the proponent agency in USACE

DATE: SEP 2 3 2019

NAME OF INSTALLATION	LOCATION	ACCOUNTABLE OFFICER
REDSTONE ARSENAL	REDSTONE ARSENAL, AL SITE CD: 01202	Jordan Matthews

POST NO.	DESIGNATION AND DESCRIPTION (Include information on installed property to be removed prior to disposal)	SQ FT	TYPE OF CONSTRUCTION*	ORIGINAL COST & YEAR BUILT (Estimate if not known)	
7352	***Propulsion Systems Building***	5,464.0	PERM	$599,650.00	1989
	CATEGORY CODE: 31820 FOUNDATION: Concrete FLOOR: Concrete WALLS: Metal ROOF: Metal LOCATED AT: 7352 SWALLOW ROAD				
	TOTAL SF:	5,464.0			
	TOTAL COST			$599,650.00	

CONTINUE ON ADDITIONAL SHEETS IF NECESSARY

* P - Permanent S - Semi=permanent T - Temporary (See AR 420-70)

DA Form 337, May 59 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

REMARKS (Include conditions prompting disposal, and indicate whether land on which property is located is leased or government owned.)

FACILITY #: 7352

1. Land on which facility is located is government owned. A map depicting the area is attached at enclosure 1.

2. Disposal of this facility will not result in any environmental impact nor cause any adverse public reaction. Environmental documentation REC is attached at enclosure 2.

3. A historical site is not involved.

4. This facility is not required for a mobilization mission.

5. There is not equipment-in-place in this facility that will be removed prior to disposal. Installed property will be removed with the facility during disposal.

6. Asbestos has been found in this facility and will be removed prior to demolition. Enclosure 2 specifies that no presence of toxic substances exists. Building will be flash burned for one hour at 650 F to get rid of any explosive residue.

7. Proposed method of disposal is: Deconstruction.

8. Condition prompting disposal: Facility has served the purpose for which constructed, and is uneconomical to repair or refurbish, structural integrity reflects unsafe conditions, and facility is dilapidated This disposal conforms with the Installation Master Plan and has been requested by the Garrison Commander.

9. IAW Stewart B. McKinney Act, this facility is exempt from HUD Screening.

4 Encls
1. Map
2. Environmental Documentation (REC, ESD, Cultural Resource Clearnace, etc..)
3. Concurrence from Local Proponent
4. Photographs (OPTIONAL)

THE ESTIMATED TOTAL SALE VALUE OF THE PROPERTY ☐ IS ☑ IS NOT IN EXCESS OF $50,000	SIGNATURE OF ESTIMATOR Allen Colley
TYPED NAME, GRADE, AND ORGANIZATION OF FINAL APPROVING AUTHORITY Kelsey A. Smith COL/ AV Commanding	SIGNATURE
FINAL DISPOSITION OF PROPERTY COMPLETED OCT 2 3 2019	V-1369-19

Reverse DA Form 337, MAY 59

Record of McKinney Act Exemption

Installation: **Redstone Arsenal, AL**

Facility Number: 7352

Facility Description: PROPULSION SYSTEMS BLDG.

Property Category:	**Excess**	Underutilized	Unutilized
Future Disposition:	**Demolition**	Renovation	New Tenant

Determination:

1. Is the property infeasible to relocate? **YES**

Explain: Facility has a structurally integrated permanent foundation. Overall condition of facility is deteriorated.

2. Is the property located in an area to which the general public is denied access in the interest of national security? **YES**

Explain: Redstone Arsenal is restricted to the general public in the interest of national security. All assets on Redstone Arsenal are fenced inside a secure area.

3. Would exempting the property from reporting under the McKinney Act facilitate the efficient disposal of excess property or result in more efficient real property management? **YES**

Explain: The authorization of delegation to the local authority reduces processing time and facilitates an efficient excess property disposal process.

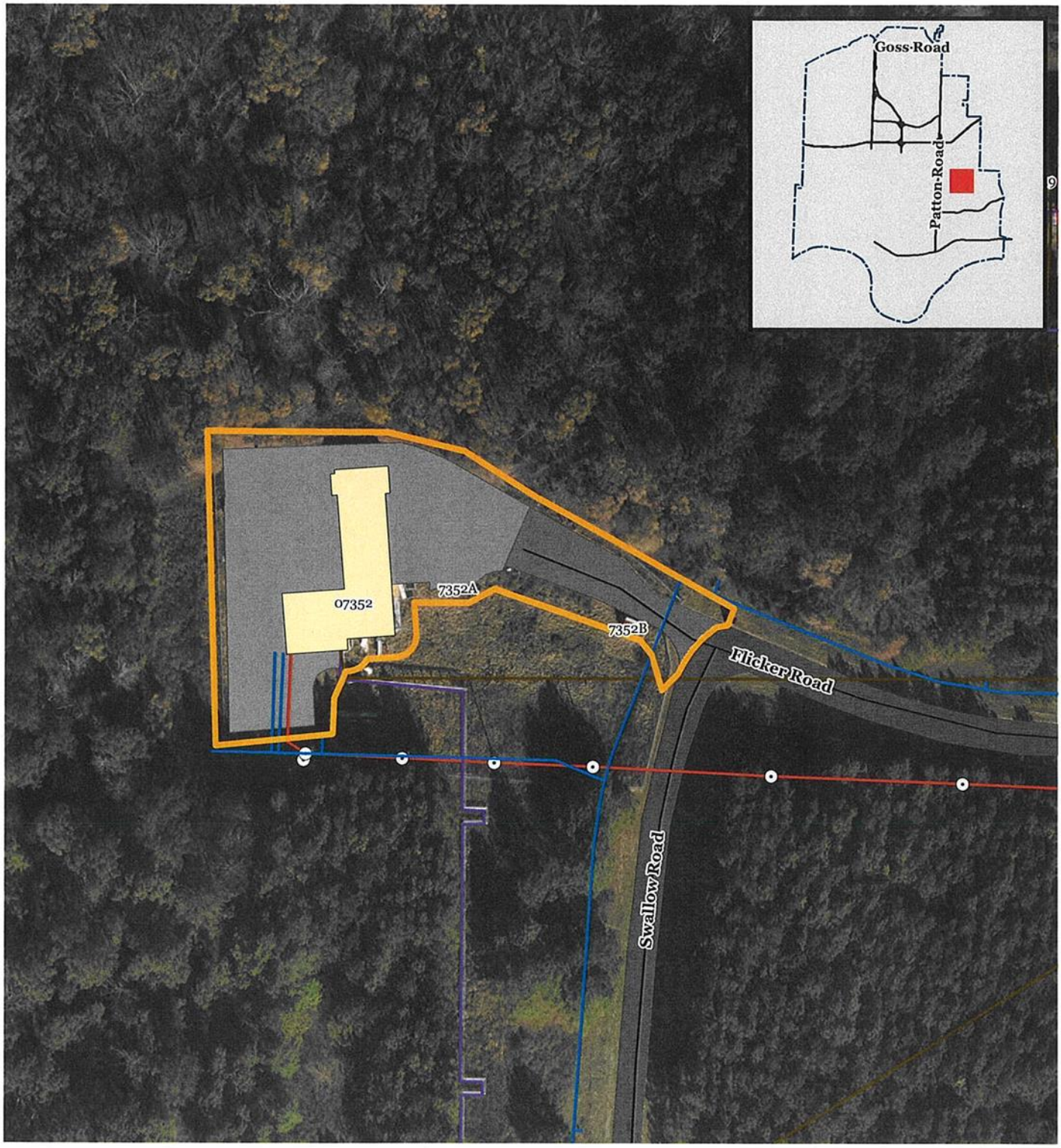
Based on the foregoing and based on delegated authority from the Secretary of the Army, I determine that pursuant to Section 2822 of Public Law 115-232, the subject property is exempt from screening under the McKinney-Vento Homeless Assistance Act.

(print and sign name)

01 AUG 19
date

7352

5464 Sqft.



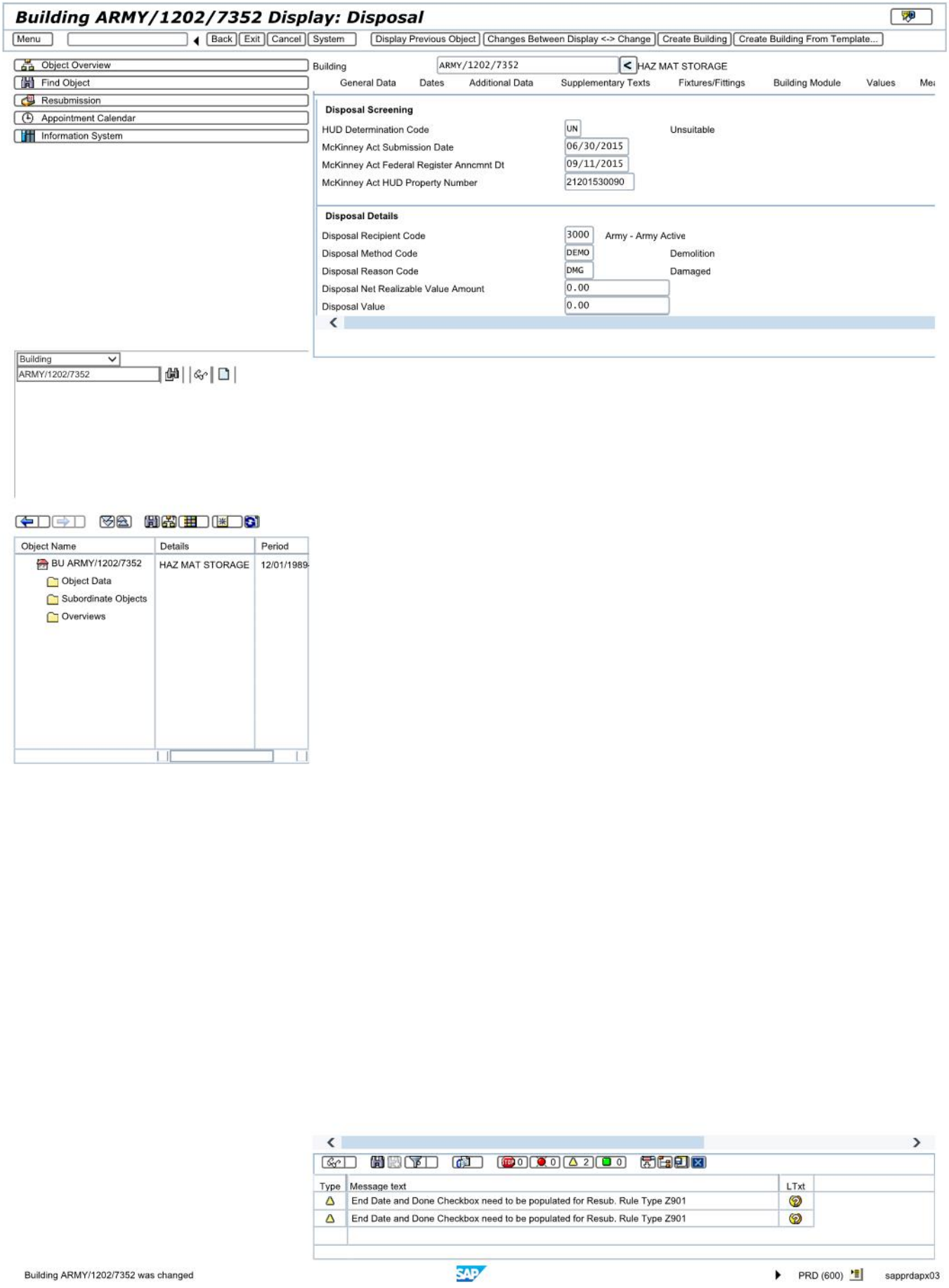
Legend

- DEMO Buildings
- Demo Buffer
- Water Line
- Wastewater Line
- Steam Line
- Natural Gas Line
- Utility Pole
- Electrical Line
- Other Buildings

N W E S

100 50 0 100 Feet

4/30/2015


Building ARMY/1202/7352 Display: Disposal
Menu
Back
Exit
Cancel
System
Display Previous Object
Changes Between Display <-> Change
Create Building
Create Building From Template...
Object Overview
Find Object
Resubmission
Appointment Calendar
Information System
Building
ARMY/1202/7352
HAZ MAT STORAGE
General Data
Dates
Additional Data
Supplementary Texts
Fixtures/Fittings
Building Module
Values
Disposal Screening
HUD Determination Code
UN
Unsuitable
McKinney Act Submission Date
06/30/2015
McKinney Act Federal Register Anncmnt Dt
09/11/2015
McKinney Act HUD Property Number
21201530090
Disposal Details
Disposal Recipient Code
3000
Army - Army Active
Disposal Method Code
DEMO
Demolition
Disposal Reason Code
DMG
Damaged
Disposal Net Realizable Value Amount
0.00
Disposal Value
0.00
Building
ARMY/1202/7352
Object Name
Details
Period
BU ARMY/1202/7352
HAZ MAT STORAGE
12/01/1989
Object Data
Subordinate Objects
Overviews
Type
Message text
LTxt
End Date and Done Checkbox need to be populated for Resub. Rule Type Z901
End Date and Done Checkbox need to be populated for Resub. Rule Type Z901
Building ARMY/1202/7352 was changed
PRD (600)
sapprdapx03

TRANSFER AND ACCEPTANCE OF DoD REAL PROPERTY

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Washington Headquarters Services, Executive Services Directorate, Information Management Division, 4800 Mark Center Drive, Alexandria,VA 22350-3100 (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if itdoes not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION.

1. FROM *(Organization Name)*	2. DATE PREPARED *(YYYYMMDD)*	3. PROJECT/JOB NUMBER	4. SERIAL NUMBER	8. TRANSACTION DETAILS
US Army Garrison-Redstone Attn: Allison Guilliams Building 4488 Martin Road	20200521	CC removal	NA	a. METHOD *(X all that apply)* [ ] ACQUISITION BY CONSTRUCTION [ ] TRANSFER BETWEEN SERVICES [ ] CAPITAL IMPROVEMENT [X] INVENTORY ADJUSTMENT b. WHEN/EVENT *(X one)* [X] TOTAL ASSET PLACED-IN-SERVICE [ ] PARTIAL ASSET PLACED-IN-SERVICE
5. TO *(Organization - Installation Code and Name)* US Army Garrison-Redstone Building 4488 Martin Road Redstone Arsenal. AL 35898-5000	**6. RPSUID/SITENAME/ INSTCODE/INSTNAME** 6964/REDSTONE/1202 REDSTONE ARSENAL	**7. CONTRACT NUMBER(S)** NA	**7a. PLACED-IN-SERVICE DATE** *(YYYYMMDD)* 19891201	c. TYPE *(X one)* [ ] DRAFT [X] FINAL [ ] INTERIM

9. ITEM NO.	10a. FACILITY NO.	10b. RPUID	11. CATEGORY CODE	12. CATCODE DESCRIPTION	13. TYPE CODE	14. SUST. CODE	AREA 15. PRIMARY UM	AREA 16. PRIMARY UM QUANTITY	OTHER 17. SECONDARY UM	OTHER 18. SECONDARY UM QUANTITY	19. COST	20. FUND SOURCE	21. FUND ORG	22. INTEREST CODE	23. ITEM REMARKS
1	7352	367869	85225	PAD	P	3	SY	(9)	-	-	-	2020	00	FEE	CC end date documented as 10/23/2019. See project remarks.
2	7352	367869	83150	SEWAGE LIFT STATION	P	3	EA	(1)	KG	(360)	-	2020	00	FEE	CC end date documented as 10/23/2019. See project remarks.
3	7352	367869	85125	NONORG PL PAVD	P	3	SY	(2,291)	-	-	-	2020	00	FEE	CC end date documented as 10/23/2019. See project remarks.

24. STATEMENT OF COMPLETION. The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

a. TRANSFERRED BY *(Typed Name and Signature)*	b. DATE SIGNED *(YYYYMMDD)*
Allison Guilliams GUILLIAMS.ALLISON.NAIL.1381224097 Digitally signed by GUILLIAMS.ALLISON.NAIL.1381224097 Date: 2020.05.21 05:56:49 -05'00'	20200521
c. TITLE *(Area Engr./Base Engr./DPW/Construction Agent)* Real Property Specialist	

25a. ACCEPTED BY *(Typed Name and Signature)*	b. DATE SIGNED *(YYYYMMDD)*
Christina Fults FULTS.CHRISTINA.MICHELLE.1392831874 Digitally signed by FULTS.CHRISTINA.MICHELLE.1392831874 Date: 2020.05.21 16:32:38 -05'00'	20200521
c. TITLE *(DPW/RPAO)* Real Property Accountable Officer	**26. PROPERTY VOUCHER NUMBER** V290-20

27. CONSTRUCTION DEFICIENCIES *(Attach blank sheet for continuations)*	28. PROJECT REMARKS *(Attach blank sheet for continuations)*
	Per DA337 V1369-19, Facility 7352, catcode 31820, was demolished on 23 October 2019. The 3 referenced catcodes were not previously undbundled from the facility, nor identified on the DA337. This 1354 serves to document the that these catcodes and their related UMs were demoed as part of the full 7352 demo on 10/23/2019 and will be removed from GFEBS along with the predominant catcode as listed on the DA337. Total asset costs to be removed from GFEBS can be found in the DA337.

INSTRUCTIONS

GENERAL. This form has been designed and issued for use in connection with the transfer of military real property between the military departments and to or from other government agencies. It supersedes ENG Forms 290 and 290B (formerly used by the Army and Air Force) and NAVDOCKS Form 2317 (formerly used by the Navy).

Existing instructions issued by the military departments relative to the preparation of DD Form 1354 are applicable to this revised form to the extent that the various items and columns on the superseded forms have been retained. The military departments may promulgate additional instructions, as appropriate.

For detailed instructions on how to fill out this form, please refer to Unified Facilities Criteria (UFC) 1-300-08, dated 16 April 2009 or later.

SPECIFIC DATA ITEMS.

1. From. Name of the transferring agency.

2. Date Prepared. Date of actual preparation. Enter all dates in YYYYMMDD format (Example: March 31, 2010 = 20100331).

3. Project/Job Number. Project number on a DD Form 1391 or Individual Job Order Number.

4. Serial Number. Sequential serial number assigned by the preparing organization (e.g., 2010-0001).

5. To. Name and address of the receiving installation, activity, and Service of the Real Property Accountable Officer (RPAO).

6. RPSUID/SITENAME/INSTCODE/INSTNAME. Site Unique Identifier and name or installation code and name where the constructed facility is located.

7. Contract Number(s). Contract number(s) for this project.

7a. Placed-In-Service Date. RPA Placed In Service Date. This is the date the asset is actually placed-in-service.

8. Transaction Details.

a. Method of Transaction. Mark (X) as many boxes as apply.
b. When/Event. When or event causing preparation of DD Form 1354. X only one box.
c. Type. Draft, interim, or final DD Form 1354. X only one box.

9. Item Number. Use a separate item number for each facility, no item number for additional usages.

10a. Facility Number. Assigned in accordance with the Installation/Base Master Numbering Plan.

10b. RPUID. Identified in Real Property Inventory.

11. Category Code. The category code describes the facility usage.

12. Catcode Description. The category code name which describes the facility usage.

13. Type. Type of construction: P for Permanent; S for Semi- permanent; T for Temporary.

14. Sustainability Code. Reports whether or not an asset meets the sustainability guidelines set forth in Section 2(g) of Executive Order 13514. Valid values are: 1 (asset meets the guidelines); 2 (asset does not meet the guidelines); 3 (asset not evaluated); 4 (asset not subject to guidelines).

15. Area: UM 1. Area unit of measure; use the unit of measure associated with the category code selected in 11.

16. Total Quantity UM 1. The total area for the measure identified in Item 15. Use negative numbers for demolition.

17. Other: UM 2. Unit of Measure 2 is the capacity or other measurement unit (e.g., LF, MB, EA, etc.).

18. Total Quantity UM 2. The total capacity/other for the measure identified in Item 17.

19. Cost. Cost for each facility; for capital improvements to existing facilities, show amount of increase only. If there is no increase for the capital improvement, enter N/A.

20. Fund Source. Enter the Fund Source Code for this item.

21. Funding Organization. Enter the code for the organization responsible for acquiring this facility.

22. Interest Code. Enter the code that reflects government interest or ownership in the facility.

23. Item Remarks. Remarks pertaining only to the item number identified in Item 9; show cost sharing.

24. Statement of Completion. Typed name, signature, title, and date of signature by the responsible transferring individual or agent.

25. Accepted By. Typed name, signature, title, and date of signature by the RPAO or accepting official.

26. Property Voucher Number. Next sequential number assigned by the RPAO in voucher register.

27. Construction Deficiencies. List construction deficiencies in project during contractor turnover inspection.

28. Project Remarks. Project level remarks and continuation of blocks.

Department of the Army
United States Army Garrison
Redstone Arsenal, AL 35898-5000
RECORD OF ENVIRONMENTAL CONSIDERATION
Control Number: **1137-15_D**

Job Order Request Number: 2014335-2

1. Title: Demolition of Facility 7352

2. Description of Proposed Action:
On May 5, 2010, Facility 7352 was severely damaged when an explosion occurred due to a mission-related accident that occurred while employees were working on demilitarization operations involving ammonia perchlorate and an oxidizer used in solid rocket propellant. The facility sustained severe structural damage throughout. More than half of the facility was completely destroyed/leveled and only a portion of the facility remains. The remaining portion is structurally unsound. As it stands now, the facility is uninhabitable and beyond any repair, with demolition being the only viable option.

This structure will be demolished by heavy machinery and debris transported by covered dump trucks to the Redstone Arsenal landfill for disposal. Fill dirt will be placed around the site following debris disposal, to be graded, compacted, hayed, and seeded. If a structure contains contaminated material or asbestos containing material, demolition and disposal will be completed according to State and Federal regulatory requirements. Ground disturbance will not exceed 0.25 acre within the limits of disturbance. The location of the structure planned for demolition is included as Appendix B.

Amendment 24 Jul 2019:
Building 7352 contains a lead floor. Prior to demolition, Building 7352 will be flash burned for one hour at 650 degrees F to get rid of explosive residue. Hay and wood will be used in the burning of the building.

3. Anticipated date of Proposed Action: 27 Jul 2019

4. It has been determined that this action:
   a. is supported by the existing Environmental Assessment: ____; Environmental Impact Statement: _____; Title and date of document:

   b. Proposed Action is exempt from the requirements of the National Environmental Policy Act: Yes ____ No __X__

   c. Similarity to actions previously examined and found to meet the criteria for using a Record of Environmental Consideration: This action is similar to actions previously examined and found to meet the criteria for using a Record of Environmental Consideration

Record of Environmental Consideration (Continued)
Control Number: 1137-15_C

5. Coordination with other agencies (List agencies if any):
Directorate of Public Works
Environmental Management Division

6. Environmental impact/impacts of Proposed Action: see Appendix A.

7. Site location map (8 1/2" BY 11") of the proposed project: see Appendix B.

8. Conclusion: This action has been evaluated in accordance with **Part II 32 Code of Federal Regulation 651 Section 651.29**. It has been determined that this action does not individually or cumulatively have a significant effect on the human environment. No extraordinary circumstances exist as defined in **Section 651.29 Paragraph (b)(1) through (14)**. There will be no environmentally controversial changes to existing environmental conditions. There are no circumstances which would require an Environmental Assessment or an Environmental Impact Statement under the National Environmental Policy Act. This action qualifies as (a) Categorical Exclusion(s) found in **Appendix B to Part 651 Section II ____(c)(2)___** per Part II 32 Code of Federal Regulation Part 651, and meets the screening criteria in **Section 651.29 (a) through (e)**.

9. Categorical Exclusion(s):
(c) **Construction and demolition:**
(2) Demolition of non-historic buildings, structures, or other improvements and disposal of debris there from, or removal of a part thereof for disposal, in accordance with applicable regulations, including those regulations applying to removal of asbestos, polychlorinated biphenyls, lead-based paint, and other special hazard items (Record of Environmental Consideration required).

10. How this Record of Environmental Consideration meets the Screening Criteria:
The action is not segmented. There are no extraordinary circumstances. One (or more) Categorical Exclusion(s) encompasses the proposed action.

11. This document and compliance with the National Environmental Policy Act **does not** relieve the proponent of compliance with applicable Federal and State Laws and Regulations.

12. **Legal Requirements**: The Record of Environmental Consideration for "Demolition of Facility 7352" has been reviewed and released by the Environmental Management Division, contingent on the implementation of the noted legal requirements. Any changes to the scope of work must be reviewed by the Environmental Management Division prior to the start of construction. The Environmental Management Division may inspect the project to ensure that these legal requirements are adhered to. Contact Valerie Mason (256-876-1899) for any questions concerning this Record of Environmental Consideration.

a. The current material handling and disposal requirements in accordance with Environmental Protection Agency regulations have been condensed into a Letter of Instruction for the operational requirements, handling, and disposal of all demolition materials. This Letter of Instruction is included as Appendix C.

b. The lead floor will be recycled.

c. All structure demolition project require submission of a standard ADEM notification form whether or not asbestos containing material is present. ADEM requires at least 10 weekdays advance notice prior to initiation of work on demolitions or renovations. Use ADEM Form 496.

   There are no records from the 2011 Asbestos Survey indicating this building contains/contained asbestos. Because this is a demolition project, it would be in the best interest of the demolition contractor to test any questionable materials before starting demolition.

   If any work is done that deals with asbestos containing materials, it should be done in compliance with all Applicable Asbestos Regulations:
   OSHA Regulations: 29 CFR 1910.1001 (General Industry) and 29 CFR 1926.1101 (Construction Industry)
   EPA Regulations: 40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and 40 CFR 61 - National Emission Standards for Hazardous Air Pollutants (NESHAP).

   For further information or to arrange for sampling and analysis of suspect asbestos containing materials contact Austin York, 256-876-9877, (austin.s.york.civ@mail.mil).

d. “Open Burning" shall mean the burning of any matter in such a manner that the products of combustion resulting from the burning are emitted directly into the ambient air without passing through an adequate stack, duct, or chimney.

   Pursuant to ADEM Rule below addressing open burning, this project is authorized to continue if one of the below criteria are met;

   335-3-3-.01 Open Burning.

   (1) No person shall ignite, cause to be ignited, permit to be ignited, or maintain any open fire except as follows:

   (c) Fires to abate a fire hazard, providing the hazard is so declared by the fire department or fire district having jurisdiction;

   (e) Fires for training personnel in the methods of fighting fires, provided that all requirements of ADEM Admin. Code r. 335-3-11-.02(12) are met; ADEM Admin. Code r. 335-3-11-.02(12)-Asbestos Rule

   (f) Fires for the disposal of dangerous materials where there is no practical alternate method of disposal and burning is approved by the Director;

e. Solid Waste Disposal/Diversion Practices shall apply to all construction and demolition activities at Redstone Arsenal. Contract specifications shall require at least 50 percent diversion (by weight) of demolished building materials such as wood, plumbing fixtures, electrical materials (lights and panels), windows, doors, toilet partitions, heating, ventilation and air conditioning equipment and scrap metal be diverted from the landfill. Quantities of materials diverted from landfill disposal must be reported to the Environmental Management Division. The Redstone Arsenal Landfill reuses/recycles concrete, asphalt, soil and wood (unless contamination or conditions prohibit it). Scrap metal shall be placed in receptacles for recycling. Contractors shall supply scrap metal receptacles. Contact the Environmental Management Division, building 4488, A-323, 256-842-1426. Aleah.m.bridges.civ@mail.mil with all data and any questions.

f. This project lies within an area with an Unexploded Ordnance (UXO) Probability of Low – In accordance with the Redstone Arsenal (RSA) Explosive Safety Management Program, an area where the UXO probability is “Low” requires that at a minimum UXO support be “on-call” during intrusive digging operations. If Explosive Ordnance Disposal (EOD) support is required on RSA or a UXO is discovered on RSA, contact the AMCOM UXO Safety Officer (UXOSO) at 256-842-4253 during normal business hours. For after-hours contact 256-945-0293. The AMCOM UXOSO will gather pertinent information, and follow the UXO, Suspect/Unsafe Ammunition Response, Assessment, and Demolition Process Change 1 (Appendix I).

The location and type of all discovered UXOs shall be reported to the USAG-R Master Planning for recording in the required database.

g. Contractors must complete material certification and delivery ticket forms if debris from this project are to go the Redstone Construction and Demolition Landfill. For further information contact 256-955-8230.

a. This project lies within environmental investigation site RSA-311. An Installation Restoration Program Work Plan Checklist has been prepared, is attached to this Record of Environmental Consideration (Appendix D), and must be included (in its entirety) in the Scope of Work for this project. The job site foreman must have this Installation Restoration Checklist and attached map showing boundary of site RSA-311 when at the job site. All workers must be informed of the contingencies listed in the Checklist and informed of the site description. Contact the Installation Branch at (256) 842-0314 one week prior to start work. This project may be inspected for regulatory compliance.
   i. According to the Revision 2 RCRA Facility Investigation (RFI) report conducted for RSA-311, no contaminants at or above risk levels have been identified in the surface and subsurface soils.
   ii. If groundwater seeps into an excavation, stop work immediately and contact the Installation Restoration
   iii. Branch for additional guidance at (256) 603-1945 or (256) 651-0574. Groundwater is not suitable for drinking water purposes. Do not pump the groundwater from the disturbed area. The groundwater must be collected and sampled before disposal.
   iv. Erosion controls are required for excavated soil.
   v. Personnel must take precautions to avoid disturbing the groundwater monitoring wells within the project footprint.
   vi. The proponent must secure 24-hour UXO On-Call construction support to be provided by Munitions and Explosives of Concern (MEC) qualified personnel. Notify the AMCOM Safety Office at (256) 842-3243 (Brad Champion).
   vii. Demolish the sump structures located within the footprint of the project and backfill the holes left by their removal.
   viii. Stop the project if an excavation exposes UXO or an unidentifiable anomaly and call the 24-hour UXO On-Call construction support, the Installation Restoration Branch (Jason Watson) at (256) 842-1448 or (256) 361-8399, and the AMCOM Safety Office (Brad Champion) at (256) 842-3243.

h. The proposed action lies within the 100-year floodplain. Executive Order 11988 requires any agency supporting actions within a 100-year floodplain to consider alternatives that would not affect floodplains. This action may require a Finding of No Practicable Alternative to be prepared by the agency and approved by the head of the agency. Since the US Army is supporting this action, the Finding shall be approved by the Deputy Assistant Secretary of the Army.

Legal counsel has advised that a FNPA will not be required for this action due to unacceptable risks associated with life and safety and further environmental contamination.

i. The contractor is required to follow a Construction Best Management Practices Plan for erosion and sediment control in order to control the impact of erosion, sedimentation and other pollutants on receiving waters, both during and after demolition of building 7352. The Alabama Handbook for Erosion and Sediment Control published by the Alabama Soil and Water Conservation Committee provides information to assist with the development of plans and the design of best management practices. It is available for review at:

   https://alconservationdistricts.gov/resources/erosion-and-sediment-contro

   Multiple best management practices may need to be implemented to provide adequate erosion and sediment control protection. Best Management Practices are guidelines and techniques that, when used properly, can eliminate or help reduce water pollution.

   Ensure the following best management practices are implemented:

   i. All disturbed soil areas will be protected with silt fences; the contractor will utilize silt fence barriers to contain all topsoil materials within its pre demolition site. Storm drain inlet/outlet protection such as filter fabric, gravel bags or hay bales needs to be implemented as required by the Construction Best Management Practices Plan for construction site storm water runoff control. Upon completion of the project, these items will be removed and properly discarded and the remaining ground cover will then be returned to its original condition and sodden to match existing indigenous material.

   ii. Runoff from the project site should be free of excessive sediments and other constituents during demolition since activities are constantly changing site conditions. The contractor must ensure that existing water quality is protected.

   iii. Soil stabilization practices shall be designed to preserve existing vegetation where feasible and to revegetate open areas as soon as feasible after disturbance. These control practices shall include temporary seeding, permanent seeding, mulching or other soil stabilization practices in order to prevent erosion or sediment runoff from happening.

   iv. Trash disposal must be properly handled throughout the operation in accordance with all applicable laws. Fuel, lubricants and other toxic chemicals must never be drained into the soil. Food and drink containers, discarded equipment parts, and used fluids must be properly removed and disposed of. Trash and debris will be removed daily.

   v. All dump trucks hauling demolition debris shall be covered by a tarp or other cover in a matter that will prevent the load or any part of the load from falling from the dump truck.

   vi. Ensure all disturbed soil areas are backfilled, compacted, leveled, dressed, seeded and stabilized upon successful completion of the demolition site.

vii. The nearest water body or impoundments of waters is approximately 0.3 miles away, according to GIS data. Based on this finding, the burning metal structure action will not cause a discharge to surface waters of the state. However, here are my recommendations:

- Apply minimum amount of water to extinguish the fire or let the fire burn itself out. By doing so, it will most likely decrease the amount of pollutants into the soil or groundwater.
- Ensure the burned area is revegetated as soon as practical after the fire, in order to reduce sediment runoff from the impacted site. A ground cover needs to be remained on the soil as soon as possible.
- Oil and fuel for vehicles and equipment must also be carefully checked. Spills, and leaks are potential sources of soil and water contamination if improperly managed.

viii. Furthermore, ensure the impacted site is free of debris and the discarded materials are taken to Redstone Construction and Demolition Landfill for proper disposal, unless otherwise specified in this Record of Environmental Consideration.

I have read the required legal requirements presented in this Record of Environmental Consideration and understand these requirements. I will ensure that these legal requirements are provided to the appropriate parties for inclusion into associated contractual documentation.

Jeremy Jackson
Signature

7/25/19
Date

Jeremy Jackson
Printed Name

Project Manager
Title

Record of Environmental Consideration (Continued)
Control Number: 1137-15_D

Proponent:

Ruby Hamm
(Signature)

Date: 7/25/19

(Title)

(Office Symbol)

Date:

Prepared by:

Concurrences:

Redstone Arsenal Environmental Office Review

A. Guilliams
ALLISON GUILLIAMS,
National Environmental Policy Act Coordinator

Date: 7/25/19

Tom Richardson
TOM RICHARDSON, Chief
Cultural/Natural Resources Branch

Date: 7/25/19

Clint Howard
CLINT HOWARD, Chief
Installation Restoration Branch

Date: 7/25/19

a-Keith Cook
for MIKE STIERWALT, Chief
Installation Compliance Branch

Date: 7/25/19

Approved by:

a-Keith Cook
A. KEITH COOK
Chief, Environmental Management Division
Directorate of Public Works
IMRE-PWE

Date: 7/25/19

Appendix A

Environmental Quality Considerations Checklist

1. Does proposal conform to Installation Master Plan? Yes _X_ No__

2. Would the proposed project alter Land Use on the Installation? Yes __ No_X_

3. Describe project activities that could possibly affect environmental resources on the Installation, including archaeological and/or cultural resources and the qualities of air, land, and water (i.e. clearing, digging, or leveling). These actions must be coordinated with the Redstone Arsenal Environmental Office.
Description:
Digging, leveling

4. Prior use and condition of the property and/or equipment involved: Damaged structure beyond economical repair

5. Proposed use of the property, equipment, and/or completed project: Open ground for development

6. Will borrow material be utilized for this project? If so, where will it be obtained? Yes, regulated borrow pit

7. Will there be spoils as a result of this project? If so, how will it be disposed? No

Record of Environmental Consideration (Continued)
Control Number: 1137-15_D

8. Areas of potential Environmental Impact during implementation of project (i.e., construction phase, equipment placement/replacement phase, etc.) of proposed action. 1=improvement, 2=no change, 3=minor adverse impact, 4=moderate adverse impact, 5=major adverse impact:

a. Potential to cause air pollution.	1 2 **3** 4 5
b. Potential to cause water pollution.	1 2 **3** 4 5
c. Potential to impact on the quality or quantity of groundwater.	1 **2** 3 4 5
d. Potential to affect wetlands, floodplain, wild and scenic rivers.	1 2 **3** 4 5
e. Potential for discharge or release of hazardous substance.	1 2 **3** 4 5
f. Potential to cause soil contamination.	1 2 **3** 4 5
g. Potential to violate a safety, public health, or noise standard.	1 **2** 3 4 5
h. Potential to impact on protected species or their habitat.	1 2 **3** 4 5
i. Potential to affect cultural resources that are either on or eligible for the National Register, or unstudied.	1 **2** 3 4 5
j. Potential effects upon labor force.	1 **2** 3 4 5
k. Potential to impact upon recreational areas and/or prime farmland.	1 **2** 3 4 5
l. Potential to affect energy demand.	1 **2** 3 4 5
m. Potential environmental controversy involved with project:	
(1) Local	Yes __ No_X_
(2) National	Yes __ No_X_
n. Potential to violate Federal, State, or local law/regulation designed to control air pollution.	Yes __ No_X_
o. Potential to violate Federal, State or local law/regulation designed to control water pollution.	Yes __ No_X_
p. Potential involvement with contaminated areas and/or material.	Yes _X_ No__

Record of Environmental Consideration (Continued)
Control Number: 1137-15_D

9. Areas of potential Environmental Impact during operation phase of proposed action. 1=improvement, 2=no change, 3=minor adverse impact, 4=moderate adverse impact, 5=major adverse impact:

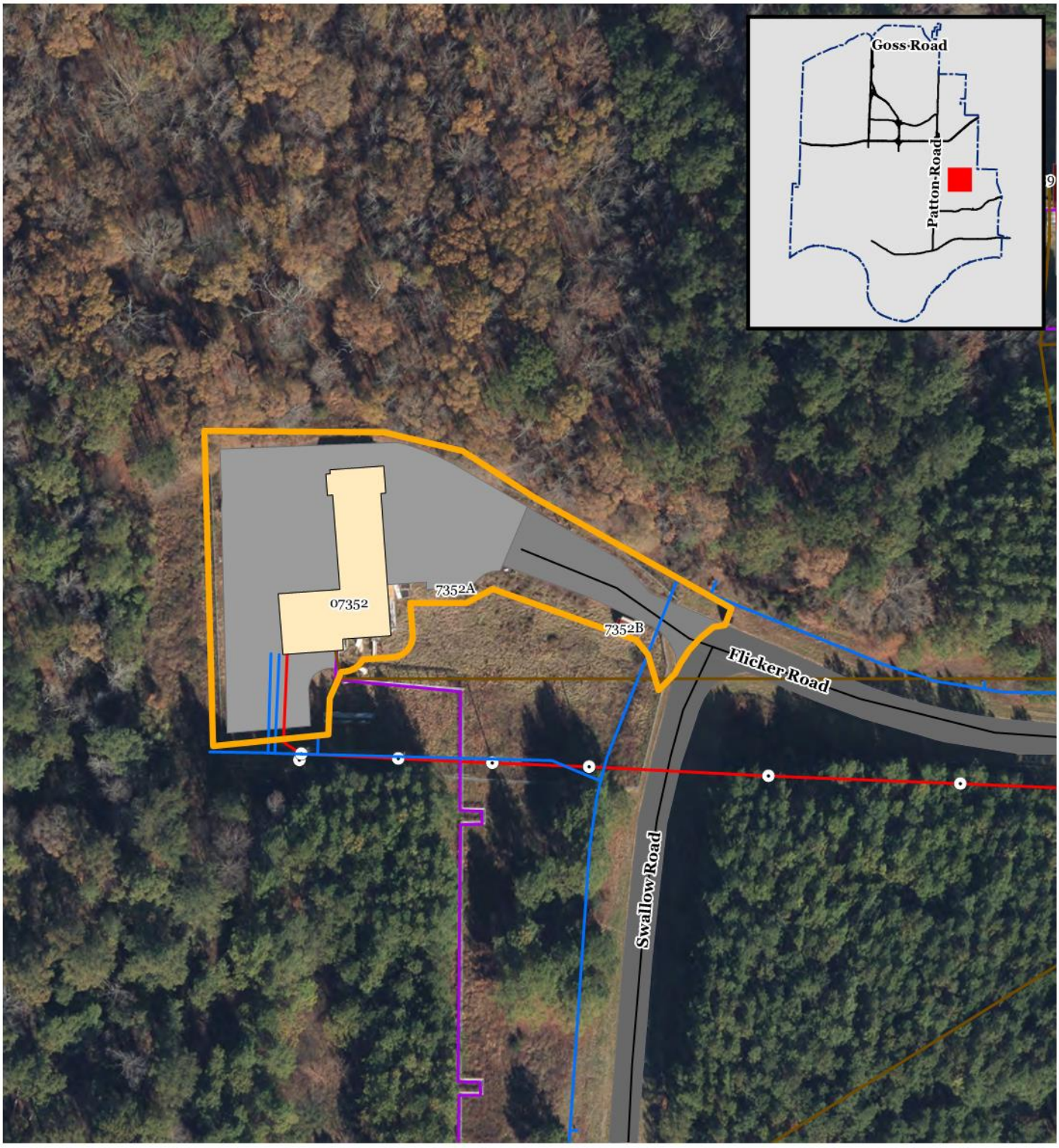
a.	Potential to cause air pollution.	1 **2** 3 4 5
b.	Potential to cause water pollution.	1 **2** 3 4 5
c.	Potential to impact on the quality or quantity of groundwater.	1 **2** 3 4 5
d.	Potential to affect wetlands, floodplain, wild and scenic rivers.	1 **2** 3 4 5
e.	Potential for discharge or release of hazardous substance.	1 **2** 3 4 5
f.	Potential to cause soil contamination.	1 **2** 3 4 5
g.	Potential to violate a safety, public health, or noise standard.	1 **2** 3 4 5
h.	Potential to impact on protected species or their habitat.	1 **2** 3 4 5
i.	Potential to affect cultural resources that are either on or eligible for the National Register, or unstudied.	1 **2** 3 4 5
j.	Potential effects upon labor force.	1 **2** 3 4 5
k.	Potential to impact upon recreational areas and/or prime farmland.	1 **2** 3 4 5
l.	Potential to affect energy demand.	1 **2** 3 4 5
m.	Potential environmental controversy involved with project:	
	(1) Local	Yes __ No_X_
	(2) National	Yes __ No_X_
n.	Potential to violate Federal, State, or local law/regulation designed to control air pollution.	Yes __ No_X_
o.	Potential to violate Federal, State or local law/regulation designed to control water pollution.	Yes __ No_X_
p.	Potential involvement with contaminated areas and/or material.	Yes __ No_X_

Appendix B

Site Maps
Job Order Request

7352

5464 Sqft.



Legend

- DEMO Buildings
- Demo Buffer
- Water Line
- Wastewater Line
- Steam Line
- Natural Gas Line
- Utility Pole
- Electrical Line
- Other Buildings

N W E S

100 50 0 100 Feet

4/30/2015

Environmental INFORMATION

TRACKING NUMBER: 2014335 - 2

CUSTOMER ID: U.S. Army Garrison Engineering **DATE SUBMITTED:** 12/1/2014 **COST CTR:** 2L32
FACILITY/BLDG #: 07352 **NON-BLDG INFO:**
UIC: NONE **UIC EXT:** NONE
POC: Rick Cooper **PHONE:** 313-3287 **EMAIL:** rickey.l.cooper6.civ@mail.mil
REQUESTOR: Art Cole(DPW Engineering) **PHONE:** 842-0233 **EMAIL:** arthur.j.cole4.civ@mail.mil
SHORT DESC: Demo Facility 7352
DETAIL DESC: Demo 7352 to include pads and above and below ground utilities. Facility is the AMRDEC building that was damaged in the explosion of 2010.
JUSTIFICATION: Facility no longer serves a valid mission and was damaged by explosion beyond repair.
JON: **TYPE FUNDS:** NONE **AMS CODE:** TBD
FY DES: **YEAR RANK:** **SYSTEM RANK:**
MOA: MPA **ISR RATING:** None **TYPE SYSTEM:** None

ROUTING	DEPT	ACTION	STATUS	EST/ FUNDED AMT	ACTUAL COST	RECEIVED DATE (8/25/2004)	SCHEDULE RELEASE DATE (8/25/2004)	RELEASED TO	RELEASED DATE (8/25/2004)
1	ENV	EV	INPRG			5/4/2015		NONE	

REVIEW DATE	REQUIREMENT	REQUIRED	STATUS	STATUS DATE	JOURNAL NOTES	ATTACHMENTS
	HAZARD ANALYSIS	NONE	NONE		NONE	NONE
	REC	NONE	NONE		NONE	NONE
	EA	NONE	NONE		NONE	NONE
	SHIPO	NONE	NONE		NONE	NONE
	CONSTRUCTION PERMIT	NONE	NONE		NONE	NONE
	AIR PERMIT	NONE	NONE		NONE	NONE
	AGENCY COORDINATION	NONE	NONE		NONE	NONE

ASSIGNED TO: **ASSIGNED DATE:** (8/25/2004) **COMPLETED DATE:** (8/25/2004) **ADD NEW ASSIGNEE:**

Appendix C

Letter of Instruction – Guidance on Demolition on Redstone Arsenal

15 AUG 2012

IMRE-PWE

MEMORANDUM FOR Engineering Division (IMRE-PWF) and Business Operations/Integration (IMRE-PWB)

SUBJECT: Letter of Instruction - Guidance on Demolition on Redstone Arsenal

1. To provide specific guidance on the handling and disposal of materials during and resulting from the demolition of buildings and other structures on Redstone Arsenal. All demolition will follow the guidance in order to ensure worker safety, community safety and proper disposition of all materials resulting from demolition actions (encl).

2. Any questions regarding the following requirements contained in this Letter of Instruction may be addressed to the Directorate of Public Works, Environmental Management Division, building 4488, room A-323, 256-876-6122.

3. My point of contact is Mr. Michael Stierwalt, Environmental Management Division, 256-955-8505 or email michael.j.stierwalt.civ@mail.mil.

Encl

JOE L. DAVIS
Director
Directorate of Public Works

APPENDIX A

1.0 National Environmental Policy Act, 40 CFR 1500-1508.

Demolition contractors shall not initiate demolition until the contractor receives guidance from the Environmental Management Division that contains the following information:

a. Mitigations necessary to proceed with actions.

b. Checklist for the proposed work on each Comprehensive Environmental Response Compensation and Liability Act site (where applicable).

c. The Environmental Management Division Letter of Instruction for the operational requirements, handling and disposal of all demolition materials.

2.0 Polychlorinated Biphenyls, 40 CFR 761.60(b)(2).

Old Fluorescent Lighting Systems Manufactured Through 1979: If the old lighting system consists of fluorescent lights, there is a possibility the ballasts could contain polychlorinated biphenyls. Light ballasts are the primary electric components of fluorescent light fixtures and are generally located within the fixture under a metal cover plate. The ballast units are generally composed of a transformer to reduce the incoming voltage, a small capacitor (which may contain 1 to 1 1/2 ounces of polychlorinated biphenyls) and possibly a thermal cut-off switch and/or safety fuse. All ballasts manufactured through 1979 contain polychlorinated biphenyls. Ballasts manufactured after 1979 do not contain polychlorinated biphenyls and should be labeled "No polychlorinated biphenyls". If the ballasts are not labeled, you must assume they contain polychlorinated biphenyls. These polychlorinated biphenyl ballasts should be disposed by the contractor per Alabama Department of Environmental Management and Environmental Protection Agency regulations. If the ballasts are labeled "No polychlorinated biphenyls" they can be discarded as normal trash.

3.0 Asbestos, 40 CFR, Part 61.

All building demolitions are subject to the requirements of 40 CFR 61. In order to determine which provisions of this regulation apply, a thorough inspection of the project building must be completed to locate, identify and quantify all friable and non-friable Asbestos Containing Material, prior to commencement of any demolition operation.

The two requirements that apply to demolition operations are “notification” and “emission control”. If the total quantity of Asbestos Containing Material in the building is less than the minimum standards set by 40 CFR 61, then only the notification requirements apply. If the total quantity meets or exceeds the standards, then both the notification and emission control requirements must be met.

a. The notification requirement consists of the completion and mailing of specified information as detailed by the regulation. This requirement can be met by use of the standard Alabama Department of Environmental Management form. Copies of all notifications need to be furnished to the Environmental Management Division also. Forms are available from http://www.adem.state.al.us/DeptForms (form 496).

b. Procedures for emission control: Remove all asbestos in accordance with all applicable Occupational Safety and Health Administration requirements (29 CFR 1910 and 1926) prior to any demolition.

4.0 Lead-Based Paint, Alabama Department of Environmental Management Regulation 335-13-4-.26(3).

a. Buildings constructed prior to 1978 are presumed to have lead-based paint.

b. Materials painted with lead-based paint may be taken to the Redstone landfill only if representative sample passed the Toxicity Characteristic Leachate Procedure for lead..

c. Lead-based paint removed from structures prior to disposal must be disposed of as hazardous waste.

5.0 Recycling Construction/Demolition Materials, Department of Army Memorandum, Sustainable Management of Waste in Military Construction, Renovation and Demolition Activities, 6 February 2006.

Solid Waste Disposal/Diversion Practices shall apply to all construction and demolition activities at Redstone Arsenal. Contract specifications shall require at least 50 percent diversion (by weight) of demolished building materials such as wood, plumbing fixtures, electrical materials (lights and panels), windows, doors, toilet partitions, heating, ventilation and air conditioning equipment and scrap metal be diverted from the landfill. Contractors must submit a Construction and Demolition Management Plan that meets this minimum diversion goal. The Construction and Demolition Management Plan will be submitted to Environmental Management Division and quantities of materials diverted from landfill disposal will also be reported to the Environmental Management Division. The Redstone Arsenal Landfill reuses/recycles concrete, asphalt, soil and wood (unless contamination or conditions prohibit it). Scrap metal shall be placed in receptacles for recycling. Contractors shall supply scrap metal receptacles. Contact the Environmental Management Division, building 4488, room A-323, 256-955-8501 or 256-876-6122.

6.0 Landfill, Alabama Department of Environmental Management Regulation 335-13-1-.03, Executive Order 13423 (2007).

Redstone Arsenal operates a construction and demolition landfill permitted to accept asbestos. Asbestos will be disposed in the construction and demolition landfill. Loads of non-hazardous, non-contaminated debris will be accepted with the completion of a Material Certification sheet and a delivery ticket for each load. Contact the Environmental Management Division, building 4488, room A-323 256-955-7435 or 256-876-6122.

7.0 Hazardous Waste, Alabama Department of Environmental Management Regulation 335-14-3.

The contractor is responsible for proper disposal of the hazardous waste per Alabama Department of Environmental Management and Environmental Protection Agency regulations. Shipment of all waste requiring a hazardous waste manifest must be coordinated with Environmental Management Division personnel. Contact the Environmental Management Division, building 4488, room A-323, 256-955-7435 or 256-876-6122.

Appendix D

Installation Restoration Checklist

IRP/MMRP Work Plan Evaluation Checklist

Installation Restoration (IR) Program, RSA Reg. 200-7, Appendix C, (Non-IM/SR/CMI)

Site / Activity Information		IRP Tracking: IR1027-19
Environmental Site Number: RSA-311	DPW Tracking: 2014335-2	EMD Tracking: 1137-15 C
Title: Demolition of Building 7352		
Requestor: ART COLE	Point of Contact: Rick Cooper	
Office Symbol: DPW Engineering	Bldg. # or Area: 7352	
Phone: 313-3287	Email: rickey.l.cooper6.civ@mail.mil	

A Project Work Plan is required to be submitted through PWE for an environmental evaluation. The Installation Restoration Program may require other submittals before any job commences.

Required submittals if an IRP/MMRP site is affected:

☐ - Key Personnel List - Project Manager, Safety Officer, etc. ☐ - Project Safety and Health Plan

☑ - Project Work Plan ☐ - Other, Specify:

☐ COPIES OF REQUIRED SUBMITTALS SHALL BE FORWARDED TO IMRE-PWE-R BRANCH BEFORE JOB COMMENCES

Reviewer Certification / Recommendation

1. Based on my review of the data provided about the nature of the work to be performed this activity is:
   - ☐ - Approved, project is not on an identified site.
   - ☑ - Approved, contingent on the controls noted being implemented.
   - ☐ - Disapproved, contact the Installation Restoration Branch, 842-2836, for possible solutions and resubmit revised plan.
2. Regulatory oversight concurrence ☐ - is / ☑ - is not - recommended by ☑ - ADEM, ☑ - EPA.

Primary Reviewer Signature: James A. Sheehy, Garrison/Installation Restoration Program, 876-2129	Date: 16-Apr-19
Final Reviewer Signature: Larry E. Galloway, Garrison/Installation Restoration Program, 842-2850	Date: 16-Apr-19

Regulatory Agency Review

ADEM	EPA
Approved By:	Approved By:
☐ - Concur Date:	☐ Concur Date:
☐ - Do Not Concur	☐ - Do Not Concur
☐ - Conditional Concurrence (Specify:)	☐ - Conditional Concurrence (Specify:)

Special Instructions / Restrictions / Notes

*Prior to starting work, coordinate with the Installation Restoration Branch at (256) 603-1945 (Larry Galloway). An Installation Restoration Branch representative will need to be present at the construction kickoff meeting. Work is not permitted when the ground is easily rutted because of rainfall or a high water table.

SPECIAL INSTRUCTIONS:

1) This Installation Restoration (IR) Program (IRP/MMRP Work Plan Evaluation) Checklist must be included, in its entirety, in the Scope of Work for this project. The job site supervisor must have the IR Checklist and attached map for RCRA site RSA-311 when at the job site. All workers must be informed of the contingencies listed in the IR Checklist below and informed of the RCRA site description. Contact the IR Branch one week prior to starting work at (256) 842-0314. The IR Program reserves the right to inspect the project for regulatory compliance.

2) According to the Revision 2 RCRA Facility Investigation (RFI) report conducted for RSA-311, no contaminants at or above risk levels have been identified in the surface and subsurface soils.

3) If groundwater seeps into an excavation, stop work immediately and contact the Installation Restoration Branch for additional guidance at (256) 603-1945 or (256) 651-0574. Groundwater is not suitable for drinking water purposes. Do not pump the groundwater from the disturbed area. The groundwater must be collected and sampled before disposal.

4) Erosion controls are required for excavated soil.

5) Personnel must take precautions to avoid disturbing the groundwater monitoring wells within the project footprint.

6) The proponent must secure 24-hour UXO On-Call construction support to be provided by Munitions and Explosives of Concern (MEC) qualified personnel. Notify the AMCOM Safety Office at (256) 842-3243 (Brad

Champion).
7) Demolish the sump structures located within the footprint of the project and backfill the holes left by their removal.
8) Stop the project if an excavation exposes UXO or an unidentifiable anomaly and call the 24-hour UXO On-Call construction support, the Installation Restoration Branch (Jason Watson) at (256) 842-1448 or (256) 361-8399, and the AMCOM Safety Office (Brad Champion) at (256) 842-3243.

1. Worker Exposure Evaluation

Evaluation Goal: If IRP/MMRP site contaminants are present at levels in site media which pose a threat to worker health then the specific controls noted below must be implemented.

Concern	Recommended / Required Controls
a. Surface Soil Contaminants: ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - Dust Control Methods ☐ - Personal Protective Equipment (consistent with job / task hazard analysis) ☑ - Other, specify: According to the Revision 2 RCRA Facility Investigation (RFI) report conducted for RSA-311, no contaminants at or above risk levels have been identified in the surface and subsurface soils.
b. Subsurface Soil Contaminants: ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - No excavation below depth of ☐ - Control water entry into all excavations ☑ - Other, Specify: According to the Revision 2 RCRA Facility Investigation (RFI) report conducted for RSA-311, no contaminants at or above risk levels have been identified in the surface and subsurface soils.
c. Groundwater Contaminants: ☑ - Yes, controls required ☐ - No, N/A / no specific controls required	☑ - No excavations which exposes groundwater ☑ - No pumping / discharge of groundwater to surface without sampling and EMD approval for release ☐ - Other, Specify:
d. Other Media, specify (sediment, SW, etc.) ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - Exposure control for following media: ☐ - ☐ -

2. IRP/MMRP Contaminant Migration / Transport Evaluation

Evaluation Goal: If the activity involves work that might impact the rate or nature of IRP/MMRP contaminant migration or if the work will potentially transport site contaminants to other locations then the specific controls noted below must be implemented.

Concern	Recommended / Required Controls
a. Increased surface contaminant migration / transport ☑ - Yes, controls required ☐ - No, N/A / no specific controls required	☑ - Runoff control techniques ☑ - Drainage control techniques ☑ - Other, Specify: Erosion controls are required for excavated soil.
b. Increased subsurface contaminant migration / transport ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - No subsurface excavation ☐ - No disturbance of surface cover which would increase subsuface water infiltration / permeation, i.e. grade to drain ☐ - Other, Specify:
c. Increased migration / transport of other media contaminants ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - No changes in site drainage characteristics that would increase groundwater, sediment or other media contaminant migration / transportation ☐ - No ☐ - Other, Specify:

3. IRP/MMRP Investigation / Removal / Remediation Evaluation

Evaluation Goal: If the activity involves work that might impact the ability to conduct further site investigation, removal actions, or remedial efforts then the specific controls noted below must be implemented.

Concern	Recommended / Required Controls
a. Impaired ability to perform future investigative work (well placement, specimen collection, etc.) ☑ - Yes, controls required ☐ - No, N/A / no specific controls required	☐ - Relocation of proposed structures to maintain access or proposed future sampling locations ☐ - ☑ - Other, Specify: Personnel must take precautions to avoid disturbing the groundwater monitoring wells within the project footprint.
b. Potential for activity to result in additional contaminant releases which might complicate interpretation / future removal or remedial action ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - No future activity involving the following chemicals: ☐ - No buildings or utilities over areas identified on attached map ☐ - Other, Specify:
c. Impaired ability to conduct Interim Measures, Source Removal or Corrective Measure Implementation activities ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - No building over areas identified on attached map ☐ - Adjust project schedule to allow completion of Interim Measures, Source Removal or Corrective Measure Implementation activities completion ☐ - Other, Specify:
d. Impaired ability to conduct Removal Actions ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - No building over areas identified on attached map ☐ - No changes in site drainage characteristics ☐ - Other, Specify:

4. Activity Debris / Waste Evaluation

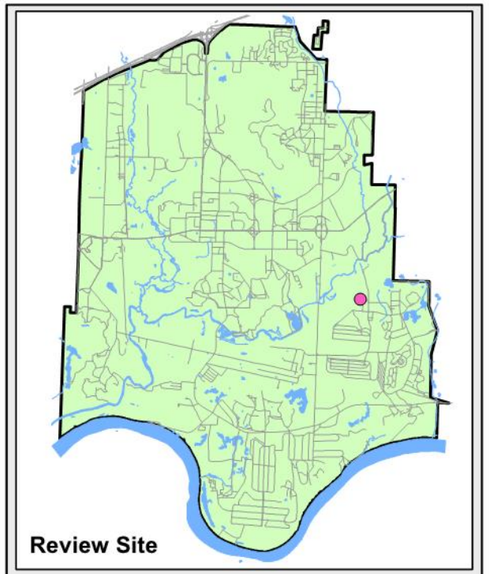
Evaluation Goal: If the activity involves work that might generate solid waste that might be hazardous waste due to the material being contaminated by IRP/MMRP release related contaminants then the specific controls noted below must be implemented.

Concern	Recommended / Required Controls
a. Building demolition / debris might contain IRP/MMRP contaminants that could be trasported off-site by the planned work ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - Do not remove specific types of debris noted below: ☐ - Collect specific media samples for analysis for the following contaminants: ☐ - Other, Specify:

b. IRP/MMRP contaminants might result in building demolition debris being classified as a regulated waste or might trip other special disposal requirements. ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - Disposal of the following debris in a permitted hazardous waste landfill: ☐ - Collect specific media samples for analysis for the following contaminants: ☐ - Other, Specify:
Concern	**Recommended / Required Controls**
c. Planned work might directly transport contaminated site media to other locations ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - No removal of the following media: ☐ - Decontamination of all tools, equipment, vehicles prior to leaving the site. ☐ - Other, Specify:
d. Planned work might generate waste media that might result in the media being classified as a regulated waste or might trip other special disposal requirements. ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - Analyze all transported site media for the following contaminants: ☐ - Dispose of the following media as indicated: ☐ - Other, Specify:
5. Special Hazards Evaluation	
Evaluation Goal: If the site has safety and health issues requiring special actions (Munitions and Explosives of Concern, to include Chemical Warfare Material/Agents) then the specific controls noted below must be implemented.	
Concern	**Recommended / Required Controls**
a. OE / UXO - Potential for Ordnance / Explosives or Unexploded Ordnance. ☑ - Yes, controls required ☐ - No, N/A / no specific controls required	☑ - UXO construction support required ☐ - UXO removal / clearance required prior to any work ☑ - Other, Specify: The proponent must secure 24-hour UXO On-Call construction support to be provided by Munitions and Explosives of Concern (MEC) qualified personnel. Notify the AMCOM Safety Office at (256) 842-3243 (Brad
b. CWM /CWA - Potential for chemical warfare material / chemical warfare agent. ☐ - Yes, controls required ☑ - No, N/A / no specific controls required	☐ - CWM / CWA removal / clearance required prior to any work ☐ - CWM / CWA real time monitoring required for all site activities ☐ - Other, Specify:
c. Other special hazards. ☑ - Yes, controls required ☐ - No, N/A / no specific controls required	☑ - Installation Wide Groundwater Land Use Controls Exist. ☐ - ☐ -

RSA-311
Building 7352
Demolition
1137-15_C
April 16, 2019

311-RS2789
311-RS2790
311-RS2398
311-RS2399
206N-RS2186
K136b-RS673
311-RS2396
311-RS2397
311-RS2636
RSA-311
RSA-311
7352
7352A
7352B
Flicker Road
Swallow Road
564
566
568



Legend

- Restoration Sign
- Road
- Gate
- Fence
- Drainage Feature
- Elevation Contour (2 ft)
- Building Footprint
- Work Order Site
- Environmental Restoration

UXO Probability

- Moderate/High
- Low
- None

Environmental Sample

- Other
- Hydropunch
- Groundwater
- Piezometer
- Soil

0 20 40 80 Feet

Environmental Management Division
US Army Garrison - Redstone
Redstone Arsenal, Alabama

March 2015 RGB Orthophotos - 3 Inch
Map Projection - Transverse Mercator
Horizontal Datum - North American Datum 1983
Grid Coordinate System - State Plane Alabama East
Planar Distance Units - U.S. Survey Feet

Prepared for the Installation Restoration Program (IRP) Prior to any work inside an IRP Environmental Investigation Site call (256) 842-0314 or (256) 651-0574.

Journal Notes

DPW Tracking No. 2014335-2 **ENV No.** 137-15_D

Date	Notes No.	Notes:
25-Jul-19	1	My original comment regarding building inspections for bats does not apply since the newly provided information states there is a human health and safety risk because of hazardous waste and explosive residue. Impacts to federally protected bats that may be roosting in the forested area surrounding Building 7352 will be negligible if the burn is conducted in atmospheric conditions that will promote uplifting of smoke and not drift. **Reviewer:** Easterwood, Christine **Branch:** CNR
25-Jul-19	2	I have reviewed this project and have found no significant environmental impacts in my area of expertise. **Reviewer:** Hicks, Gregory **Branch:** CNR
25-Jul-19	3	I have reviewed this project and have found no significant environmental impacts in my area of expertise. **Reviewer:** Hoksbergen, Ben **Branch:** CNR
25-Jul-19	4	I have no additional commments beyond what has been previously stated by others. **Reviewer:** Braxton, Jason **Branch:** ICP
25-Jul-19	5	Open Burning" shall mean the burning of any matter in such a manner that the products of combustion resulting from the burning are emitted directly into the ambient air without passing through an adequate stack, duct, or chimney. Pursuant to ADEM Rule below addressing open burning, this project is authorized to continue if one of the below criteria are met; 335-3-3-.01 Open Burning. (1) No person shall ignite, cause to be ignited, permit to be ignited, or maintain any open fire except as follows: (c) Fires to abate a fire hazard, providing the hazard is so declared by the fire department or fire district having jurisdiction; (e) Fires for training personnel in the methods of fighting fires, provided that all requirements of ADEM Admin. Code r. 335-3-11-.02(12) are met; ADEM Admin. Code r. 335-3-11-.02(12)-Asbestos Rule (f) Fires for the disposal of dangerous materials where there is no practical alternate method of disposal and burning is approved by the Director; Solid Waste Disposal/Diversion Practices shall apply to all construction and demolition activities at Redstone Arsenal. Contract specifications shall require at least 50 percent diversion (by weight) of demolished building materials such as wood, plumbing fixtures, electrical materials (lights and panels), windows, doors, toilet partitions, heating, ventilation and air conditioning equipment and scrap metal be diverted from the landfill. Quantities of materials diverted from landfill disposal must be reported to the Environmental Management Division. The Redstone Arsenal Landfill reuses/recycles concrete, asphalt, soil and wood (unless contamination or conditions prohibit it). Scrap metal shall be placed in receptacles for recycling. Contractors shall supply scrap metal receptacles. Contact the Environmental Management Division, building 4488, A-323, 256-842-1426. Aleah.m.bridges.civ@mail.mil with all data and any questions. **Reviewer:** Bridges, Aleah **Branch:** ICP
25-Jul-19	6	UXO Probability Low – In accordance with the RSA Explosive Safety Management Program, an area where the UXO probability is “Low” requires that at a minimum UXO support be “on-call” during intrusive digging operations. If Explosive Ordnance Disposal (EOD) support is required on RSA or a UXO is discovered on RSA, contact the AMCOM UXO Safety Officer (UXOSO) at 256-842-4253 during normal business hours. For after-hours contact 256-945-0293. The AMCOM UXOSO will gather pertinent information, and follow the UXO, Suspect/Unsafe Ammunition Response, Assessment, and Demolition Process Change 1 (Appendix I). The location and type of all discovered UXOs shall be reported to the USAG-R Master Planning for recording in the required database. **Reviewer:** Douglas, Lisa **Branch:** ICP

Journal Notes

DPW Tracking No. 2014335-2 **ENV No.** 137-15_D

Date	Notes No.	Notes:
25-Jul-19	7	Contractors must complete material certification and delivery ticket forms if debris from this project are to go the Redstone C and D Landfill. For further information, you may contact 256-955-8230

Reviewer: Hoge, Eric **Branch:** ICP

Journal Notes

DPW Tracking No. 2014335-2 **ENV No.** 137-15_D

Date	Notes No.	Notes:
25-Jul-19	8	The contractor is required to follow a Construction Best Management Practices Plan for erosion and sediment control in order to control the impact of erosion, sedimentation and other pollutants on receiving waters, both during and after demolition of building 7352. The Alabama Handbook for Erosion and Sediment Control published by the Alabama Soil and Water Conservation Committee provides information to assist with the development of plans and the design of best management practices. It is available for review at: https://alconservationdistricts.gov/resources/erosion-and-sediment-contro Multiple best management practices may need to be implemented to provide adequate erosion and sediment control protection. Best Management Practices are guidelines and techniques that, when used properly, can eliminate or help reduce water pollution. So, please ensure the following best management practices are implemented: All disturbed soil areas will be protected with silt fences; the contractor will utilize silt fence barriers to contain all topsoil materials within its pre demolition site. Storm drain inlet/outlet protection such as filter fabric, gravel bags or hay bales needs to be implemented as required by the Construction Best Management Practices Plan for construction site storm water runoff control. Upon completion of the project, these items will be removed and properly discarded and the remaining ground cover will then be returned to its original condition and sodden to match existing indigenous material. Runoff from the project site should be free of excessive sediments and other constituents during demolition since activities are constantly changing site conditions. The contractor must ensure that existing water quality is protected. Soil stabilization practices shall be designed to preserve existing vegetation where feasible and to revegetate open areas as soon as feasible after disturbance. These control practices shall include temporary seeding, permanent seeding, mulching or other soil stabilization practices in order to prevent erosion or sediment runoff from happening. Trash disposal must be properly handled throughout the operation in accordance with all applicable laws. Fuel, lubricants and other toxic chemicals must never be drained into the soil. Food and drink containers, discarded equipment parts, and used fluids must be properly removed and disposed of. Trash and debris will be removed daily. All dump trucks hauling demolition debris shall be covered by a tarp or other cover in a matter that will prevent the load or any part of the load from falling from the dump truck. Ensure all disturbed soil areas are backfilled, compacted, leveled, dressed, seeded and stabilized upon successful completion of the demolition site. Building 7352 was constructed in 1989 according to our records. Buildings are presumed to have lead- based paint, if they were built prior to 1978. Therefore, Lead-based paint is not suspected to be in the building. ***To project developers: I would recommend to plant two trees on site in memory of the two personnel who have lost their lives. ***The nearest water body or impoundments of waters is approximately 0.3 miles away, according to GIS data. Based on this finding, the burning metal structure action will not cause a discharge to surface waters of the state. However, here're my recommendations: 1. Apply minimum amount of water, to extinguish the fire. Or, you can let the fire burn itself out. By doing so, it will most likely decrease the amount of pollutants into the soil or groundwater. 2. Ensure the burned area is revegetated as soon as practical after the fire, in order to reduce sediment runoff from the impacted site. A ground cover needs to be remained on the soil as soon as possible. 3. Oil and fuel for vehicles and equipment must also be carefully checked. Spills, and leaks are potential sources of soil and water contamination if improperly managed. Furthermore, ensure the impacted site is free of debris and the discarded materials are taken to Redstone Construction & Demolition Landfill for proper disposal, unless otherwise specified in this Record of Environmental Consideration. **Reviewer:** Makkouk, Ramzi **Branch:** ICP

Journal Notes

DPW Tracking No. 2014335-2 **ENV No.** 137-15_D

Date	Notes No.	Notes:
25-Jul-19	9	The contingencies provided in the existing project checklist (IR1027-19) sufficiently cover the work proposed under the amendment.
		Reviewer: Sheehy, James **Branch:** IRP
25-Jul-19	10	Per Ricky Hammond the lead from the lead floor will be recycled. I have no issues with the project.
		Reviewer: Harris, Steven **Branch:** ICP
25-Jul-19	11	The proposed action lies within the 100-year floodplain. Executive Order 11988 requires any agency supporting actions within a 100-year floodplain to consider alternatives that would not affect floodplains. This action may require a Finding of No Practicable Alternative to be prepared by the agency and approved by the head of the agency. Since the US Army is supporting this action, the Finding shall be approved by the Deputy Assistant Secretary of the Army. Legal counsel has advised that a FNPA will not be required for this action due to unacceptable risks associated with life and safety and further environmental contamination. - TR
		Reviewer: Symonds, Jared **Branch:** CNR

APPENDIX H

NOTICE OF ENVIRONMENTAL USE RESTRICTION

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STATE OF ALABAMA

MADISON COUNTY

NOTICE OF ENVIRONMENTAL USE RESTRICTIONS

WHEREAS, this Notice is consistent with the provisions of the Alabama Department of Environmental Management (ADEM) Admin. Code r. 335-5-1-.02(3) and the Alabama Hazardous Wastes Management and Minimization Act (AHWMMA) Permit Number AL7 210 020 742 dated July 19, 2021; and,

WHEREAS, the UNITED STATES OF AMERICA is the owner of certain property under the jurisdiction of the Secretary of the Army ("Army") commonly referred to as RSA-311, located at Redstone Arsenal, Madison County, Alabama, attached hereto and incorporated herein by reference as though fully set forth (hereinafter referred to as "the Property"); and,

WHEREAS, this Notice is provided for information only and is not independently enforceable. This notice should not be construed to transfer, dispose of, or in any way alienate any real property interest held by the United States of America in the Property, and the filing of this Notice does not transfer, relinquish, or in any way create any real property interest in the Property; and,

WHEREAS, this Notice is advisory in nature and does not independently impose use restrictions on the Property. The use restrictions described herein are a part of the approved environmental corrective action prepared and proposed by the Army to ensure protection of human health and the environment by limiting exposure to chemicals of concern which remain on the Property after implementation of the approved corrective action; and,

WHEREAS, implementation of such environmental corrective actions has achieved, or is expected to achieve, risk-based clean-up levels deemed protective of human health and the environment based on certain use restrictions implemented for the Property to limit exposure to chemicals of concern; and,

WHEREAS, the purpose of this Notice is to promote protection of human health and the environment by giving notice of the restrictions identified as components of the environmental corrective actions described in Permit Number: AL7 210 020 742, Part VIII.C.; and,

WHEREAS, further information concerning the environmental corrective actions may beobtained by contacting:

Chief, Land Division
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, Alabama 36110
(334) 271-7700

NOW, THEREFORE, the Army hereby gives notice and declares that the land use restrictions as contained in the environmental corrective actions described in

Permit Number: AL7 210 020 742, Part VIII.C. and as described as follows are in place at the Property for the protection of human health and the environment:

1. Use restrictions.

    a. Potable use of groundwater is prohibited.

    b. Non-potable uses so that exposure to contaminated groundwater is prohibited.

    c. The installation of wells for drinking water is prohibited.

    d. All requests for the installation of wells for industrial or agricultural purposes will be subject to Army review and approval.

    e. Annual inspection and repairs (if needed) for land use control (LUC) signage will be performed.

    The Army has incorporated the above land use restrictions into its Installation Master Plan GIS database of record denoting the coordinates of the Land Use Control boundaries. The land use restrictions will be managed and maintained by the Site Access Control Program as well as the Record of Environmental Review Program for any land disturbance on the Installation. This database is the incorporated into the Redstone Arsenal Master Plan and utilized for all land constraint analysis and evaluation. All cleanup plans, decision documents, permits and other instruments relying upon or referencing this Notice shall include appropriate conditions requiring that this Notice remain in place for the duration of federal ownership. The continued approval of any remedy relying upon or referencing this Notice is conditioned upon the timely execution and filing of a covenant at the time the property is transferred to an owner that is not the federal government.

2. Modifications. These use restrictions continue in effect as long as required by AHWMMA Permit Number AL7 210 020 742. Where the conditions necessitating the restrictions have been appropriately remediated or no longer exist and ADEM has approved a modification or termination of the use restrictions in the Permit Number AL7 210 020 742 pursuant to the AHWMMA, this Notice may be modified or terminated consistent with such approval.

3. Conveyances out of Federal Control. If the Army conveys any of the Property to any entity or person that is not an agency, department, or instrumentality of the United States, the Army will assist any such non-federal entity with the development of an Environmental Covenant to be executed with ADEM approval and appropriately filed in the land records of Madison County, Alabama pursuant to § 35-19-1, Code of Alabama, as amended at the time of such conveyance.

4. Transfer of Jurisdiction to another Federal Agency. If the Property is transferred to another federal agency, these use restrictions shall remain in effect and are binding on

the recipient agency, unless this Notice is modified or terminated consistent with the Permit.

5. Other Regulations. Pursuant to ADEM Admin. Code r. 335-5-1-.02(3)(a)(1)(vi), other regulations applying to an environmental covenant shall apply to this Notice of Environmental Use Restrictions; and consistent with ADEM Admin. Code r. 335-5-1-.02(3) for property or sites that are owned by the federal government, which are unable to execute an environmental covenant, only the procedural regulations (e.g., those regulations that do not convey or acquire a real property interest) apply. However, nothing herein shall create, modify, or replace underlying legal requirements which establish or remove environmental use restrictions.

6. Filing. This Notice shall be recorded by the Army in the land records of Madison County, Alabama.

In Witness Thereof, this Notice of Environmental Use Restrictions is given by U.S. Army, Garrison Redstone, Alabama on this the_____day of_____, 20___.

By: _____

Title: _____

STATE OF ALABAMA

COUNTY OF MADISON

ACKNOWLEDGEMENT

I, the undersigned Notary Public in and for said County and State, hereby certify that _____, whose name is signed to the foregoing Notice, and who is known to me, acknowledged before me this day that, being informed of the contents of the Notice, he executed the same voluntarily on the day the same bears date.

Given under my hand and official seal the_____day of_____, 20___.

SEAL

_____
Notary Public

My commission expires: _____

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

This Notice of Land Use Restrictions has been approved by and registered with the AlabamaDepartment of Environmental Management this__day of_____, 20___.

By:_____

Chief, Land Division

Alabama Department of Environmental Management

ACKNOWLEDGEMENT

I, the undersigned Notary Public in and for said County and State, hereby certify that _____, whose name is signed to the foregoing Notice, and who is known to me, acknowledged before me this day that, being informed of the contents of the Notice, he executed the same voluntarily on the day the same bears date.

Given under my hand and official seal the_____day of_____, 20___.

SEAL

_____

Notary Public

My commission expires: _____

APPENDIX I

RESPONSE TO COMMENTS

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Responses to ADEM Review Comments
***Revision 1 Corrective Measure Implementation Plan RSA-311, Exterior Sumps and Interior Concrete Pits at Building 7352, Operable Unit 9*, dated July 19, 2024**
Redstone Arsenal

December 12, 2024

1. Page 3-3, Section 3.3, Corrective Measures Evaluation and Selection: ADEM recognizes the two (2) alternative remedies proposed in this CMIP. However, a third alternative proposing an active remedy should also be included and discussed in detail. This discussion should also contain rationale as to the dismissal or acceptance of that alternative. Please revise.

   Response: A third alternative (In Situ Enhanced Bioremediation, MNA, LTM, and LUCs) has been added in Section 3.3.1.3. Changes have been made globally in the CMIP to accommodate the addition of this third alternative.

2. Page 3-4, Section 3.3.2, Selection of Corrective Measures for RSA-311: The CMIP should be revised to reflect the following schedule for groundwater monitoring: quarterly monitoring should be conducted for the first year, followed by three (3) years of semi- annual monitoring. After the three (3) full years of semi-annual monitoring, the Army may request a permit modification to change to annual monitoring. ADEM will evaluate the request based on the sampling results presented in Annual Effectiveness Report. Please revise.

   Response: Section 3.3.2 has been revised as suggested. Changes have been made globally in the CMIP to accommodate the revised groundwater monitoring schedule.

3. Page 3-4, Section 3.3.2.2, Baseline Groundwater Sampling Event in Year 0: Additional information should be provided to support the flow of site groundwater to the northwest. A potentiometric map of RSA-311 demonstrating groundwater flow to the northwest should be included in the CMIP with the surface water flow map that has been provided. In addition, please cite the exact location within the RSA-146 RFI being referenced.
   Due to the statement in Section 1.5.3 that groundwater flow is to the northwest, additional wells will still be needed downgradient of the exceedances detected in well 311-RS2854 for monitoring.

   Response: As illustrated in left panel of Figure 3 (adapted from Figure 1-6 of the Rev 4 RSA-311 RFI Report [Aptim 2020]), groundwater flows toward northwest toward Huntsville Spring Branch across a larger scale RSA-146 area where RSA-311 is part of. Dye trace studies at RSA-146 also demonstrate an overall northwesterly groundwater flow as illustrated in right panel of Figure 3 (adapted from Figure 1-6 of the Rev 4 RSA-311 RFI Report [Aptim 2020]). Additional discussion has been added to Section 1.5.3.

   Given that downgradient of well 311-RS2854 is a wooded/wetland area (Figure 7), installation of additional wells there would likely encounter site access issues and thus would be difficult to implement. Because of the karstic nature of the site, constant exchange of surface water and groundwater would be expected at RSA-311. This was confirmed by a groundwater-wetland interaction investigation at a large scale at RSA-146 (CB&I, 2015). Analytical results from the springs and surface water samples thus would be indicative of the contaminant concentrations of the local shallow groundwater. Therefore, we recommend collecting samples from springs and surface water bodies in the northwestern area, as a more practicable alternative to installing new monitoring wells. In addition, although overall groundwater flow at a larger scale RSA-146 area where RSA-311 is part of is toward northwest, localized groundwater flow may vary at different times. For example, the interpreted groundwater flow direction based on the May 2014 and January 2016 potentiometric surface maps for the RSA-311 (Figures 4 and 5,

respectively) varied from northwest to southwest over this time, with an overall westerly flow south of the site and southwesterly flow north of the site. Based on this consideration, we propose to add RSP-1802, a spring location in the vicinity of well 311-RS2854, to the existing groundwater monitoring network, to monitor downgradient of the groundwater exceedances detected in this well.

Rev 2 Corrective Measure Implementation Plan RSA-311, Exterior Sumps and interior Concrete Pits at Building 7352, Operable Unit 9
U.S. Army Garrison-Redstone Arsenal, Madison County, Alabama
Dated December 2024

Responses to Comments dated January 7, 2025, from Redstone Arsenal.

Comment No.	Page/Section	RSA Comment	ECC Response
1	3-5, Sec 3.3.2.2	Does the spring sampling location (RSP-1802) address ADEMs comment 3. ADEM requested additional wells northwest of well 311-RS2854. RSP-1802 is west of 311-RS2854 as shown on figure 7, is there another spring sampling location that would better satisfy ADEMS request.	Springs RSP-1802 and RSP-1802a are the only two springs in the area, and they are to the west and southwest of well 311-RS2854, respectively. The interpreted groundwater flow direction based on the May 2014 and January 2016 potentiometric surface maps for RSA-311 (Figures 4 and 5) varied from northwest to southwest over this time, with an overall westerly flow south of the site and southwesterly flow north of the site. Based on this consideration, RSP-1802, a spring location in the vicinity of well 311-RS2854, should be added to the existing groundwater monitoring network. Samples from RSP-1802 would monitor downgradient of the groundwater exceedances detected in 311-RS2854 and address ADEM concerns.

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