Guerrero, Heather L

From: Pam G. Foti <PFoti@ecc.net>
Sent: Thursday, February 13, 2025 3:27 PM
To: Cobb, Stephen
Cc: Guerrero, Heather L; Jannett, Richard; Xanthos, George CIV USARMY IMCOM AEC (USA); Howard, J C (Clint) CIV USARMY USAG (USA); Watts, Keely A CTR (USA); Campanella, Nicholas E CTR (USA); Pope.Robert@epa.gov; Zapata.cesar@Epa.gov; Land-GHWBmail@adem.alabama.gov; kwatts@cci-alliance.com; Rachel L. Urban
Subject: Revision 2, Corrective Measures Implementation Work Plan RSA-008, Inactive Sewage Treatment Plant #4, Operable Unit 02, US Army Garrison – Redstone
Attachments: RSA-008 REV02 CMIP Transmittal Letter 12Feb25.pdf

Mr. Cobb,

On behalf of the US. Army Garrison - Redstone, Environmental Restoration Program, ECC is pleased to provide responses to ADEM comments and the *Revision 2, Corrective Measures Implementation Work Plan RSA-008, Inactive Sewage Treatment Plant #4, Operable Unit 02*, US Army Garrison – Redstone, Madison County, Alabama, for your review. The document can be retrieved at the link below:

RSA-008_CMIP Rev 2_020425.pdf

Please confirm receipt of this email and don't hesitate to reach out if you have any issues downloading the document.

Best regards,

Pam

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DEPARTMENT OF THE ARMY
U.S. 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 February 12, 2025

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

SUBJECT: Revision 2, Corrective Measures Implementation Plan (CMIP), RSA-008 Inactive Sewage Treatment Plant #4, Operable Unit 02, 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 Comments, dated December 27, 2025: Revision 1 Corrective Measures Implementation Work Plan (CMI WP) for RSA-008, Inactive Sewage Treatment Plant #4, Operable Unit 02, dated September 6, 2025.

Dear Mr. Cobb:

This letter transmits the Response to ADEM comments on the subject document and the Revision 2, Corrective Measures Implementation Plan (CMI WP), RSA-008 Inactive Sewage Treatment Plant #4, Operable Unit 02, 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 Ms. Heather Guerrero 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, 540-725-7224 or email nicholas.e.campanella.ctr@army.mil.

Sincerely,

Clint Howard

Clint Howard
Chief, Installation Restoration Branch

Enclosure

Responses to ADEM Review Comments
Rev. 1 Corrective Measures Implementation Work Plan RSA-008, Inactive Sewage Treatment Plant #4, Operable Unit 02
Redstone Arsenal, Alabama

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1. **Section 3.1.3 Cleanup Goals for Corrective Measures, Pages 3-2 and 3-3:** In the Department's July 8, 2024 letter, ADEM requested the Army revise the plan to explain how the cleanup goals provided for RSA-008 were calculated. However, the Army's explanation in Section 3.1.3 failed to describe how the risk-based cleanup goals for 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), alpha-BHC (alpha- hexachlorocyclohexane), and dieldrin were derived. Please revise this section to clarify how the risk-based cleanup goals for the aforementioned contaminants of concern (COCs) were calculated (e.g., methodology, input values).

   Response: The text in Section 3.1.3 will be revised to read as follows:

   Arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE are identified as groundwater COCs requiring action at RSA-008. As noted above, for relevant COCs in groundwater with MCLs, the MCLs are selected as the CGs (arsenic and TCE). 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. The method used to derive the groundwater cleanup goals is described in the following text and the cleanup goal derivation is shown in Table 5.

   The cleanup goals were calculated using a simple method that relies on the linear nature of the relationship between concentration and risk. The equation is as follows:

$$\frac{Representative\ Concentration}{Calculated\ Risk} = \frac{Cleanup\ Goal}{Target\ Risk}$$

   where:

   Representative Concentration – site exposure point concentration (EPC) from Table D-22 in the RFI

   Calculated Risk – site risk calculated using site EPC from Table D-22 in the RFI

   Target Risk – the individual chemical target risk is derived by dividing the cumulative risk by the number of COCs with available toxicity data

   Cleanup Goal – cleanup goal corresponding to target risk.

   The linear equation above is then rearranged to solve for the cleanup goal:

$$Cleanup\ Goal = \frac{Representative\ Concentration\ x\ Target\ Risk}{Calculated\ Risk}$$

   This equation applies to both cancer and noncancer effects. However, because the calculations for cancer effects result in more conservative cleanup goals (i.e., lower values) than the noncancer effect calculations, the former are the selected cleanup goals.

Because there are multiple COCs (5), the individual target risk for each COC was derived by dividing the cumulative risk by the number of COCs with toxicity data available to calculate risk. For noncancer effects, individual and cumulative risks are addressed separately for each target organ or system.

2. **Table 5 Derivation of Cleanup Goals:** The units of measure for the representative concentration (RC) and IELCR columns are incorrect. Please revise the RC column from milligrams per liter (mg/L) to micrograms per liter (µg/L) to match the values provided. Please also remove the units from the IECLR column, as risk values are unitless.

   Response: Changes have been made to Table 5 as suggested.

3. **Table 6 Summary of Cleanup Goals:** The target risk and risk-based cleanup goals calculated for 4,4'-DDD, alpha-BHC, and dieldrin have higher values than the unacceptable risk and the maximum detected concentrations that were determined to require remediation in the RCRA Facility Investigation Report for RSA-008. Please recalculate the target risk and cleanup goals utilizing a method that provides more appropriate values.

   Response: The calculation of the cleanup goals follows the Ratio Method (Method 3) for Calculating Risk-Based Target Levels from the Alabama Risk-Based Corrective Action Guidance Manual (Revision 3.0, February 2017, Section 6.7.2). However, for this version, the individual chemical target cancer risk has been reduced to 2E-06 to include all 5 COCs with carcinogenic effects and toxicity information (see Table 5). Setting the individual chemical target cancer risk at 2E-6 ensures that the cumulative risk from all 5 chemicals does not exceed the cumulative cancer risk target of 1E-05. We note that even though 2 chemicals (arsenic and TCE) contribute to the cumulative cancer risk, their cleanup goals are set to the MCL.

   The cleanup goals are similar to the representative concentrations because the individual chemical target cancer risk is 2E-06 while the calculated chemical risks round to 1E-06 (for 4,4'-DDD and Dieldrin) or 2E-06 (for alpha-BHC). Revised Table 6 is attached.

Table 5. Derivation of Groundwater Cleanup Goals

Redstone Arsenic, Madison County, Alabama

COC	Representative Concentration for Site (µg/L)	MCL (µg /L)	Calculated Risk for Site	Site Hazard Quotient	Target Cancer Risk	Target Hazard Quotient*	Target Organ for RfD	Resident Cancer Cleanup Goal (µg /L)	Resident Noncancer Cleanup Goal (µg/L)
Arsenic	11.1	10	2.15E-04	1.85E+00	2E-06	1	Skin, Blood	NA	NA
4,4'-DDD	0.044	-	1.42E-06	-	2E-06	0.33	Liver	0.062	-**
alpha-BHC	0.015	-	2.11E-06	1.56E-04	2E-06	0.33	Liver	0.014	32
Dieldrin	0.002	-	1.16E-06	5.27E-03	2E-06	0.34	Liver	0.003	0.13
Trichloroethene	7.9	5	5.85E-06	9.06E-01	2E-06	1	Developmental, Immune	NA	NA

*Target organs: liver for DDD, A-BHC, and dieldrin; skin and blood for arsenic; developmental and immune for trichloroethene

**Value not calculated because noncancer hazard quotient was not calculated in RFI; however, cancer cleanup goal is available

COC - chemical of concern

MCL - maximum contaminant level

RFI - RCRA Facility Investigation Report (APTIM 2020)

Table 6. Summary of Cleanup Goals – RSA-008
Redstone Arsenal, Madison County, Alabama

COC Requiring Action	Groundwater CG (µg/L)	Basis
Arsenic	10	MCL
4,4′-DDD	0.062	Risk[a]
alpha-BHC	0.014	Risk[a]
Dieldrin	0.003	Risk[a]
Trichloroethene	5	MCL
COC Requiring Monitoring Only	**MAG (µg/L)**	**Basis**
4,4′-DDE	0.23	Risk[b]

Notes:

[a]See Table 5.
[b]USEPA. 2024. Regional Screening Levels, May. Value based on oral RSL at a cancer risk of 1E-06.

µg/L = Micrograms per Liter
BHC = Hexachlorocyclohexane
CG = Cleanup Goal
COC = Chemical of Concern
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
MAG = Monitoring Acceptance Goal
MCL = Maximum Contaminant Limit
RSL = Regional Screening Level

Rev 2

CORRECTIVE MEASURE IMPLEMENTATION PLAN RSA-008, INACTIVE SEWAGE TREATMENT PLANT #4, OPERABLE UNIT 02

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:

February 2025

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Corrective Measures Implementation Work Plan
RSA-008, Inactive Sewage Treatment Plant #4, Operable Unit 02

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



02/13/2025

Matt Vest
Alabama P.G. No. 1026

Date

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per Liter
4,4′-DDD	4,4′-Dichlorodiphenyldichloroethane
4,4′-DDE	4,4′-Dichlorodiphenyldichloroethylene
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
BHC	Hexachlorocyclohexane
ARBCA	Alabama Risk-Based Corrective Action
BCEE	bis(2-Chloroethyl)ether
bgs	Below Ground Surface
BHC	Hexachlorocyclohexane
BSV	Background Screening Value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CG	Cleanup Goal
CMA	Corrective Measures Alternative
CMI	Corrective Measures Implementation
CMI-O	Corrective Measures Implementation-Operations
CMO	Corrective Measures Objective
CMS	Corrective Measures Study
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CSM	Conceptual Site Model
DAF	Dilution Attenuation Factor
DDT	Dichlorodiphenyltrichloroethane
DIA	Defense Intelligence Agency
DNAPL	Dense Nonaqueous-Phase Liquid
DNOC	4,6-Dinitro-2-Methylphenol
ECC	Environmental Chemical Corporation
EPC	Exposure Point Concentration
ESV	Ecological Screening Value
HI	Hazard Index
HMW	High Molecular Weight
HQ	Hazard Quotient
IDW	Investigation Derived Waste
IELCR	Individual Excess Lifetime Cancer Risk
IROD	Interim Record of Decision
IW-QAPP	Installation Wide-Quality Assurance Program Plan
IWGW	Installation-Wide Groundwater
IWWP	Installation-Wide Work Plan
LMW	Low Molecular Weight
LOAEL	Lowest-Observable-Adverse-Effect Level
LUC	Land Use Control
MAG	Monitoring Acceptance Goal
MCL	Maximum Contaminant Level
MDC	Maximum Detected Concentration

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

mgd	Million Gallons per Day
MICC	Mission and Installation Contracting Command
MNA	Monitored Natural Attenuation
NDPA	N-Nitroso-Di-N-Propylamine
NOAEL	No-Observable-Adverse-Effect Level
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
OWS	Oil/Water Separator
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
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
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RM	Risk Management
RSA	Redstone Arsenal
RSL	Regional Screening Levels
SAC	Site Access Control
SAIC	Science Applications International Corporation
SLERA	Screening-Level Ecological Risk Assessment
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
USAEC	U.S. Army Environmental Command
USAEHA	U.S. Army Environmental Hygiene Agency
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WOE	Weight-of-Evidence

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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)-008 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-008, Inactive Sewage Treatment Plant #4, located within Operable Unit (OU) 02.

The area occupied by RSA-008 lies within groundwater site RSA-145, located in the northeastern portion of Redstone Arsenal, north of Martin Road Southwest, and west of the southern end of Triana Boulevard Southwest. RSA-008 consists of an 8-acre parcel. The sewage treatment plant in RSA-008 was used for the treatment of domestic sewage and wastewater generated in the northern portion of RSA. Floor wash liquids from research laboratories and motor pools and water separated by the oil/water separators (OWSs) in the northern portion of RSA were treated at this plant. The topography in the vicinity of RSA-008 generally slopes downward from higher elevations in the northern portions of the site toward lower elevations in the southern portions of the site. The soil beneath RSA-008 consists of low-permeability layers of silty clay and clayey silt, which are underlain over most of the site by a thin layer of highly plastic clay. No permanent or seasonal surface water features are present within the site. Site drainage is controlled by ephemeral unlined ditches. Groundwater at RSA-008 generally occurs in the unconsolidated overburden and the upper portion of the carbonate bedrock.

This CMI Work Plan details the tasks to complete the corrective measures for the site. Exposure to groundwater was determined to pose unacceptable risks if groundwater were used as a source of potable drinking water. Arsenic, 4,4′-DDD (4,4′-dichlorodiphenyldichloroethane), alpha-BHC (hexachlorocyclohexane), dieldrin, and TCE are identified as groundwater COCs requiring action at RSA-008. Exposure to surface media was not determined to pose unacceptable health risks to human health or ecological receptors. Corrective measures are therefore needed at RSA-008 to address unacceptable risks to potential receptors from exposure to arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE in groundwater.

Alternatives to address the chemicals of concern (COCs) were developed to meet the corrective measures objectives (CMOs) for groundwater at RSA-008 and include:

- Alternative 1 – No Action for groundwater
- Alternative 2 – Land Use Controls (LUCs)
- Alternative 3 – Monitored Natural Attenuation (MNA) for groundwater.

Alternative 3, MNA for groundwater, is recommended for addressing the groundwater contamination at this site. Through groundwater MNA, natural processes will act to reduce the arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE groundwater contamination to below the Cleanup Goal (CG). Alternative 3 would protect human health and achieve the CMOs by maintaining the existing LUCs that prohibit potable use of groundwater at RSA-008. Future potable use of groundwater from some areas within the groundwater units would potentially pose an unacceptable threat to human health; however, there is no current potable use of groundwater at RSA-008, and such use would remain controlled by interim remedy instead of site-specific LUCs due to the relatively short (10-year) restoration time frames. 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-008 Corrective Measures Implementation (CMI) Work Plan for Redstone Arsenal (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 Alabama Hazardous Wastes Management and Minimization Act 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 corrective measures selected for RSA-008, Inactive Sewage Treatment Plant #4, located within Operable Unit (OU) 02.

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-008 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-008 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 soil and hypothetical groundwater does pose a health threat to the commercial worker, construction worker, or hypothetical residential receptor by direct exposure pathways.
- A screening-level vapor intrusion evaluation showed that volatile organic compounds (VOC) 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 recommended that corrective measures be implemented at RSA-008 to address the potential for arsenic, 4,4′-dichlorodiphenyldichloroethane (4,4′-DDD), hexachlorocyclohexane (alpha-BHC), dieldrin, and trichloroethene (TCE) 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-008.

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-008 SITE DESCRIPTION AND HISTORY

1.2.1 Site Description

RSA-008, Inactive Sewage Treatment Plant #4, is located in the northeastern portion of RSA, north of Martin Road and southwest and west of the southern end of Triana Boulevard Southwest (**Figure 1** and **Figure 2**). RSA-008 comprises approximately 8 acres. The sewage treatment plant was constructed in 1959 and removed from active service in 1992. This plant was used for the treatment of domestic sewage and wastewater generated in the northern portion of RSA. Floor wash liquids from research laboratories and motor pools and water separated by the OWSs in the northern portion of RSA were treated at this plant.

RSA-008 was initially constructed with a design capacity of 1.0 million gallons per day (mgd). In 1977, several plant upgrades were performed, and a National Pollutant Discharge Elimination System (NPDES) permit allowing for a capacity of up to 2.0 mgd was issued. The plant underwent additional upgrades in 1982 to provide for a capacity of up to 6.0 mgd. After the upgrade, effluent from RSA-008 was discharged through a manifold force main system to a Parshall flume near Shields and Buxton Roads. Prior to the upgrade in 1982, treated effluent was discharged to McDonald Creek (USAEHA 1970) via an unlined drainage ditch, which flowed east just outside the southern site boundary toward McDonald Creek.

Treated sludge from the various plant units was collected and dried in eight onsite sludge drying beds and disposed of in a sanitary landfill on RSA. The sludge drying beds were equipped with a collection system to divert filtrate to the trickling filter unit (Shaw 2012).

1.2.2 History

The current body of knowledge regarding historical operations at RSA-008 was developed through a review of historical documents, RSA records, aerial photographs, and previous environmental reports. Information from these sources was synthesized to develop a list of potential contaminants and sources, which forms the basis of the conceptual site model (CSM). The sewage treatment plant was constructed in 1959 and removed from active service in 1992.

A report written by the U.S. Army Environmental Hygiene Agency (USAEHA) from 1970 (USAEHA 1970) documented several problems associated with the plant. The plant suffered infiltration problems in its sewer collection lines and occasionally received large quantities of oil. Both of these conditions adversely affected normal plant operations. This report also documented several of the specific types of wastes managed at the plant, which included organic and metal-contaminated liquids and sludges.

From 1974 to 1984, the primary and secondary clarifiers were expanded again. Based on the aerial photographs, the influent and effluent lift station structures in the southwestern corner of the site were originally constructed sometime between 1974 and 1984.

In 1982, the plant underwent upgrades to increase its capacity to 6.0 mgd. At that point in the plant's history, treated effluent water was discharged to McDonald Creek via an unlined, open ditch, which led to the treatment plant's NPDES-permitted effluent discharge point at McDonald Creek.

According to the RSA records, heavy precipitation in November and December 1986 caused equipment malfunctions and scouring of the algal films in the treatment plant, which led to a violation of the total suspended solids NPDES permit discharge limits. Reportedly, 3 million gallons of untreated effluent were accidently discharged into a ditch leading to McDonald Creek.

From 1984 to 2002, the influent and effluent lift station structures in the southwestern corner of the facility were expanded. The active use of RSA-008 to treat sewage ceased in 1992, when a larger, modern treatment plant constructed as a replacement for this unit came online. In the photographs from 2002 to 2015, no significant changes to the structures appear to be present within the site boundary.

Throughout the time period documented on the aerial photographs (1950 to 2015), no structures are visible in the area immediately adjacent to and outside the site boundary with the exception of the small structure noted in the aerial photograph from 1950, which is no longer present in the photograph from 1984. On these photographs, the adjacent area surrounding RSA-008 appears much as it does today, with agricultural properties located primarily to the north, west, and southwest of the site and undeveloped areas to the northeast, east, and southeast.

1.3 ECOLOGY

This approximately 8-acre environmental site area is covered by grassy areas that are interspersed with a few small gravel areas, gravel paved roads, and the remnants of more than a dozen inactive man-made structures, which were formerly used by the sewage and wastewater treatment plant. Some trees and larger shrubs within the site boundary have emerged since the site was removed from service in 1992. Land areas adjoining the site to the north, west, and southwest generally consist of grassy fields, which are harvested seasonally for hay. The surrounding lands to the northeast, east, and southeast are overgrown with thick native vegetation, which is not regularly mowed or cleared. Adjoining the site to the south on the opposite side of the drainage ditch, which runs parallel to the southern site boundary, is a closed former landfill known as RSA-048. RSA-048 was a construction and sanitary debris landfill, which was closed in the mid-1950s, and this area was subsequently used to graze cattle in the 1980s. Historical aerial photographs indicate that the surrounding areas have remained undeveloped and used primarily to grow hay or graze cattle since 1950. A palustrine emergent wetland area is located along the southwestern boundary of the site, and palustrine forested wetlands occur north and east of the site.

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 stormwater and groundwater flow conditions. Therefore, climate plays a role in groundwater flow and contaminant transport. 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 stormwater, 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

General installation-wide environmental setting information is presented in the Installation-Wide Work Plan (IWWP) (IT 2002) and RSA-145 groundwater unit RFI report (APTIM 2020) and includes discussions of regional stratigraphic and structural geology, surface and subsurface hydrology, and other physiographic and geographic topics.

1.5.1 Soil

The subsurface geologic setting beneath RSA-008 includes an overburden layer, which lies over a thick sequence of limestone bedrock formations. The overburden beneath RSA-008 consists of low-permeability layers of red, brown, and yellowish silty clay and clayey silt, which are underlain over most of the site by a thin layer of highly plastic clay. Beneath these silt and clayey layers, the site is underlain by a rocky, clayey epikarst stratum with intervals of chert and chert fragments. Together, these three stratums represent the overburden layer. The overburden layer was formed by in situ chemical weathering of the underlying limestone bedrock. The entire thickness of the overburden layers beneath RSA-008 generally ranges from approximately 45 to more than 80 feet thick beneath the site and is variable over short lateral distances.

The overburden or unconsolidated soil layer across most of RSA (including RSA-008) is called residuum because it formed from in situ chemical weathering of the underlying karstic limestone bedrock. This overburden layer consists primarily of clay and silty clay. It also 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 is scattered within the clay matrix as nodules or concentrated locally as near-horizontal layers within the soil. Although little compositional variation occurs 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. Preferred groundwater flow pathways in the overburden also include macropores caused by rotting tree roots and burrowing animals.

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 also act as preferred groundwater flow pathways.

1.5.2 Bedrock

Depth to bedrock varies across RSA-008 from approximately 45 feet in monitoring well B8-RS1282 (which is the shallowest depth from a monitoring well boring that encountered bedrock) to greater than 80.8 feet below ground surface (bgs) in monitoring well B8-RS1040 (the deepest monitoring well boring that did not encounter 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 upper Tuscumbia Limestone Formation and exhibits well-developed karst features. The Tuscumbia Limestone 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 Formation, which consists of thinly bedded, fossiliferous limestones interbedded with

chert. The Fort Payne Formation is underlain by the Chattanooga Shale Formation, a dark gray to black, fissile shale. Groundwater samples from wells screened in the basal Fort Payne and Chattanooga Shale Formations are locally saline and high in total dissolved solids (greater than 12,000 parts per million); therefore, they are not considered part of the potable water aquifer flow system at RSA.

1.5.3 Hydrogeology

Surface Water – No permanent or seasonal surface water features are present within the boundary of RSA-008. Site drainage is controlled by ephemeral unlined ditches.

Groundwater – Groundwater beneath RSA-008 is typically first encountered in the unconsolidated overburden just above bedrock. This soil/bedrock interface zone is typically described as predominantly clay silt or silty clay, usually with small percentages of sand, and with moderate to abundant limestone or chert gravel. Groundwater is first encountered in the overburden at RSA-008. However, in some higher elevation locations within RSA-145, the water table falls below the top of bedrock surface during extended dry periods; at other locations, the water table always lies below the bedrock surface. **Figure 3** presents potentiometric surface maps for RSA-008 based on measurements made in July 2015 and December 2015, respectively. The localized groundwater flow direction is influenced by a persistent mounded area in the central portion of the site, and groundwater generally flows outward in a northeasterly, westerly, and south-southeasterly direction from this mounded area. Consistent with groundwater within this portion of RSA-145 (APTIM 2019), overall shallow groundwater flows east to southeast toward the primary surface water stream in this area of the groundwater unit, McDonald Creek. The depth to groundwater decreases near the streams, and groundwater discharges to the streams and adjacent wetlands.

Features controlling groundwater flow are much less numerous and more discrete with increasing depth in bedrock, such that flow is stratibound. Solution-enlarged fractures and stylolites are encased in impermeable chert-rich rock, such that confined or semiconfined flow exists in deep flow features, at least locally.

Depth to groundwater in overburden wells on RSA-008 fluctuates seasonally. Potentiometric depths (from surface) ranged from an average localized depth of 1.99 to 11.86 feet bgs, with an average overall site depth of 7.95 feet bgs.

1.6 DOCUMENT ORGANIZATION

This CMI Work Plan is organized into the following six 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 sites.
- Section 2.0 presents additional background information about the sites, including investigations and reporting history, nature and extent of contamination, fate and transport, site risks, and the final CSM.
- Section 3.0 describes the basis for the action, including the Corrective Measures Objectives (CMOs), Cleanup Goals (CGs), and selected corrective measures.
- Section 4.0 presents the planned CMI activities necessary to complete the corrective measures at RSA-008.
- 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 (QCP)
- Appendix E. Site Safety and Health Plan (SSHP)
- Appendix F. Groundwater Monitoring Plan.

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 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 the Alabama Department of Environmental Management (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 sites.

2.0 INVESTIGATION RESULTS

This section presents additional background information for RSA-008, 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-008 in 1996. This section describes the data collected under previous studies at RSA-008 and those efforts conducted in support of the RFI (APTIM 2020). The following investigations were conducted at RSA-008:

- RSA interim facility assessment report
- Final identification and evaluation of potential SWMUs and areas of concern
- RSA-008 Site Investigation
- RSA-008 Remedial Investigation (RI)
- RSA-145 Potential Source Area (PSA) investigation
- RSA RCRA Facility Assessment
- RSA basewide sampling event
- RFI.

In 1996, Science Applications International Corporation (SAIC) prepared a Site Inspection Report for SWMU RSA-008 (SAIC 1996). The results indicated that, with the exception of cobalt and thallium, the detected concentrations of potential contaminants were either below the background levels or below risk-based screening levels.

In October 1997, SAIC performed additional field sampling at RSA-008 as part of a Comprehensive Environmental Response, Compensation, and Liability Act RI (SAIC 2001). During the second phase of the RI completed in December 1999, SAIC installed and sampled 9 monitoring wells and collected 25 additional soil samples.

In 2005, Shaw conducted a PSA investigation for groundwater unit RSA-145 and recommended that this site continue to be investigated under RCRA (Shaw 2005).

In 2008, ADEM prepared a draft RFI and concluded that the probability of releases from this unit to soil and groundwater were medium, the probability of a release to surface water was unknown, and the probability of a release to other environmental media was low (ADEM 2008). ADEM recommended that RSA proceed with the completion of the RFI for this site.

During the 2009 RSA basewide sampling event, all concentrations of VOCs and semivolatile organic compounds (SVOCs) detected in groundwater were below the preliminary screening values (PSVs). None of the metal concentrations detected exceeded both the PSVs and background screening values (BSVs).

In 2017, the information obtained from previous investigations was evaluated and additional fieldwork was planned and executed to support the Rev. 1 RFI (CB&I 2017). Supplemental soil and groundwater sampling activities were performed in 2018 to support preparation of the Rev. 2 RFI report (APTIM 2018).

In 2020, an RFI report was prepared. One VOC (TCE); one metal (arsenic); and four chlorinated pesticide compounds (alpha-BHC, dieldrin, 4,4′-DDD, and 4,4′-dichlorodiphenyldichloroethylene [4,4′-DDE]) were determined to be the relevant chemicals of concern (COCs) in groundwater at RSA-008 (APTIM 2020). The RFI concluded that exposure to groundwater potentially used for potable purposes

would pose unacceptable risks to hypothetical future receptors. Corrective actions are needed to address contamination in groundwater at RSA-008, and groundwater CGs were developed for the COCs that require corrective action, as identified in the Rev. 4 RFI report (APTIM 2020). Soils at RSA-008 currently meet unrestricted reuse requirements, and a corrective measure is not required.

In the 2022, a focused Corrective Measures Study (CMS) (ECC 2022) report was prepared in accordance with USEPA RCRA guidance. The focused CMS report summarizes information that was originally presented in the final RFI report for RSA-008, including the site background, operation, regulatory history, physical setting, nature and extent of contamination, fate and transport evaluation, and risk assessment (APTIM 2020). During this CMS, two corrective measures alternatives (CMAs) were developed from the screened available remedial technologies and a detailed evaluation of these two CMAs was conducted against a number of criteria, including technical feasibility, cost, effectiveness in cleaning up the contamination, and protection of human health and the environment. This evaluation provides the technical and financial basis for the Army's selection of the corrective measure at RSA-008. Based on this evaluation, groundwater monitored natural attenuation (MNA) was recommended as the preferred corrective measure for RSA-008 to prevent exposure to contaminated groundwater until CGs are attained. The total cost of implementing groundwater MNA at RSA-008 is estimated to be $479,668. No source areas for the COCs were identified at RSA-008, nor does a defined plume exist near the site. Concentrations of groundwater COCs are relatively low, and these compounds should attenuate fairly rapidly. Therefore, monitoring of groundwater at RSA-008 for 10 years is recommended in the CMS report.

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-008, which consists of analytical results from 53 surface soil samples, 133 subsurface soil samples, 12 sediment samples, and 44 groundwater samples from 23 overburden monitoring wells located within and adjacent to the RSA-008 site boundary (**Table 1**). The RFI concluded that this data set is adequate for evaluating nature and extent of contamination for RSA-008.

2.2.1 Soil

- Metals with anomalous concentrations in surface soil and subsurface soil do not have concentrations that exceed both the BSVs and PSVs. Therefore, metals in soil at RSA-008 do not represent COCs at the site.
- All explosives, perchlorate, polychlorinated biphenyls (PCBs), pesticides, and VOCs detected in surface soil and subsurface soil were below the PSVs.
- One polycyclic aromatic hydrocarbon (PAH) was detected in two surface soil sampling locations and one subsurface soil location associated with RSA-008 at concentrations above the PSV. These sampling locations are considered to be delineated both horizontally and vertically to concentrations below the PSV by samples from the surrounding surface soil and subsurface soil sampling locations.

2.2.2 Sediment

- Two metals (chromium and mercury) in sediment have anomalous concentrations that are elevated with respect to both the BSVs and PSVs. The mercury PSV exceedances (B8-SD04, B8-SD11, B8-SD12, and B8-SD15) are delineated by sediment samples collected from both upstream (B8-SD02, 008-SD001, B8-SD03, and B8-SD16) and downstream (B8-SD09 and B8-SD10) locations in the drainage ditch. The chromium PSV exceedance (B8-SD13) is delineated by sediment samples collected from both upstream (B8-SD05 and B8-SD14) and downstream (B8-SD06 and 008-SD003) locations in the drainage ditch. All other metals detected

in sediment were present at concentrations below the BSVs and PSVs or were determined to be naturally occurring.

- One PAH (benzo[a]pyrene) was detected at two locations at concentrations greater than the PSV at the eastern end of the drainage ditch that empties into McDonald Creek. All other SVOCs/PAHs detected in sediment were at concentrations below the PSVs. The exceedance of benzo(a)pyrene is not believed to be from RSA-008; therefore, delineation downstream in McDonald Creek was not performed because the creek receives runoff from a regional area. Sediments in the creek are impacted by releases from many non-regulated sources of PAHs, such as roads, parking lots, and building runoff, as well as potentially by other upstream SWMUs.
- All explosives, perchlorate, PCBs, pesticides, and VOCs detected in sediment were at concentrations below the PSVs.

2.2.3 Groundwater

- With the exception of results for arsenic and zinc in one monitoring well sample each, all of the metals detected in the site groundwater samples were determined to be background related. The arsenic and zinc exceedances are delineated by samples from the surrounding monitoring wells or by more recent samples from these wells, which did not exhibit elevated concentrations of metals.
- All concentrations of explosives, perchlorate, and PCBs in groundwater were below the PSVs.
- Dieldrin, 4,4′-DDD, 4,4′-DDE, and alpha-BHC were each detected in older samples at concentrations above the PSVs. With the exception of the 4,4′-DDD and alpha-BHC concentrations detected at 008-RS2585 in July 2015, the pesticide concentrations in the most recent groundwater samples were below the PSVs. These most recent pesticide exceedances at 008-RS2585 are delineated by samples from other surrounding monitoring wells in which pesticides were not detected at concentrations exceeding the PSVs.
- VOCs and SVOCs were not detected at concentrations greater than the PSVs in the most recent samples from all 23 groundwater monitoring wells located within and adjacent to RSA-008. TCE was detected above the PSV in January 2015 in one site well (008-RS2585) but was below the PSV in the subsequent sample collected in July 2015. In addition, TCE was not detected in surface or subsurface soil at RSA-008, which suggests that RSA-008 is not the source of TCE detected in groundwater.
- The RSA-008 groundwater COC results are summarized in **Figure 4**.

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.

A contaminant migration assessment was conducted for RSA-008. Non-background-related constituents detected in soil that exceeded the RSA dilution attenuation factor (DAF)4 soil screening levels (SSLs) included benzo(a)anthracene, p-nitrotoluene, and methylene chloride. Background-related constituents (i.e., metals) detected in soil in exceedance of both the BSV and the DAF4 SSL were limited to selenium. Following a weight-of-evidence (WOE) evaluation, it was determined that no chemicals detected in soil are likely to pose a threat to groundwater from the soil-to-groundwater migration pathway.

2.3.1 Migration Mechanisms

Potential routes of contaminant migration among environmental media at RSA-008 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 vapor
- Migration through biotic pathways such as plant uptake
- Facilitated transport where the physical or chemical properties of one chemical or material promote migration of other chemicals.

At RSA-008, the major potential contaminant migration pathway is the dissolution of site-related chemicals from soil to form leachate and the subsequent transport to the water table resulting from the downward percolation of infiltrating rainfall. Overland transport of soil contaminants by wind or water over the majority of the site area is unlikely at RSA-008 because the site is relatively level and heavily vegetated. Migration of free-phase nonaqueous liquids is not a viable mechanism at this site because VOCs or SVOCs were not detected at sufficiently high concentrations in soil or groundwater. VOC or SVOC concentrations that exceed 1 percent of their aqueous solubility value are conservatively considered to indicate the potential presence of dense nonaqueous-phase liquid (DNAPL) (USEPA 1998).

Biotic migration pathways such as plant uptake have been assessed in the human health risk assessment and SLERA.

Facilitated transport mechanisms in groundwater beneath RSA-008 are not a concern for this site. These mechanisms include but are not limited to the following examples: migration of contaminants suspended or dissolved in DNAPL; colloidal transport associated with carbon-enriched leachate from sanitary landfills; or cosolvency, in which more water-soluble solvents like acetone or 2-butanone may dissolve and mobilize other contaminants (e.g., pesticides).

2.3.2 Soil-to-Groundwater Migration

Organic and inorganic chemicals present in soil may undergo dissolution by rainfall, partition into leachate, and be transported to groundwater via percolation and downward migration. Prior to reaching groundwater, contaminant concentrations are attenuated during transport by mechanical dispersion, degradation, and/or adsorption to soil particles. The potential for contaminants detected in soil at RSA-008 to leach and impact groundwater was evaluated in a migration assessment in the RSA-008 RFI report and resulted in the following conclusions.

Based on concentrations of chemicals in soil at RSA-008, four constituents (benzo[a]anthracene, selenium, p-nitrotoluene, and methylene chloride) were evaluated for the potential to leach from soil to groundwater and result in adverse impacts to groundwater. Benzo(a)anthracene, selenium, p-nitrotoluene, and methylene chloride concentrations in soil are unlikely to represent a potential leaching threat to groundwater.

2.4 SITE RISK

An ARBCA evaluation for human health and an ecological risk evaluation were performed for RSA-008 in accordance with the ARBCA Guidance Manual (ADEM 2017a) as part of the Rev. 4 RFI (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-008 is located within the central portion of RSA in an area designated as "Business" in the RSA Master Plan. RSA-008 will most likely not be developed for future residential use. Although risk regulations, policy, and guidance specify the evaluation of 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 (ADEM 2017b) and ARBCA guidance (ADEM 2017a). RSA is legally mandated to comply with the Alabama Hazardous Wastes Management and Minimization Act (AHWMMA). In RSA's AHWMMA Permit, ADEM requires that these guidance documents, including approved risk assessment work plans (IT 2002, Shaw 2010a), 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 support the use of land use controls (LUC) as a component of the selected remedy. Therefore, risks to a residential receptor were assessed in the RFI (APTIM 2020).

There is no current potable use of groundwater at RSA-008, and development of groundwater as a potable source is precluded by the terms of the installation-wide groundwater interim record of decision (IROD) (Shaw 2007). Nevertheless, the exposure to groundwater hypothetically developed as a potable source was evaluated in the RFI (APTIM 2020).

2.4.2 Human Health ARBCA

The human health risk assessment for RSA-008 was prepared and presented in the Rev. 4 RFI (APTIM 2020) in accordance with the ARBCA guidance (ADEM 2017a). 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-008, 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 PSVs. In the case of soil, the PSVs generally were the USEPA (2017) regional screening levels (RSLs), based on the lower of an individual excess lifetime cancer risk (IELCR) of 1E-06 and a non-cancer hazard index (HI) of 0.1. In the case of groundwater, maximum contaminant levels (MCLs) were used as the PSVs, if available. Otherwise, tap water RSLs (USEPA 2017) were used. Residential PSVs were selected for the evaluation of this site to consider alternatives to attain unrestricted land use. The protocol for the PSL evaluation is described in the Rev. 4 RFI report (APTIM 2020) and the installation-wide work plan (Shaw 2010a).

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 the BSVs or shown in a site-to-background evaluation to be naturally occurring are judged not to be site related and are not evaluated further. Concentrations of all other detected chemicals are compared to the PSVs in the PSL evaluation. A substance is identified as a COC if the MDC is greater than the PSV. Chemicals that may accumulate in homegrown produce from soil are also considered to be COCs, and chemicals in groundwater that have MCLs, whether the concentrations exceed them, are considered COCs in the RM-2 evaluation. In addition, aldrin was included in the RM-2 evaluation of groundwater. This compound was not detected in groundwater, but the maximum analytical detection limit was greater than the PSV.

A screening-level vapor intrusion evaluation was conducted for RSA-008. It was concluded that VOCs in soil and groundwater at RSA-008 do not represent a source that would pose an unacceptable health threat to occupants of 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). The protocol for the RM-2 cumulative risk evaluation

is presented in the Rev. 4 RFI report (APTIM 2020). Receptor scenarios evaluated in the cumulative risk assessment included a commercial worker, a construction worker, and a hypothetical residential receptor.

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 by RSA's site access control (SAC) program (Army 2012) and the terms of the installation-wide groundwater IROD (Shaw 2007).

The ARBCA guidance considers an IELCR of 1E-05 as the target cumulative risk used to guide site management. 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**. The cumulative IELCR estimates for exposure to soil alone are less than the ADEM trigger level of 1E-05 for all receptors. The cumulative HI estimates for all receptors for exposure to soil alone also fall below the threshold level of 1.0.

For groundwater, the cumulative IELCR estimate is greater than 1E-05 for the hypothetical resident and the commercial worker but not the construction worker. The cumulative HI for groundwater exceeded 1.0 for the hypothetical resident only.

Table 3 summarizes the RM-2 evaluation of human health for RSA-008. 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. Arsenic and TCE were identified as relevant COCs in groundwater for all receptors because the MDCs exceeded the MCLs. In addition, 4,4′-DDD, alpha-BHC, and dieldrin were identified as relevant COCs for the hypothetical resident. Non-detect aldrin was not identified as a relevant COC.

2.4.3 Preliminary Screening-Level Ecological Risk Assessment

A SLERA was completed for RSA-008 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 (ESVs). A WOE evaluation was completed to further evaluate the constituents identified in the initial screening. The WOE evaluation examined multiple lines of evidence in order to draw conclusions as to whether site-related constituents have the potential to pose hazards to ecological receptors. In addition to the evaluation of surface soil at RSA-008, sediment in the unlined drainage ditch along the southern boundary of RSA-008 was also evaluated.

Surface Soil

The initial comparison of the detected constituent concentrations in RSA-008 surface soil to the ESVs and BSVs identified nine metals (cadmium, calcium, chromium, cobalt, lead, manganese, mercury, selenium, and silver), p-nitrotoluene, total dichlorodiphenyltrichloroethane (DDT) and metabolites, alpha-chlordane, beta-BHC, methoxychlor, carbazole, total high molecular weight (HMW) PAHs, bis(2-ethylhexyl)phthalate, and methylene chloride as preliminary chemicals of potential ecological concern (COPECs) that required further assessment. Results of the COPEC refinement process follow:

- The COPEC refinement process concluded that no further evaluation was warranted for cadmium, calcium, chromium, cobalt, lead, manganese, mercury, selenium, and silver in surface soil at RSA-008 because concentrations of these preliminary COPECs are considered background related.
- No further evaluation was warranted for p-nitrotoluene, beta-BHC, and carbazole in surface soil at RSA-008 because these COPECs were detected in less than 5 percent of the surface soil samples and are unlikely to contribute significantly to the site's overall risk.

- Methylene chloride warranted further evaluation for potential impacts to community-level receptors, but further assessment for food chain effects was not warranted because methylene chloride is not bioaccumulative.
- Total DDT and metabolites, alpha-chlordane, methoxychlor, total HMW PAHs, and bis(2-ethylhexyl)phthalate warranted further evaluation for potential impacts to community-level receptors and food chain receptors.

Following the COPEC refinement process, a terrestrial invertebrate community-level assessment, terrestrial plant community-level assessment, and terrestrial food chain assessment were completed for RSA-008 surface soils. Conclusions include the following:

- Terrestrial Invertebrate Assessment Results – This assessment concluded that adverse impacts to terrestrial invertebrate communities from exposure to alpha-chlordane, total DDT and metabolites, total HMW PAHs, bis(2-ethylhexyl)phthalate, and methylene chloride are unlikely. In addition, methoxychlor is unlikely to pose hazards to terrestrial invertebrate community segments at RSA-008 or within the context of the more than 38,000-acre RSA facility.
- Terrestrial Plant Assessment Results – This assessment concluded that adverse impacts to terrestrial plant communities from exposure to alpha-chlordane, total DDT and metabolites, total HMW PAHs, bis(2-ethylhexyl)phthalate, and methylene chloride in surface soil at RSA-008 are unlikely. In addition, the COPEC methoxychlor is unlikely to pose hazards to terrestrial plant community segments that occur at RSA-008 or within the context of the more than 38,000-acre RSA facility.
- Food Chain Assessment Results – The results indicate that adverse impacts to local populations of food chain receptors from exposure to total DDT and metabolites, alpha-chlordane, methoxychlor, and bis(2-ethylhexyl)phthalate in surface soil at RSA-008 are not expected because calculated hazard quotients (HQ) for food chain receptors are less than 1.0 for these COPECs. In addition, exposures to the COPEC total HMW PAHs is unlikely to cause adverse impacts to local populations of food chain receptors.

The results of this SLERA indicate that none of the detected constituents in surface soil at RSA-008 are likely to pose hazards to terrestrial ecological receptor communities and/or populations, and further evaluation of terrestrial ecological hazards from these COPECs in surface soil at RSA-008 is not warranted.

Sediment (Unlined Drainage Ditch)

The unlined drainage ditch evaluated in the SLERA does not support true aquatic habitat, and many aquatic receptors may not be present at RSA-008. However, the sediment samples collected from RSA-008 were evaluated as true sediments in the SLERA. Sediment sample results were compared to both sediment ESVs and BSVs in selecting preliminary COPECs. The screening-level hazard evaluation for sediment at RSA-008 identified arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, vanadium, zinc, total DDT and metabolites, total HMW PAHs, total low molecular weight (LMW) PAHs, bis(2-ethylhexyl)phthalate, and acetone as preliminary COPECs in sediment that required further assessment. The COPEC refinement process concluded the following:

- No further evaluation was warranted for arsenic, barium, beryllium, cadmium copper, iron, and selenium in sediment because detected concentrations of these preliminary COPECs are likely background related.
- Acetone detections in sediment are likely the artifacts of analytical procedures and are not considered site related; therefore, further evaluation of acetone in the SLERA is not warranted.

- Chromium, lead, mercury, silver, total DDT and metabolites, total HMW PAHs, total LMW PAHs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, and bis(2-ethylhexyl)phthalate warranted further evaluation for potential impacts to community-level receptors and food chain receptors.

Following the COPEC refinement process, a benthic invertebrate community-level assessment and a food chain assessment were completed for RSA-008 sediments. Conclusions include the following:

- Benthic Invertebrate Assessment – Adverse impacts to terrestrial invertebrate communities from exposure to total DDT and metabolites, total HMW PAHs, total LMW PAHs, and bis(2-ethylhexyl)phthalate in sediment at RSA-008 are not expected to occur. In addition, adverse impacts to terrestrial invertebrate communities from exposure to lead in sediment at RSA-008 is unlikely. Although HQs for chromium, mercury, and silver were greater than 1.0, a spatial analysis determined that less than 20 percent of the length of the drainage ditch at RSA-008 exhibits concentrations of chromium, mercury, and silver that could adversely affect terrestrial invertebrate community segments. The actual area of the ditch is much less than the 3-acre threshold at which community impacts would be expected to occur. Therefore, no contaminant in sediment was determined to have the potential to pose hazards to terrestrial invertebrate communities at RSA-008.
- Food Chain Assessment – The calculated HQs for food chain receptors based on the MDC and no-observable-adverse-effects level (NOAEL)-based food chain screening values are less than 1.0 for silver, total DDT and metabolites, total HMW PAHs, total LMW PAHs, and bis(2-ethylhexyl)phthalate. The calculated HQs for food chain receptors based on the MDC and NOAEL-based food chain screening values are greater than 1.0 for mercury but less than 1.0 when lowest-observable-adverse-effects level (LOAEL)-based food chain screening values are used. These results indicate that adverse impacts to local populations of food chain receptors from exposure to chromium, lead, mercury, silver, total DDT and metabolites, all PAHs, and bis(2-ethylhexyl)phthalate in sediment at RSA-008 are not expected.

The results of this SLERA indicate that COPECs in sediment at RSA-008 are unlikely to pose hazards to ecological food chain receptor populations or to terrestrial invertebrate or plant communities.

2.5 CONCEPTUAL SITE MODELS

A CSM was developed for RSA-008 based on historical operations; available site information; and soil, sediment, and groundwater data obtained from prior investigations. **Figure 5** presents a visual representation of the CSM with chemicals of potential concern (COPC), their likely sources, possible migration pathways, potentially impacted media, and hypothetical receptors.

Release mechanisms identified during the investigation of RSA-008 could have included the following:

- Releases of petroleum products to the subsurface from the former underground storage tanks (USTs) could have occurred due to tank failure, loose fittings, and/or structural failure.
- Releases of chemicals to the surface from the former ASTs could have occurred due to physical damage, mechanical failure, and overfills.
- Floor wash water from research laboratories could have contained hazardous materials. Hazardous materials were not manufactured at RSA-008, but flow processes could have brought hazardous materials as contaminants to the site.
- Surface release points could have originated from overfill, spills, and operations associated with sewage treatment plant maintenance.

- Sludge drying beds could have leached contaminants to surface soil.
- Clarifiers, filters, lift station, and the digester are large aboveground vessels which could have overflowed, leaked along joints, or had other mechanical failures that could have provided a pathway to surface soil contamination.
- Subsurface release points from underground piping due to deterioration, physical damage, or mechanical failure could have occurred. Pumping stations are partially buried and could have leaked to surface and/or subsurface soil.
- Potential impacts from the accidental release of untreated sewage in 1986 to the unlined drainage ditch along the southern border of the site.

Potential migration pathways identified for RSA-008 include the following:

- Migration of past surface releases to large surface areas or to subsurface soil
- Migration of past surface and potential subsurface releases to groundwater through leaching.
- COPCs include the following:
- Fuel-related VOCs, including benzene, toluene, ethyl benzene, and xylenes (associated with the former diesel USTs).
- Fuel-related SVOCs, including LMW and HMW PAHs such as naphthalene and methylnaphthalene (associated with the former diesel USTs).
- Metals, including arsenic, lead, manganese, mercury, nickel, selenium, and zinc, associated with the sludge drying beds. Metals associated with petroleum oils including cobalt and vanadium are in the CSM because there were formerly diesel USTs located onsite.
- VOCs, SVOCs, pesticides, and PCBs detected in the floor wash water or water from OWSs treated at the plant.
- Perchlorate or explosive compounds detected in the floor wash water or water from oil/water separators (OWSs) treated at the plant.

Surface releases typically radiate horizontally and vertically away from the release point. Horizontal migration may be accelerated by precipitation events and resulting surface runoff. The topography at RSA-008 is generally flat except at the engineered mound surrounding the inactive digester tank in the northeastern corner of the site. The primary mechanism for the vertical migration of a surface release to subsurface soils is natural infiltration/percolation.

Subsurface releases above the water table tend to saturate soils surrounding the release point and follow the path of least resistance downward. These releases then migrate through the subsurface soil matrix and fractures to the shallow groundwater aquifer. After encountering the water table, the release may partially dissolve into the groundwater and/or move along the water table, where it may impact other subsurface soil and groundwater. Because petroleum products have lower specific gravity than water, they have the potential to float on the top of the water table; the movement of the groundwater and the fluctuation of the water table are important factors that may influence the subsurface migration of the petroleum releases.

Several chemicals included in RSA's standard analytical lists for SVOCs are not in the CSM of RSA-008 because their uses and sources of environmental release are not relevant to the activities performed on the site: 4,6-dinitro-2-methylphenol (DNOC), bis(2-chloroethyl)ether (BCEE), bis(2-chloroisopropyl)ether, hexachlorobutadiene, and n-nitroso-di-n-propylamine (NDPA). In addition,

low concentrations of organochlorine pesticides used in crop production before the area was incorporated into the RSA facility are not in the CSM of RSA-008.

When considering potential releases of contaminants from RSA-008, it is important to consider that the raw sewage that was pumped to the plant is a very dilute mixture of the parent or source materials. Even an undiluted release of a strong chemical contaminant, which could have been poured into a sewer at a building several miles upstream of the plant, would have been diluted by several orders of magnitude by domestic sewage flowing in the lines as it flowed to the influent discharge point inside the plant, potentially rendering this chemical undetectable in the influent waste stream.

3.0 DECISION SUMMARY

The Rev. 4 RFI report (APTIM 2020) for RSA-008 concluded that one metal (arsenic), three pesticides (4,4′-DDD, alpha-BHC, and dieldrin), and one VOC (TCE) pose an unacceptable risk to residential receptors if groundwater is ever used for potable water. The results of the RFI SLERA indicate that chemicals of potential ecological concern (COPECs) in surface soil at RSA-008 are unlikely to pose hazards to ecological receptor communities and/or populations, and further evaluation of ecological hazards at RSA-008 is not warranted. 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 contaminated with arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE under RSA-008 would pose unacceptable risks/hazards if used for potable purposes.

Corrective actions are necessary at RSA-008 to address the unacceptable risks/hazards posed by hypothetical future potable use of groundwater. 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 installation-wide groundwater IROD (Shaw 2007).

The Army intends to achieve closure for RSA-008 through the implementation of groundwater corrective measures monitoring for 10 consecutive years as they are needed to verify protection of human health.

3.1.1 Corrective Measure Objectives

Based on the results of the Rev. 4 RFI, the CMO for RSA-008 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.

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 CGs will comply with applicable laws and regulations and be set such that an acceptable risk/hazard would be achieved. The following laws and regulations are relevant to RSA-008 groundwater and its potential for potable use:

- 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 and have been adopted as CGs for groundwater for chemicals with MCLs. Other laws and regulations may affect alternative evaluation and selection. **Table 4** lists relevant guidance and regulations pertinent to the RSA-008 corrective measures.

3.1.3 Cleanup Goals for the Corrective Measures

Arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE are identified as groundwater COCs requiring action at RSA-008. As noted above, for relevant COCs in groundwater with MCLs, the MCLs are selected as the CGs (arsenic and TCE). 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. The method used to derive the groundwater cleanup goals is described in the following text, and the cleanup goal derivation is shown in **Table 5.**

The cleanup goals were calculated using a simple method that relies on the linear nature of the relationship between concentration and risk. The equation is as follows:

$$\frac{Representative\ Concentration}{Calculated\ Risk} = \frac{Cleanup\ Goal}{Target\ Risk}$$

where:

Representative Concentration = Site exposure point concentration (EPC) from Table D-22 in the RFI

Calculated Risk = Site risk calculated using site EPC from Table D-22 in the RFI

Target Risk = The individual chemical target risk is derived by dividing the cumulative risk by the number of COCs with available toxicity data

Cleanup Goal = Cleanup goal corresponding to target risk.

The linear equation above is then rearranged to solve for the cleanup goal:

$$Cleanup\ Goal = \frac{Representative\ Concentration\ x\ Target\ Risk}{Calculated\ Risk}$$

This equation applies to both cancer and noncancer effects. However, because the calculations for cancer effects result in more conservative cleanup goals (i.e., lower values) than the noncancer effect calculations, the former are the selected cleanup goals. Because there are multiple COCs (five), the individual target risk for each COC was derived by dividing the cumulative risk by the number of COCs with toxicity data available to calculate risk. For noncancer effects, individual and cumulative risks are addressed separately for each target organ or system.

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 PSV. Two analytes (zinc and 4,4′-DDE) were each detected in groundwater on a single occurrence above the BSV and PSV in 2015. Zinc (657 micrograms per liter [µg/L]), detected in July 2015, was determined to be anomalous. Zinc was detected at a concentration of 30.5 µg/L in January 2015 and 8.08 µg/L in November 2016 in groundwater samples collected from the same monitoring well; both concentrations are below the BSV and PSV. Therefore, zinc was determined to be naturally occurring. The compound 4,4′-DDE was detected in groundwater collected from one well in January 2015 at a concentration (0.089 µg/L) above the PSV (0.046 µg/L). This compound was non-detect during resampling of this well in July 2015. Based on the results of the risk assessment performed as part of the Rev. 4 RFI (APTIM 2020), zinc and 4,4′-DDE are not included as COCs requiring action. Groundwater CGs are only established for the compounds that contribute to unacceptable risk or that have concentrations greater than an MCL. Zinc was eliminated as a COC requiring action because its total HI for a given target organ is less than the threshold level of 1.0. The compound 4,4′-DDE was eliminated as a COC requiring action because its total IELCR summed across exposure pathways is less than 1E-06. Although zinc and 4,4′-DDE do not require CGs or contribute to the unacceptable risks to human health from groundwater exposure, the Rev. 4 RFI (APTIM 2020) concluded that 4,4′-DDE would be included in the CMI work plan due to the single exceedance of the groundwater PSV. Therefore, 4,4′-DDE will be included in the site's groundwater monitoring program and monitoring results compared to the monitoring acceptance goals (MAGs). The USEPA (2024) RSL for 4,4′-DDE of 0.046 mg/L was used to develop the MAG (USEPA 2024). The CGs and MAGs for RSA-008 are summarized in **Table 6**.

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

Soil at RSA-008 does not require corrective action. Groundwater requires corrective action. As a result, groundwater CGs were developed for COCs requiring action (**Table 6**). No detected concentrations of 4,4′-DDD, dieldrin, or alpha-BHC exceed their CGs. Locations with groundwater concentrations greater than the CGs for arsenic and TCE are discussed below. The concentrations exceeding CGs are relatively low concentrations in individual wells and do not reflect the presence of a mappable plume beneath the site. These exceedances include:

- TCE – Detected only in well 008-RS2585 in January 2015 at a concentration (7.9 µg/L) slightly above the CG (5 µg/L). This compound was detected at 0.38 µg/L during resampling of this well in July 2015, which is below the CG.
- Arsenic – Detected only in well B8-RS1041 in July 2015 at a concentration (11.1J µg/L) slightly above the CG (10 µg/L).

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 Installation-Wide Groundwater (IWGW) IROD has been approved for LUCs (Shaw 2007, Shaw 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 would be in place instead of site-specific LUCs due to the relatively short (10-year) restoration time frames. 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-008

The overall strategy for cleanup at RSA has been presented to the regulators in two cleanup strategy documents, the IWGW Cleanup Strategy (Shaw 2009a) and the Installation-Wide Strategy for Cleanup of Impacted Wetlands (Shaw 2010b). 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 source areas 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 by the interim remedy instead of site-specific LUCs due to the relatively short (10-year) restoration time frames.
- 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-008 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-008 Response Action

The corrective measures already conducted at RSA-008 provide protection to potential receptors from arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE in groundwater. The groundwater monitoring program will evaluate the effectiveness of MNA to protect human health and the environment and verify groundwater COCs remain below CGs.

3.3 CORRECTIVE MEASURES EVALUATION AND SELECTION

The following information summarizes the analysis of technologies and alternatives and the selection of the corrective measures for groundwater at RSA-008. Considering the limited area of the site and the relatively low COC concentrations detected in groundwater, alternatives to address these COCs were developed.

3.3.1 Groundwater

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

Alternative 1 – No Action. Evaluation of the no action alternative will serve as a baseline for evaluating other corrective measures.

Alternative 2 – LUCs. Alternative 2 involves engineering and physical barriers, such as fences and security guards, as well as institutional controls that are non-engineering instruments, such as administrative and legal controls that help to control and minimize potential exposure to contamination and/or to protect the integrity of a response action.

Alternative 3 – MNA. Alternative 3 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 10 consecutive years to verify that concentrations remain below CGs (Years 0 through 3). Alternative 3 would protect human health by continuing the LUCs currently in place (the interim remedy) instead of site-specific LUCs due to the relatively short (10-year) restoration time frames.

3.3.2 Selection of Corrective Measures for RSA-008

Results from previous investigation of RSA-008 indicated no source areas for the COCs were identified at RSA-008, nor does a defined plume exist near the site. In addition, concentrations of groundwater COCs are relatively low, and these compounds should attenuate fairly rapidly. Therefore, Alternative 3, groundwater MNA, was selected as the preferred corrective measure to prevent exposure to contaminated groundwater until CGs are attained.

Alternative 3 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. Alternative 3 would protect human health and achieve the CMOs by maintaining the existing LUCs that prohibit potable use of groundwater at RSA-008. Future potable use of groundwater from some areas within the groundwater units would potentially pose an unacceptable threat to human health; however, there is no current potable use of groundwater at RSA-008, and such use would remain controlled by interim remedy instead of site-specific LUCs due to the relatively short (10-year) restoration time frames.

The major components of the corrective measures in Alternative 3 include the following:

- Natural attenuation monitoring at eight monitoring wells (**Figure 6**).
    - Baseline groundwater monitoring (Year 0). One baseline groundwater monitoring event would be conducted at the beginning of the monitoring program. Groundwater samples would be collected from eight existing monitoring wells (B8-RS1041, B8-RS1043, B8-RS1046, B8-RS1047, B8-RS1280, 008-RS2585, 008-RS2586, and 008-RS2588) and analyzed for the five COCs requiring action (4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE) as well as the one COC requiring monitoring (4,4′-DDE). These wells, shown in **Figure 6**, were selected for monitoring due to the presence of one or more COCs at concentrations above the PSVs in samples collected from these wells during the RFI. The 12 additional onsite monitoring wells, which are not included in the natural attenuation monitoring program, will be properly closed concurrent with the baseline sampling event. Monitoring well B48-RS111 is associated with another RSA site (RSA-048), and final closure of this well would defer to RSA-048. Baseline sampling data will be submitted along with a well closure report following the completion of the baseline sampling event.
    - Groundwater sampling (Year 1-10). Semiannual sampling and analysis would be completed in Years 1, 2, and 3. Annual sampling will begin in year 4 and continue until year 10. Groundwater samples will be collected from the same eight monitoring wells sampled during the baseline event and analyzed for target analyte list metals, pesticides, and VOCs. Depending upon the monitoring results, the natural attenuation monitoring program could be discontinued in as few as 3 years. Once the CGs have been met and ADEM concurs with the results, the program can be discontinued, and the eight remaining monitoring wells will be properly closed.
- Annual reporting
    - Reports will be submitted annually documenting monitoring activities, including groundwater sampling. The results of semiannual sampling events will be documented in memorandum form and summarized in the annual reports.
- Well closure (eight wells) (after cleanup goals are achieved and site is approved by ADEM for closure).

3.4 REQUEST FOR PERMIT MODIFICATION

The Rev. 4 RFI (APTIM 2020) received ADEM concurrence on July 8, 2020. 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-008 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.

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4.0 CORRECTIVE MEASURES IMPLEMENTATION FOR RSA-008

The CMI plan for RSA-008 is as follows.

4.1 GENERAL SCOPE

The general scope of work for RSA-008 activities is expected to include the following:

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

The general schedule for implementation of corrective measures at RSA-008 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 Installation-Wide Quality Assurance Project Plan (IW-QAPP) (HGL 2019) and the Project Management Plan (PMP) (ECC 2021).

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 (personal protective equipment, air monitoring equipment [e.g., photoionization detector]), equipment for sample collection and field parameter monitoring (e.g., submersible pump, tubing, 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-008.

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 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 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 work plan and abide by the health and safety requirements presented in the SSHP (**Appendix E**).

4.2 PRELIMINARY ACTIVITIES

Preliminary activities are summarized in further detail 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-008. 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-008 using Gate 9 at Rideout Road. Directions from Gate 9 are south on Rideout Road to Neal Road, east on Neal Road to Patton Road, north on Patton Road to Hansen Road, and east on Hansen Road. Proceed approximately 0.5 miles to the site entry point on the southern side of Hansen Road via an unnamed access road. RSA-008 is approximately 0.2 miles south on this access road. Gate 9 hours are 24 hours a day, 7 days a week.

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.

Groundwater monitoring will be performed semi-annually for Years 1 through 3 and annually from Years 4 through 10 or until CGs are achieved and confirmed. The proposed monitoring well network is shown in **Figure 6**.

One baseline groundwater sampling event would be conducted in Year 0. Groundwater samples would be collected from the eight monitoring wells included in the proposed monitoring well network (B8-RS1041, B8-RS1043, B8-RS1046, B8-RS1047, B8-RS1280, 008-RS2585, 008-RS2585, and 008-RS2588). Groundwater samples will be analyzed for the five COCs requiring action (4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE) as well as the one COC requiring monitoring (4,4′-DDE). Groundwater will also be analyzed for MNA parameters, including, pH, nitrate, sulfate, total organic carbon, alkalinity, and dissolved gases (ethane, ethene, and methane). In addition, groundwater will be analyzed for TCE daughter products in order to more directly assess the effectiveness of MNA.

Semiannual groundwater sampling for performance monitoring of MNA processes would be conducted in Years 1 through 3. Groundwater samples will be collected from the same eight monitoring wells sampled during the baseline event and analyzed for same target analyte list.

Annual groundwater monitoring would be conducted for Years 4 through Year 10 or until CGs are achieved and confirmed. Groundwater samples will be collected from the same eight monitoring wells sampled during the baseline event and analyzed for same target analyte list. Once the CGs have been met and ADEM concurs with the results, the program can be discontinued, and the eight remaining monitoring wells will be properly closed.

In the event that MNA indicates that a change to the monitoring schedule is appropriate, the Army will submit a permit modification request to ADEM for review and approval prior to any changes in the frequency of sampling.

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-008 and will be provided in the Corrective Measures 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 2021).

4.6 DEMOBILIZATION

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

4.7 IMPLEMENTATION OF LUCs

Administrative controls currently in place for groundwater include the IWGW IROD (Shaw 2007) as implemented using the RSA SAC program (Army 2012). While this IROD is interim in nature, it will continue to be in place through remedial action completion at RSA-008. For long-term remedies (i.e., remedies requiring corrective measures for 30 years or more), site-specific LUCs would additionally be required. For RSA-008, the cleanup time to attain CGs is estimated to be 10 years. Therefore, site-specific LUCs are not necessary. The decision to implement permanent LUCs for groundwater will occur in conjunction with the RSA-145 groundwater unit. RSA will perform LUC inspections as described in the Groundwater Monitoring Plan (**Appendix F**).

4.8 CORRECTIVE MEASURE IMPLEMENTATION REPORTING

CMI reporting will be conducted in accordance with Section VIII.D of the Permit and AEIRG (ADEM 2017b) 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 2021).

5.0 CONTINGENCIES

The implementation of corrective measures is based on the best information currently available for RSA-008. 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-008; (Alternative 3: MNA). If COC concentrations do not remain below the CG for three consecutive years, the contingency corrective measure will include additional years of MNA monitoring, as appropriate based on the annual effectiveness evaluation of contaminant trends.

If elevated COC concentrations are detected during the CMI baseline sampling (year 0), the contingency corrective measure will include the identification of any updates needed in the current CSM. The reevaluation of the current selected corrective measure may also be included as appropriate.

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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6.0 REFERENCES

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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)								
Inorganics								
Arsenic	6 / 42	14	1.11E+01	J	B8-RS1041	1.03E+01	**1.11E+01**	MDC
Chromium	32 / 39	82	2.26E+01		008-RS2586	3.22E+00	**2.26E+01**	MDC
Copper	7 / 32	22	1.25E+01		B8-RS1283	4.02E+00	**1.25E+01**	MDC
Lead	19 / 43	44	6.80E+00		B8-RS1042	2.45E+00	**6.80E+00**	MDC
Zinc	5 / 7	71	6.57E+02		008-RS2588	1.49E+02	**6.57E+02**	MDC
Organochlorine Pesticides								
4,4′-DDD	5 / 38	13	4.40E-02		008-RS2588	1.38E-02	**4.40E-02**	MDC
4,4′-DDE	8 / 38	21	8.90E-02		008-RS2588	2.09E-02	**8.90E-02**	MDC
alpha-BHC	2 / 38	5	1.50E-02	J	B8-RS1047	1.22E-02	**1.50E-02**	MDC
Dieldrin	1 / 38	3	2.00E-03	J	B8-RS1043	4.99E-03	**2.00E-03**	MDC
Semivolatile Organics								
Benzo(a)pyrene	1 / 24	4	5.96E-02	J	008-RS2589	4.23E-01	**5.96E-02**	MDC
bis(2-Ethylhexyl)phthalate	3 / 42	7	5.40E+00		B8-RS1280	1.52E+00	**5.40E+00**	MDC
Volatile Organics								
Chlorobenzene	4 / 45	9	4.40E-01	J	B8-RS1280	3.93E-01	**4.40E-01**	MDC
Chloroform	3 / 26	12	8.04E-01	J	B8-RS1283	3.37E-01	**8.04E-01**	MDC
Trichloroethene	24 / 44	55	7.90E+00		008-RS2585	1.03E+00	**7.90E+00**	MDC
Additional Chemicals Evaluated*								
Aldrin	NA	NA	NA		NA	NA	**1.90E-03**	MADL

Notes:

*Aldrin was not detected in groundwater but is included because the maximum analytical detection limit is greater than the PSV.

µg/L = Micrograms per Liter
J = Estimated Concentration
MDC = Maximum Detected Concentration
MADL = Maximum Analytical Detection Limit
NA = Not Applicable
PSV = Preliminary Screening Value
VQ = Validation Qualifier

Table 2. Summary of Receptor Cancer Risk and Noncancer Hazard for Chemicals of Concern
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	5.9E-08	9.6E-05	5.9E-08	9.6E-05
Construction Worker	2.8E-09	4.3E-06	2.8E-09	4.3E-06
Hypothetical Residential Receptors:				
Lifetime Resident[a]	3.1E-07	2.3E-04	3.1E-07	2.3E-04
(With Additional Evaluated Chemicals[b] Included) Lifetime Resident[a]	3.1E-07	2.3E-04	3.1E-07	2.3E-04

NON-CANCER HAZARD				
Receptors	**Total Soil HI**	**Groundwater HI**	**Cumulative HI Soil**	**Cumulative HI Soil and Groundwater**
Industrial Receptors:				
Commercial Worker	5.5E-04	0.90	5.5E-04	0.90
Construction Worker	8.9E-03	1.0	8.9E-03	1.0
Hypothetical Residential Receptors:				
Child Resident[a]	6.5E-03	3.0	6.5E-03	3.0
(With Additional Evaluated Chemical[b] Included) Child Resident[a]	6.5E-03	3.0	6.5E-03	3.0

Notes:

[a]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.

[b]Aldrin was not detected in groundwater but is included because the maximum detection limit is greater than the PSV.

HI = Hazard Index
IELCR = Individual Excess Lifetime Cancer Risk
PSV = Preliminary Screening Value

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

Receptors	Exposure to Soil[a]	Relevant COCs in Soil	Exposure to Soil and Groundwater[a]	COCs for Exposure to Groundwater[b]
Commercial Worker	√	(None)	X	Arsenic Trichloroethene
Construction Worker	√	(None)	X	Arsenic Trichloroethene
Hypothetical Resident	√	(None)	X	Arsenic 4,4′-DDD alpha-BHC Dieldrin Trichloroethene

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]Chemicals with maximum detected concentrations below their maximum contaminant levels are not included as COCs from exposure to groundwater.

alpha-BHC = Hexachlorocyclohexane
COC = Chemical of Concern
4,4′-DDD = Dichlorodiphenyldichloroethane
RM-2 = Risk-Management-2

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 maximum contaminant level, 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 – Maximum Contaminant Level Goals, 40 CFR143	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. However, the 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	No construction will be conducted in wetlands.
Protection of Wetlands – 40 CFR 230	Sets forth guidelines for fill material in wetlands	Not applicable	Filling wetlands is not a component of the expected remedy.
Wetlands Permitting – 32 CFR 650.68	Identifies permitting requirements for excavation activities in wetlands.	Not applicable	Excavation activities will not be conducted in wetlands.
Tennessee Valley Authority Act of 1933 (48 Stat. 58-59, 16 USC sec. 831), 18 CFR 1304	Identifies permit requirements for approval of construction in the Tennessee River system and regulation of structures and other alterations.	Not applicable	Site is not located within the Tennessee River system.

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

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
Endangered Species Act; 16 USC 1531; 50 CFR200 & 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.
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 the U.S. Fish and Wildlife Service.	Not applicable	Discharge to surface water is not a component of the expected remedy.
Wild and Scenic Rivers Act, 16 USC 1274, 40 CFR 6.302(e)	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), 43CFR 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 is largely developed.
National Archaeological and Historical Preservation Act (16 USC Section 469-470); 35CFR 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 is largely 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, archeological, 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 is largely 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 is largely developed.

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

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
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 is largely 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, record keeping, and accumulation time.	Not applicable	Generation of hazardous waste not anticipated as part of the expected remedy.
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.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 CFR Part 264.170-179	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	Discharge to surface water not anticipated as part of the expected remedy.
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.

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

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
Discharge to a POTW, 33 USC Section 1317, 40CFR 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.
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 maximum contaminant level, 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 the U.S. Fish and Wildlife Service. Establishes 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. Corrective action requirements for this site are regulated by ADEM through RSA's RCRA permit.
Wetlands Protection – ADEM 335-8-2.02/2.03	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.

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

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
Alabama Non-Game Species Regulation, AAC 220-2.92	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.
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 500parts 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	Nonhazardous 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.

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

Standard, Requirement, or Criterion	Requirement	Applicability	Comments
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	The use of LUCs is considered likely at least temporarily for this site until the CGs are obtained.

Notes:

AAC = Alabama Administrative Code
ADEM = Alabama Department of Environmental Management
CFR = Code of Federal Regulations
CG = Cleanup Goal
LUC = Land Use Control
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
UST = Underground Storage Tank

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

COC	Representative Concentration for Site (µg/L)	MCL (µg/L)	Calculated Risk for Site	Site Hazard Quotient	Target Cancer Risk	Target Hazard Quotient[a]	Target Organ for RfD	Resident Cancer Cleanup Goal (µg/L)	Resident Noncancer Cleanup Goal (µg/L)
Arsenic	11.1	10	2.15E-04	1.85E+00	2E-06	1	Skin, Blood	NA	NA
4,4′-DDD	0.044	-	1.42E-06	-	2E-06	0.33	Liver	0.062	-[b]
alpha-BHC	0.015	-	2.11E-06	1.56E-04	2E-06	0.33	Liver	0.014	32
Dieldrin	0.002	-	1.16E-06	5.27E-03	2E-06	0.34	Liver	0.003	0.13
Trichloroethene	7.9	5	5.85E-06	9.06E-01	2E-06	1	Developmental, Immune	NA	NA

Notes:

[a]Target organs: liver for DDD, alpha-BHC, and dieldrin; skin and blood for arsenic; developmental and immune for trichloroethene.
[b]Value not calculated because noncancer hazard quotient was not calculated in RFI; however, cancer cleanup goal is available.

µg/L = Micrograms per Liter
BHC = Hexachlorocyclohexane
COC = Chemical of Concern
DDD = Dichlorodiphenyldichloroethane
MCL = Maximum Contaminant Level
NA = Not Applicable
RFD = Reference Dose
RFI = RCRA Facility Investigation

Table 6. Summary of Cleanup Goals – RSA-008
Redstone Arsenal, Madison County, Alabama

COC Requiring Action	Groundwater CG (µg/L)	Basis
Arsenic	10	MCL
4,4′-DDD	0.062	Risk[a]
alpha-BHC	0.014	Risk[a]
Dieldrin	0.003	Risk[a]
Trichloroethene	5	MCL
COC Requiring Monitoring Only	**MAG (µg/L)**	**Basis**
4,4′-DDE	0.23	Risk[b]

Notes:

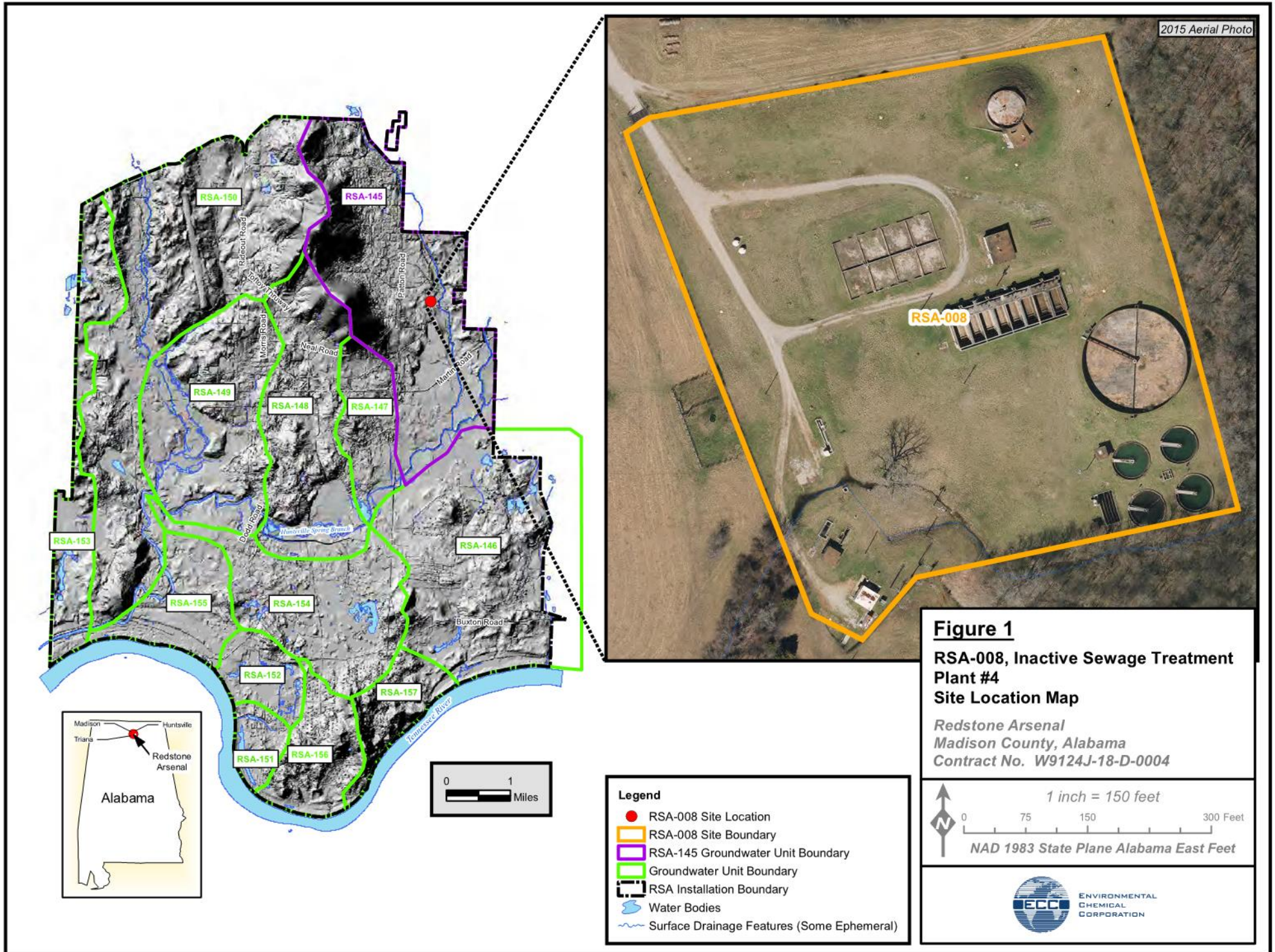
[a]See Table 5.
[b]USEPA. 2024. Regional Screening Levels, May. Value based on oral RSL at a cancer risk of 1E-06.

µg/L = Micrograms per Liter
BHC = Hexachlorocyclohexane
CG = Cleanup Goal
COC = Chemical of Concern
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
MAG = Monitoring Acceptance Goal
MCL = Maximum Contaminant Limit
RSL = Regional Screening Level

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FIGURES

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2015 Aerial Photo

Figure 2

RSA-008, Inactive Sewage Treatment Plant #4
Nearby Sites Map

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

1 inch = 500 feet

0 200 400 800 Feet

NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

RSA-008
RSA-048
RSA-283
RSA-233
RSA-233B
RSA-321
RSA-248
RSA-293
RSA-287
RSA-006
RSA-305
RSA-004
RSA-041
RSA-314
RSA-045
RSA-007

Hansom Rd SW
Ajax Rd
Roland Rd
Redstone Arsenal
Patton Rd
Neal Rd
Triana Blvd SW
Triana Blvd
McDonald Creek
Martin Rd

Legend

- RSA-008 Site Boundary
- Nearby Site Boundary
- Topographic Contour - 2 ft. Interval
- Topographic Contour - 10 ft. Interval
- Surface Drainage Features (Some Ephemeral)
- Wetland Area

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July 2015

008-RS2584
568.10

008-RS2586
566.39

B8-RS1043
568.34

B8-RS1042
568.27

008-RS2585
567.85

567

569

B8-RS1283
569.36

B8-RS1281
567.49

567

B8-RS1048
567.48

B8-RS1280
569.21

008-RS2589
567.54

008-RS2587
566.25

RSA-008

B8-RS1045
567.87

B8-RS1041
567.21

B8-RS1040
567.13

B8-RS1044
568.22

B8-RS1047
567.50

B8-RS1282
567.45

568

B8-RS1046
567.84

008-RS2588
NM

Legend

NM - Not Measured

- Overburden Well
- Potentiometric Contour
- Dashed where Inferred
- Groundwater Flow Direction
- RSA-008 Site Boundary
- Ditch Aqueduct Centerline
- Surface Drainage Features (Some Ephemeral)
- Wetland Area

December 2015

2015 Aerial Photo

570

008-RS2586
568.36

008-RS2584
570.21

569

B8-RS1043
570.67

B8-RS1042
570.56

008-RS2585
569.79

B8-RS1281
569.27

B8-RS1283
570.16

B8-RS1048
569.42

569

B8-RS1280
570.21

008-RS2589
569.36

008-RS2587
568.50

RSA-008

B8-RS1045
569.84

569

B8-RS1041
569.01

B8-RS1040
568.95

B8-RS1044
569.83

B8-RS1047
569.37

B8-RS1282
569.14

B8-RS1046
569.75

570

008-RS2588
570.18

Figure 3

RSA-008
Inactive Sewage Treatment Plant #4
Potentiometric Contour Map

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

1 inch = 100 feet

0 50 100 200 Feet

NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

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2015 Aerial Photo

Well	Sample Date	Sample No.	Parameter	Result	VQ	Units	PSV	CG
008-RS2585	1/6/2015	AHK3002	**Trichloroethene**	**7.9**		µg/L	**5**	**5**
	7/21/2015	AHK3023	Trichloroethene	0.38		µg/L	**5**	**5**

Well	Sample Date	Sample No.	Parameter	Result	VQ	Units	PSV	CG
B8-RS1041	1/5/2015	AHK3009	Arsenic	ND		µg/L	**10**	**10**
	7/23/2015	AHK3030	**Arsenic**	**11.1**		µg/L	**10**	**10**

008-RS2586
008-RS2584
B8-RS1043
B8-RS1042
B8-RS1283
B8-RS1281
B8-RS1048
B8-RS1280
008-RS2589
008-RS2587
B8-RS1045
B8-RS1040
B8-RS1044
B8-RS1047
B8-RS1282
B8-RS1046
008-RS2588
RSA-048
McDonald Creek

Legend

BOLD results exceed the RSL.
RED results exceed the CG.
COC - Chemical of Concern
COI - Chemical of Interest
J - Estimated concentration (data validation qualifier)
CG - Cleanup goals
RSL - Regional Screening Level
ND - Non-detect
NA - Not Applicable
µg/L - micrograms per liter
VQ - Validation qualifier

- Overburden Well
- Ditch Aqueduct Centerline
- Surface Drainage Features (Some Ephemeral)
- Wetland Area
- RSA-008 Site Boundary
- RSA-048 Site Boundary

- COC in most recent sample or in a historical sample exceeds the CG
- No historical or recent CG exceedence

Figure 4

RSA-008
COCs Exceeding Cleanup Goals in Groundwater

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

1 inch = 150 feet

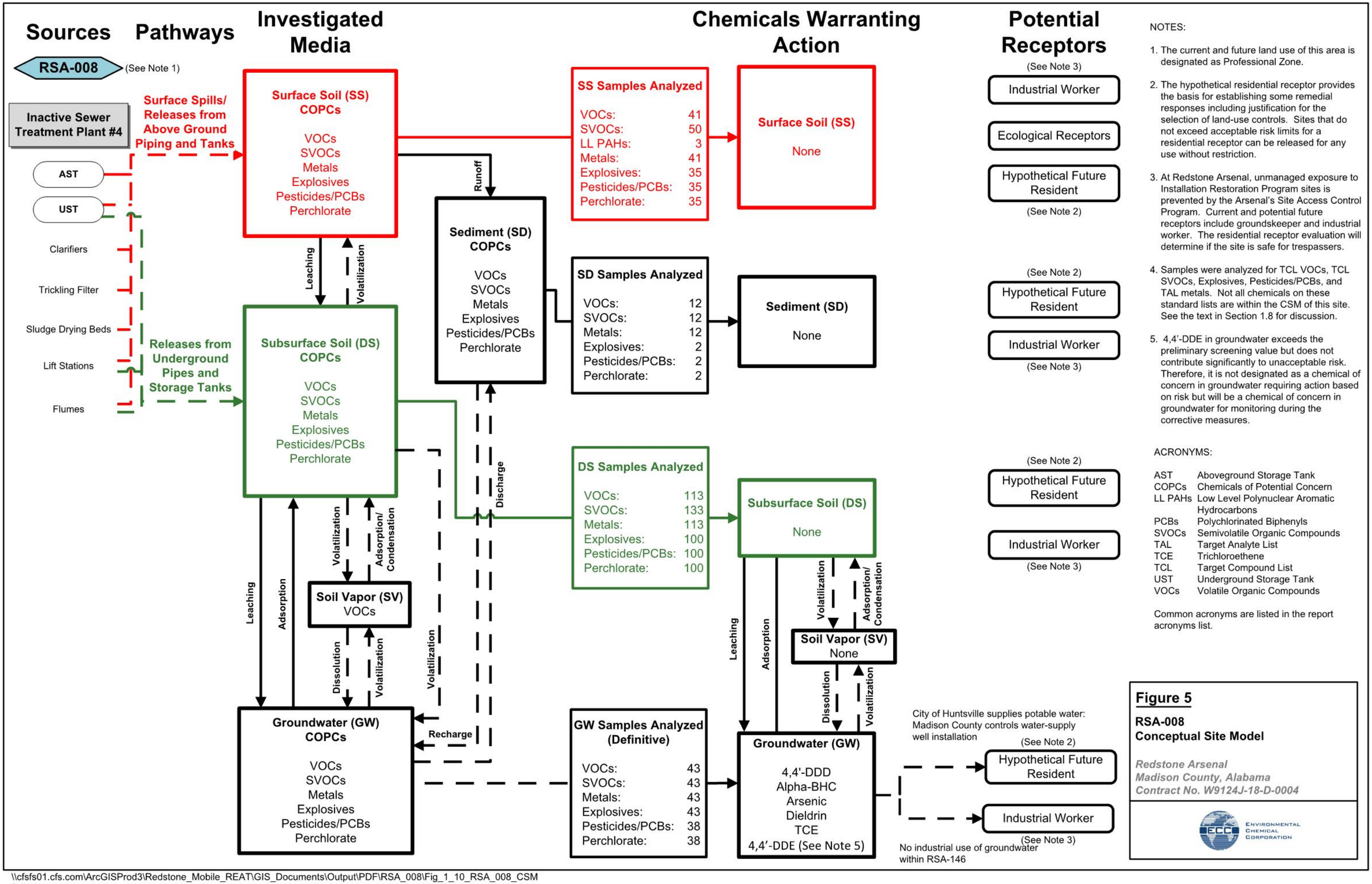
N

0 75 150 300 Feet

NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

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NOTES:

1. The current and future land use of this area is designated as Professional Zone.
2. 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.
3. 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 industrial worker. The residential receptor evaluation will determine if the site is safe for trespassers.
4. Samples were analyzed for TCL VOCs, TCL SVOCs, Explosives, Pesticides/PCBs, 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.
5. 4,4'-DDE in groundwater exceeds the preliminary screening value but does not contribute significantly to unacceptable risk. Therefore, it is not designated as a chemical of concern in groundwater requiring action based on risk but will be a chemical of concern in groundwater for monitoring during the corrective measures.

ACRONYMS:

AST	Aboveground Storage Tank
COPCs	Chemicals of Potential Concern
LL PAHs	Low Level Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
SVOCs	Semivolatile Organic Compounds
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

Common acronyms are listed in the report acronyms list.

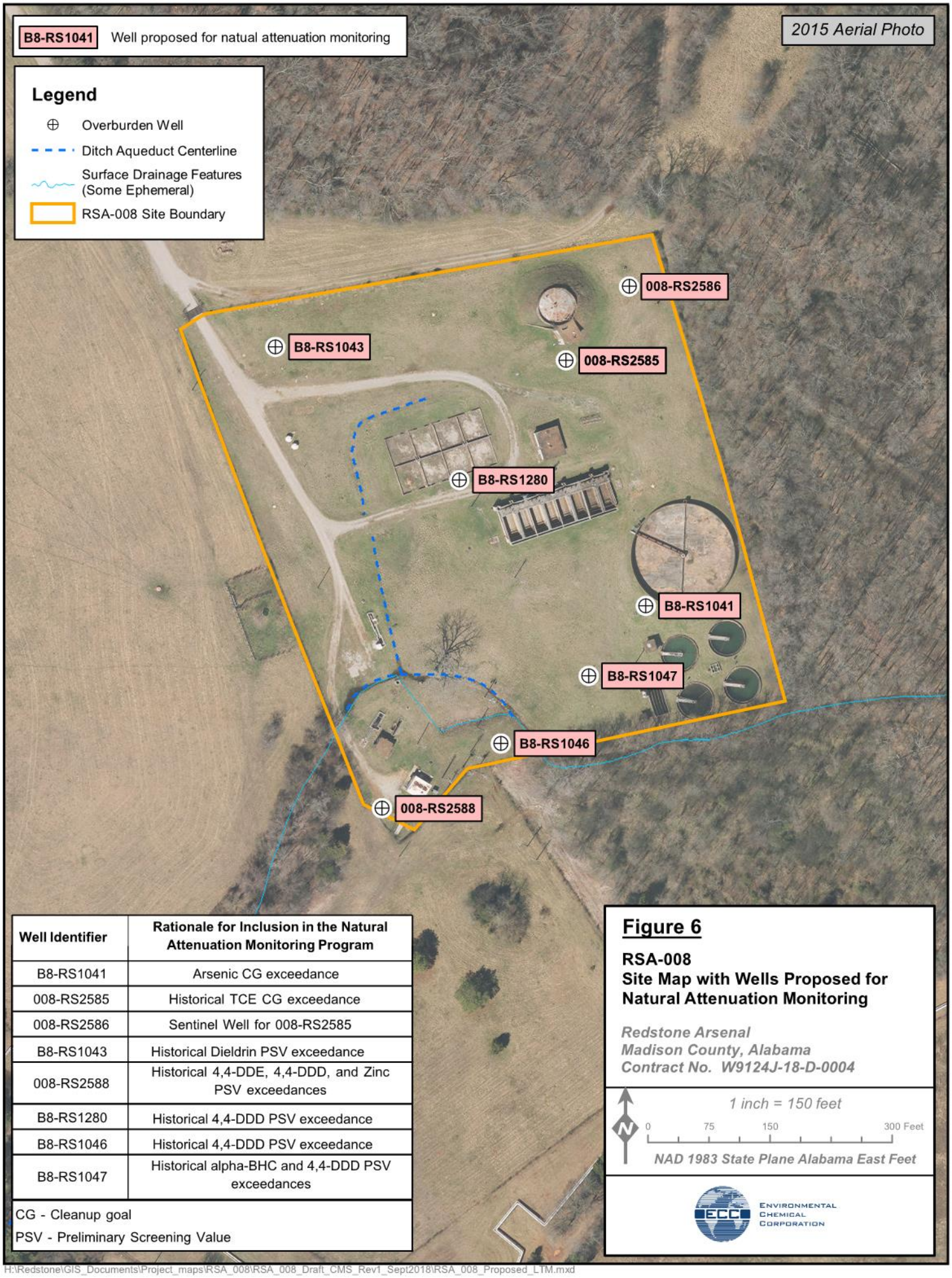
Figure 5

RSA-008
Conceptual Site Model

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

ECC Environmental Chemical Corporation

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B. Hodges



Well Identifier	Rationale for Inclusion in the Natural Attenuation Monitoring Program
B8-RS1041	Arsenic CG exceedance
008-RS2585	Historical TCE CG exceedance
008-RS2586	Sentinel Well for 008-RS2585
B8-RS1043	Historical Dieldrin PSV exceedance
008-RS2588	Historical 4,4-DDE, 4,4-DDD, and Zinc PSV exceedances
B8-RS1280	Historical 4,4-DDD PSV exceedance
B8-RS1046	Historical 4,4-DDD PSV exceedance
B8-RS1047	Historical alpha-BHC and 4,4-DDD PSV exceedances

CG - Cleanup goal
PSV - Preliminary Screening Value

Figure 6

RSA-008
Site Map with Wells Proposed for Natural Attenuation Monitoring

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

1 inch = 150 feet

N

0 75 150 300 Feet

NAD 1983 State Plane Alabama East Feet

ECC Environmental Chemical Corporation

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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

July 8, 2020

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 and Concurrence:**
Revision 4 RCRA Facility Investigation Report, RSA-008, Inactive Sewage Treatment Plant #4, dated April 13, 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 *Revision 4 RCRA Facility Investigation Report, RSA-008, Inactive Sewage Treatment Plant #4,* received April 14, 2020. Based upon this review, the Department has determined that all comments on the previous version of this document have been adequately resolved. The Department concurs with the conclusions presented in the RFI report; remedial actions are needed for groundwater only at RSA-008.

The constituents that need to be addressed as part of the remedial action include alpha-benzene hexachloride; arsenic; 4,4'-dichlorodiphenyldichloroethane; 4,4'-dichlorodiphenyldichloroethylene; dieldrin; and trichloroethylene in groundwater.

The Department will move RSA-008 from Table VI.2 (sites requiring investigation) to Table VI.6 (sites requiring corrective measures) in RSA's Alabama Hazardous Wastes Management and Minimization Act (AHWMMA) permit during the next modification. Although not all of the detected constituents in groundwater may be due to activities associated with RSA-008, the groundwater underlying the site is to be addressed with RSA-008.

In accordance with Permit Condition VI.E.2, a Corrective Measures Implementation (CMI) plan for RSA-008 must be submitted within 120 days of receiving this letter.

If you have any questions on this matter, please contact Heather Guerrero of the Remediation Engineering Section via e-mail at heather.guerrero@adem.alabama.gov or at (334) 271-7738.

Sincerely,

Jason Wilson, Chief
Governmental Hazardous Waste Branch
Land Division

JJW/ATM/HLG/tlp

cc/via email: Ashley T. Mastin, ADEM
Brian Roberson, NASA MSFC
Daniel Arthur, ADEM
Clint Howard, Redstone Arsenal
Angelique Ortiz, Redstone Arsenal
Kelley Hartley, ADEM
Robert Morris, US EPA Region IV
Kevin Greaney, 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-008, INACTIVE SEWAGE TREATMENT PLANT #4
OPERABLE UNIT 02
U.S. ARMY GARRISON – REDSTONE MADISON COUNTY, ALABAMA
July 2023

1.0 INTRODUCTION

As specified in Section VI.E.3 of the U.S. Army Garrison–Redstone's (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, Modification No. 1 (hereafter referred to as the Permit) (dated 12 August 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-008, Inactive Sewage Treatment Plant #4, Operable Unit (OU) 02, at Redstone Arsenal (RSA) in Madison County, Alabama.

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) (APTIM 2020) was prepared for RSA-008 to determine the nature and extent of contamination. The RFI report received concurrence from the Alabama Department of Environmental Management (ADEM) on July 8, 2020. 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-008 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-008 will be addressed with the RSA-145 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-008, 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 largely 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-008, Inactive Sewage Treatment Plant #4, is located in the northeastern portion of RSA, north of Martin Road and east of Patton Road. RSA-008 comprises approximately 7.96 acres. The sewage plant was constructed in 1959 and removed from active service in 1992. This plant was used for the treatment of domestic sewage and wastewater generated in the northern portion of RSA. Floor wash liquids from research laboratories and motor pools and water separated by the oil/water separators in the northern portion of RSA were treated at this plant. Site features include a digester, sludge drying beds, primary and secondary clarifiers, a trickling filter, a sewage lift station, and six small concrete aboveground storage tank saddles. Two diesel underground storage tanks (USTs) that were used to operate generators as a backup power source for the plant were removed in 1995. Environmental site RSA-048 (Inactive Sanitary Landfill, Area G), an uncovered, closed landfill, which requires corrective action under the conditions of the Permit, adjoins the southern boundary of RSA-008.

RSA-008 was initially constructed with a design capacity of 1.0 million gallons per day (mgd). In 1977, several plant upgrades were performed, and a National Pollutant Discharge Elimination System permit allowing for a capacity of up to 2.0 mgd was issued. Treated effluent was discharged to McDonald Creek (USAEHA 1970) via an unlined drainage ditch, which flowed east just outside the southern site boundary toward McDonald Creek. The plant underwent additional upgrades in 1982 to provide for a capacity of up to 6.0 mgd. After the upgrade, effluent from RSA-008 was discharged through a manifold force main system to a Parshall flume near Shields and Buxton Roads.

The sewage treatment plant at RSA-008 was taken out of service in 1992. Currently, raw sewage enters RSA-008 through an 18-inch-diameter gravity influent pipe that passes through a wet well in the southwestern corner of the site area and briefly daylights in an open, concrete-lined Parshall flume before it enters an underground piping system. An effluent pumping station sends this flow through a force main system to the active sewage treatment system on Buxton Road. Sewage does not routinely flow through the former treatment structures of the plant.

Most of the former process tanks and structures (e.g., digester tank, primary clarifier, trickling filter, secondary clarifiers, and sludge drying beds) remain onsite. These structures are maintained such that they may be used to provide additional storage capacity for untreated wastewater in the event of an emergency affecting the current wastewater treatment system. If an emergency event causes the influent capacity of the current treatment system to be exceeded or repairs to that system require a temporary diversion of the influent flow from the current treatment system, several inactive treatment structures at RSA-008 (e.g., primary clarifier, trickling filter, and secondary clarifiers) will be used to provide temporary storage capacity for untreated sewage influent. After repairs are completed, the raw sewage stored at RSA-008 would be transferred to the active central sewage treatment plant for treatment. There are no plans to resume active treatment of sewage at RSA-008 (APTIM 2020).

3.0 INVESTIGATIVE HISTORY AND INTERIM REMEDIAL ACTIONS

Environmental investigations were formally initiated at RSA-008 in 1996. This section describes the data collection efforts that contributed to the RFI at RSA-008. Results used are provided in the Rev. 4 RFI (APTIM 2020).

- RSA interim facility assessment report
- Final identification and evaluation of potential SWMUs and areas of concern
- RSA-008 Site Investigation
- RSA-008 Remedial Investigation
- RSA-145 PSA investigation
- RSA RCRA Facility Assessment
- RSA basewide sampling event
- RFI.

4.0 SCOPE OF THE CORRECTIVE MEASURES FOR RSA-008

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 2009) 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 by the interim remedy instead of site-specific land use controls (LUCs) due to the relatively short (10-year) restoration time frames.
- 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-008 are limited to one metal (arsenic), three pesticides (4,4′-dichlorodiphenyldichloroethane [4,4′-DDD], alpha-hexachlorocyclohexane [BHC], dieldrin), and one volatile organic compound (VOC) (trichloroethene [TCE]) 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 construction workers, commercial workers, and hypothetical residential receptors 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 Interim Record of Decision (IROD) (Shaw 2007). The Army has elected to perform corrective measures to address groundwater contamination:

- MNA for groundwater until all contaminants of concern (COCs) (4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE) have attained cleanup goals (CGs).

A mentioned in the Corrective Measures Study (CMS) report (ECC 20220, all groundwater COCs at RSA-008 are at concentrations only marginally below or exceeding individual CGs. Therefore, for RSA-008, a groundwater sampling program consisting of 10 years of monitoring is proposed. Attenuation of TCE may occur in as few as 2 years. Attenuation of arsenic in groundwater cannot be estimated due to known elevated concentrations of naturally occurring arsenic in soil; alkaline groundwater, which enhances desorption of arsenic from soil to groundwater; the unknown species of arsenic; and the unknown reactions inducing the mobilization. For these reasons, a 10-year basis is conservatively assumed as the time required to demonstrate attainment of the CGs and to meet the requirements for no further action. However, it should be noted that once the CGs have been reached and maintained for 3 consecutive years in all monitoring wells, the Army can petition ADEM to discontinue the monitoring program in accordance with the Permit. Alternatively, should CGs be reached and maintained for 3 consecutive years for individual COCs and/or individual wells, the Army can petition ADEM to modify the monitoring program accordingly.

5.0 SITE CHARACTERISTICS

RSA-008, Inactive Sewage Treatment Plant #4, is located in the northeastern portion of RSA, north of Martin Road Southwest and west of the southern end of Triana Boulevard Southwest. This approximate 8-acre environmental site area is covered by grassy areas that are interspersed with a few small gravel areas, gravel paved roads, and the remnants of more than a dozen inactive man-made structures, which were formerly used by the sewage and wastewater treatment plant. A palustrine emergent wetland area is present along the southwestern boundary of the site, and palustrine forested wetlands occur north and east of the site. No permanent or seasonal surface water features are present within the boundary of RSA-008. Site drainage is controlled by ephemeral unlined ditches. The topography at RSA-008 is generally flat except at the engineered mound surrounding the inactive digester tank in the northeastern corner of the site. The primary mechanism for the vertical migration of a surface release to subsurface soils is natural infiltration/percolation.

The following summarizes the RSA-008 site characteristics, including the Conceptual Site Model:

- The potential release locations and potential contaminants for soil and groundwater include the following: Overflows, leaks, and spills of fuel-related VOCs, semivolatile organic compounds (SVOCs) (i.e., polycyclic aromatic hydrocarbons [PAHs]), and the metal lead from the USTs near Buildings 3773 and 3772.
- Historical activities in the buildings included a motor repair shop, dry boat storage, equipment testing, chemical laboratories, a gasoline pump station, and a motor grease wash stall. Former USTs were located near the digester (Building 3773) and the plant office building (Building 3772).
- The following COCs were identified in the Rev. 4 RFI (APTIM 2020): 4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE.
- Potential receptors could be exposed to contaminated groundwater at the site. Current human receptors are limited to commercial and construction workers. Future potential receptors include all current receptors plus, under a land reuse scenario, hypothetical child and adult residents.

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. Fifty-three surface soil samples, 133 subsurface soil samples, 12 sediment samples, and 44 groundwater samples were collected during the RFI phase. Soil and groundwater samples were analyzed for metals, VOC, SVOCs with PAHs, polychlorinated biphenyls (PCBs), and pesticides. The RFI concluded that exposure to RSA-008 soils poses no unacceptable health risk to any of the receptors evaluated herein under commercial/industrial or residential site use. Groundwater is contaminated with 4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE, 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 4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE is presented below. COCs in site wells are summarized in Table 1 of the CMI Work Plan.

6.1 Volatile Organic Compounds

- All VOCs detected in surface soil and subsurface soil were at concentrations below preliminary screening values (PSVs).
- TCE was detected at a concentration slightly exceeding the PSV in one groundwater sample collected from overburden monitoring well 008-RS2585 in January 2015. The TCE concentration was below the PSV when the well was resampled in July 2015.
- All VOCs were detected in sediment at concentrations below the PSVs.

6.2 Metals

- Select metals were detected at anomalous concentrations in surface soil (calcium) and subsurface soil (selenium and vanadium), but the concentrations did not exceed both the background screening value (BSV) and PSV. No metals detected in soil were identified as representing contamination.
- Two metals (chromium and mercury) were detected in sediment at anomalous concentrations above the BSVs and PSVs. The anomalous concentrations of chromium and mercury were delineated by upstream and downstream samples, which did not contain elevated concentrations of either metal. All other metals detected in sediment were detected at concentrations below the BSVs and PSVs or were determined to be naturally occurring.

- Arsenic and zinc were each detected in one groundwater sample at concentrations above BSVs and PSVs and were determined to be anomalous. The arsenic exceedance was delineated by naturally occurring concentrations. The anomalous zinc concentration in 008-RS2588 from July 2015 was resampled in November 2016, detected below the BSV and PSV, and present at a naturally occurring concentration.

6.3 Semivolatile Organic Compounds/Polycyclic Aromatic Hydrocarbons

- Benzo(a)pyrene was detected in two surface soil sample locations and one subsurface soil sample location at concentrations above the PSV. The locations of benzo(a)pyrene exceeding the PSV are delineated both horizontally and vertically by concentrations less than the PSV.
- One SVOC/PAH (benzo[a]pyrene) exceeded the PSV in two sediment samples collected at the eastern end of the drainage ditch before it empties into McDonald Creek. The exceedances are delineated upstream, but delineation down McDonald Creek was not performed because the creek receives runoff from a regional area and sediments in the creek are impacted by releases from many non-regulated sources of PAHs, such as roads, parking lots, and building runoff, as well as potentially by other upstream SWMUs.
- All SVOC concentrations in groundwater were below the PSVs.

6.4 Pesticides

- The pesticides dieldrin (in B8-RS1043); 4,4′-DDD (in B8-RS1046, B8-RS1047, B8-RS1280, 008-RS2585, and 008-RS2588); 4,4′-DDE (in 008-RS2588); and alpha-BHC (in B8-RS1047) were detected in one or more of the usable groundwater samples evaluated during the RFI at concentrations exceeding the PSVs. The pesticide PSV exceedances in site wells were delineated by concentrations below the PSVs. Dieldrin, alpha-BHC, 4,4′-DDD, and 4,4′-DDE were carried forward as potential groundwater COCs at the site.
- All pesticides concentrations in soil and sediments were below the PSVs.

6.5 Fate and Transport

Potential release mechanisms and migration routes for contaminants were identified and evaluated at RSA-008 in a fate and transport evaluation in the Rev 4. RFI report (APTIM 2020). At RSA-008, the most significant potential contaminant migration pathway at RSA-008 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. No chemicals were present in soil at concentrations that could cause a groundwater impact due to leaching and migration to the water table.

7.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCES USE

RSA-008 is located within the central portion of RSA in an area designated as “Business” in the RSA Master Plan. RSA-008 will most likely not be developed for future residential use. Although risk regulations, policy, and guidance specify the evaluation of 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 (ADEM 2017b) and Alabama Risk-Based Corrective Action (ARBCA) guidance (ADEM 2017a). RSA is legally mandated to comply with AHWMMA. In RSA’s AHWMMA Permit, ADEM requires that these guidance documents, including approved risk assessment work plans (IT Corporation 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 support the use of land use controls as a component of the selected remedy. Therefore, risks to a residential receptor were assessed in the RFI (APTIM 2020).

There is no current potable use of groundwater at RSA-008, 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 (APTIM 2020).

8.0 SITE RISKS

An ARBCA evaluation for human health and an ecological risk evaluation were performed for RSA-008 in accordance with the ARBCA Guidance Manual (ADEM 2017a) as part of the Rev. 4 RFI (APTIM 2020). The complete ARBCA evaluation for human health and the ecological risk evaluation are provided in the Rev. 4 RFI report.

8.1 Human Health Risk Assessment

The human health risk assessment for RSA-008 was prepared and presented in the Rev. 4 RFI (APTIM 2020) in accordance with the ARBCA guidance (ADEM 2017a). 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-008, 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 PSVs. In the case of soil, the PSVs generally were the USEPA (2017) regional screening levels (RSLs), based on the lower of an individual excess lifetime cancer risk (IELCR) of 1E-06 and a non-cancer hazard index (HI) of 0.1. In the case of groundwater, maximum contaminant levels (MCLs) were used as the PSVs, if available. Otherwise, tap water RSLs (USEPA 2017) were used. Residential PSVs were selected for the evaluation of this site to consider alternatives to attain unrestricted land use. The protocol for the PSL evaluation is described in the Rev. 4 RFI report (APTIM 2020) and the installation-wide work plan (Shaw 2010).

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 shown in a site-to-background evaluation to be naturally occurring are judged not to be site related and are not evaluated further. Concentrations of all other detected chemicals are compared to PSVs in the PSL evaluation. A substance is identified as a COC if the MDC is greater than its PSV. Chemicals that may accumulate in homegrown produce from soil are also considered to be COCs, and chemicals in groundwater that have MCLs, whether the concentrations exceed them, are considered COCs in the RM-2 evaluation. In addition, aldrin was included in the RM-2 evaluation of groundwater. This compound was not detected in groundwater, but its maximum analytical detection limit was greater than its PSV.

A screening-level vapor intrusion evaluation was conducted for RSA-008. It was concluded that VOCs in soil and groundwater at RSA-008 do not represent a source that would pose an unacceptable health threat to occupants of 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). The protocol for the RM-2 cumulative risk evaluation is presented in the Rev. 4 RFI report (APTIM 2020). Receptor scenarios evaluated in the cumulative risk assessment included a commercial worker, a construction worker, and a hypothetical residential receptor.

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 by RSA's SAC program (U.S. Army2012) and the terms of the IWGW IROD (Shaw 2007).

The ARBCA guidance considers an IELCR of 1E-05 as the target cumulative risk used to guide site management. 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 2-2 in the CMS report. The cumulative IELCR estimates for exposure to soil alone are less than the ADEM trigger level of 1E-05 for all receptors. The cumulative HI estimates for all receptors for exposure to soil alone also fall below the threshold level of 1.0.

For groundwater, the cumulative IELCR estimate is greater than 1E-05 for the hypothetical resident and the commercial worker but not the construction worker. The cumulative HI for groundwater exceeded 1.0 for the hypothetical resident only.

Table 2-3 in the CMS report summarizes the RM-2 evaluation of human health for RSA-008. It shows the relevant COCs identified through the ARBCA evaluation that require action. No relevant COCs were identified in soil. Arsenic and TCE were identified as relevant COCs in groundwater for all receptors because their MDCs exceeded their MCLs. In addition, 4,4′-DDD, alpha-BHC, and dieldrin were identified as relevant COCs for the hypothetical resident. Non-detect aldrin was not identified as a relevant COC.

8.2 Screening-Level Ecological Risk Assessment

A screening-level ecological risk assessment (SLERA) was completed for RSA-008 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 (ESVs). A weight-of-evidence (WOE) evaluation was completed to further evaluate the constituents identified in the initial screening. The WOE evaluation examined multiple lines of evidence in order to draw conclusions as to whether site-related constituents have the potential to pose hazards to ecological receptors. In addition to the evaluation of surface soil at RSA-008, sediment in the unlined drainage ditch along the southern boundary of RSA-008 was also evaluated.

The initial comparison of the detected constituent concentrations in RSA-008 surface soil to ESVs and BSVs identified nine metals (cadmium, calcium, chromium, cobalt, lead, manganese, mercury, selenium, and silver), p-nitrotoluene, total dichlorodiphenyltrichloroethane (DDT) and metabolites, alpha-chlordane, beta-BHC, methoxychlor, carbazole, total high molecular weight (HMW) PAHs, bis(2-ethylhexyl)phthalate, and methylene chloride as preliminary contaminants of potential ecological concern (COPECs) that required further assessment. Following the COPEC refinement process, a terrestrial invertebrate community-level assessment, terrestrial plant community-level assessment, and terrestrial food chain assessment were completed for RSA-008 surface soils. The results of this SLERA indicate that none of the detected constituents in surface soil at RSA-008 are likely to pose hazards to terrestrial ecological receptor communities and/or populations, and further evaluation of terrestrial ecological hazards from these COPECs in surface soil at RSA-008 is not warranted.

The unlined drainage ditch evaluated in the SLERA does not support true aquatic habitat, and many aquatic receptors may not be present at RSA-008. However, the sediment samples collected from RSA-008 were evaluated as true sediments in the SLERA. Sediment sample results were compared to both sediment ESVs and BSVs in selecting preliminary COPECs. The screening-level hazard evaluation for sediment at RSA-008 identified arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, vanadium, zinc, total DDT and metabolites, total HMW PAHs, total low molecular weight (LMW) PAHs, bis(2-ethylhexyl)phthalate, and acetone as preliminary COPECs in sediment that required further assessment. Following the COPEC refinement process, a benthic invertebrate community-level assessment and a food chain assessment were completed for RSA-008 sediments. The results of this SLERA indicate that COPECs in sediment at RSA-008 are unlikely to pose hazards to ecological food chain receptor populations or to terrestrial invertebrate or plant communities.

9.0 CORRECTIVE MEASURE OBJECTIVES

Based on the results of the RFI (APTIM 2020), the Corrective Measures Objective (CMO) for RSA-008 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 towards 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-008 subsurface soil and groundwater will be accomplished by MNA of groundwater for 4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE 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 (i.e., Arsenic and TCE), the MCLs are selected as the CGs. 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. The target cancer risks shown for 4,4′-DDD, alpha-BHC, and dieldrin are set to achieve a cumulative cancer risk of 1E-05. The chemicals with MCLs (arsenic and TCE) are not included in the risk-based evaluation because their regulatory values are based on other considerations in addition to risk.

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-008. Considering the limited area of the site and the relatively low COC concentrations found 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 at RSA-008:

- ***Alternative 1: No Action*** – Evaluation of the no action alternative will serve as a baseline for evaluating other corrective measures.
- ***Alternative 2 – LUCs*** – Alternative 2 involves engineering and physical barriers, such as fences and security guards, as well as institutional controls that are non-engineering instruments, such as administrative and legal controls that help to control and minimize potential exposure to contamination and/or to protect the integrity of a response action.
- ***Alternative 3: MNA*** – Alternative 3 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 10 consecutive years to verify that concentrations remain below CGs (Years 1 through 10). Alternative 3 would protect human health by continuing the LUCs currently in place (the interim remedy) instead of site-specific LUCs due to the relatively short (10-year) restoration time frames.

11.0 SELECTED CORRECTIVE MEASURE

Alternative 3, MNA, most appropriately addresses the contaminated groundwater at RSA-008. 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. Alternative 3 would protect human health and achieve the CMOs by maintaining the existing LUCs that prohibit potable use of groundwater at RSA-008. Future potable use of groundwater from some areas within the groundwater units would potentially pose an unacceptable threat to human health; however, there is no current potable use of groundwater at RSA-008, and such use would remain controlled by interim remedy instead of site-specific LUCs due to the relatively short (10-year) restoration time frames.

The major components of the corrective measures in Alternative 3 include the following:

- Natural attenuation monitoring at seven monitoring wells (Figure 9 of the CMI Work Plan).
    - Baseline groundwater sampling (Year 0) of COCs requiring monitoring (4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE).
    - Semiannual groundwater sampling (Years 1, 2, and 3) of COCs requiring monitoring (4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE).
    - Annual groundwater sampling (Years 4 through 10) of COCs requiring monitoring (4,4′-DDD, dieldrin, alpha-BHC, arsenic, and TCE).
- Annual reporting
- Well closure (seven wells).

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-008 corrective measures.

13.0 REFERENCES

ADEM (Alabama Department of Environmental Management). 2017a. Alabama Risk-Based Corrective Action Guidance Manual – Revision 3.0. February.

ADEM. 2017b. Alabama Environmental Investigation and Remediation Guidance, Revision 4.0. February.

ADEM. 2022. Modification No. 1 to AHWMMA Hazardous Waste Storage/SWMU Corrective Action/Subpart X Permit. August 12.

APTIM. 2020. Revision 4 RCRA Facility Investigation Report, RSA-008, Inactive Sewage Treatment Plant #4, U.S. Army Garrison-Redstone, Madison County, Alabama, U.S. EPA ID No. AL7 210 020 742. April.

IT (IT Corporation). 2002. Draft-Final, Revision 2, Installation-Wide Work Plan, Redstone Arsenal, Madison County, Alabama. June.

Shaw. 2007. Final Interim Record of Decision, Interim Remedial Action for Installation-Wide Groundwater, Redstone Arsenal, Madison County, Alabama, prepared for the U.S. Army Corps of Engineers, Savannah District. September.

Shaw. 2009. Installation-Wide Groundwater Land-Use Control Remedial Design, Redstone Arsenal, Madison County, Alabama, prepared for U.S. Army Corps of Engineers-Savannah District, February.

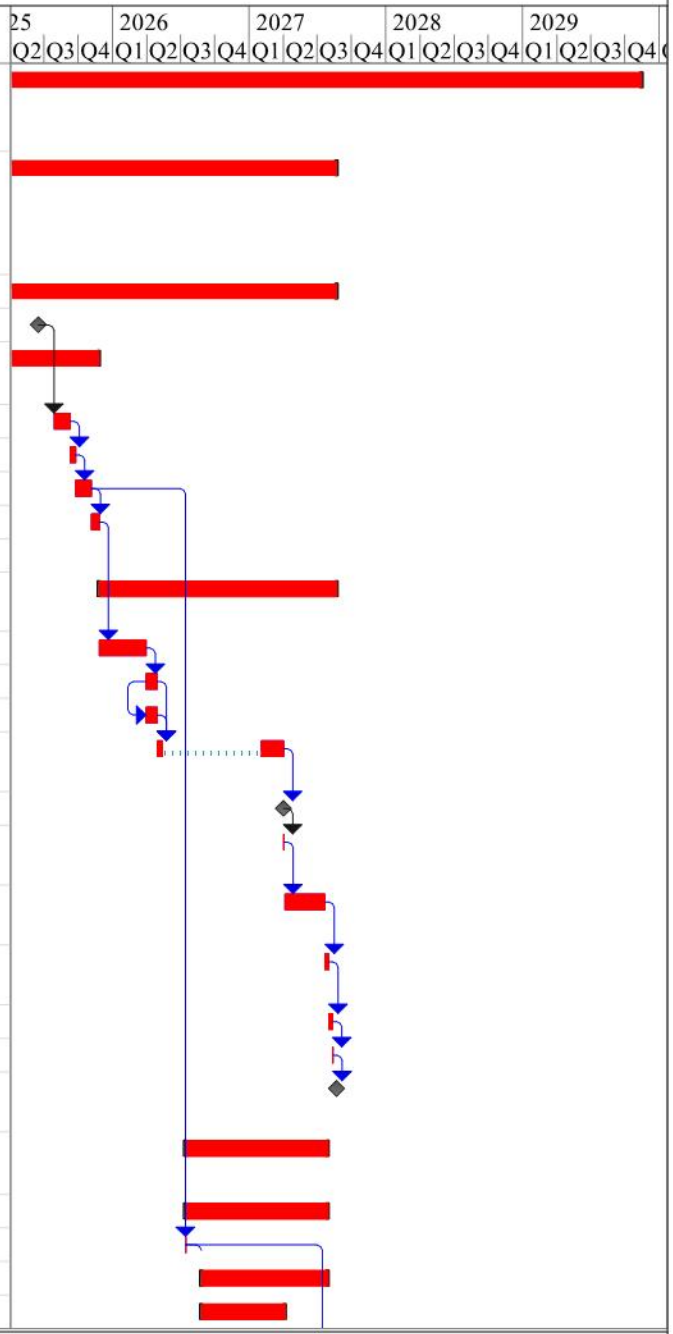
Shaw. 2010. Installation-Wide Work Plan, Final Appendices B, C, D, E, F, Redstone Arsenal, Madison County, Alabama. September.

APPENDIX C

CORRECTIVE MEASURES IMPLEMENTATION SCHEDULE

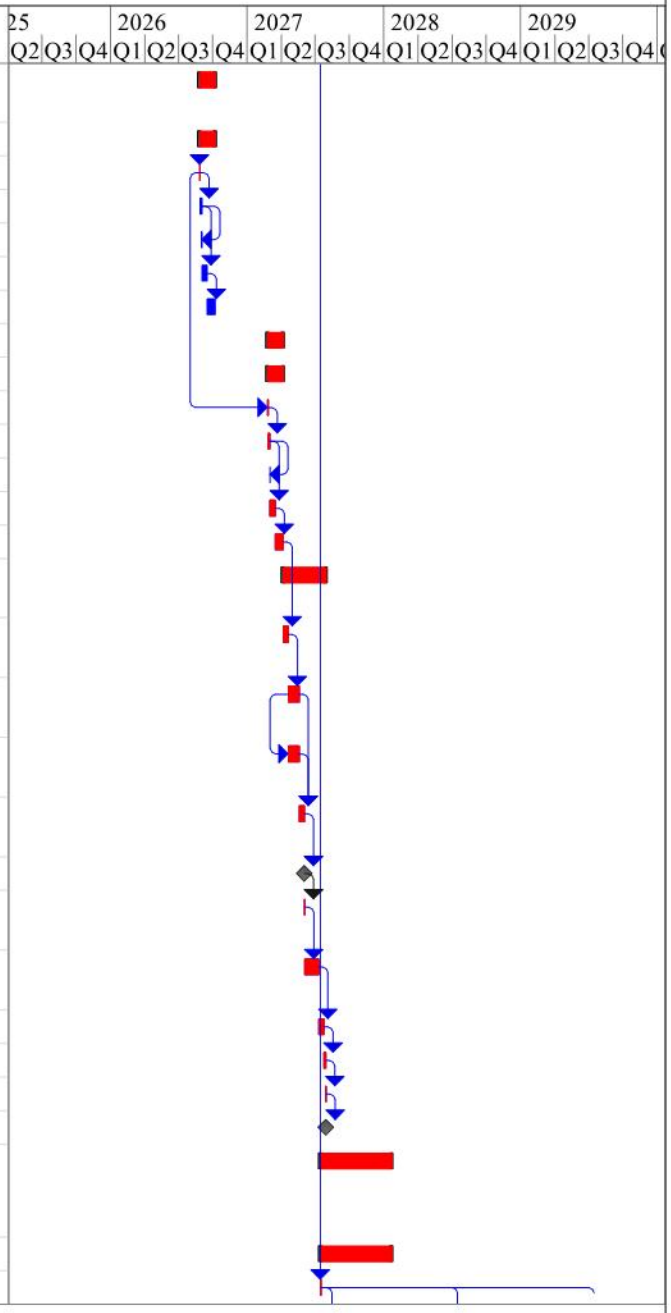
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ID	Task Name	Duration	Start	Finish
1	**Environmental Remediation Multiple Award Indefinite Delivery Indefinite Quantity (IDIQ) Contract Redstone Arsenal, AL**	**2457 days**	**Fri 1/15/21**	**Tue 8/14/29**
861	**CLIN 006 - Achieve Corrective Measures Implementation – Construction (CMI-C) and Corrective Measures Implementation Report (CMIR) for Site RSA-008**	**1642 days**	**Fri 1/15/21**	**Sat 5/22/27**
862	**RSA-008**	**1642 days**	**Fri 1/15/21**	**Sat 5/22/27**
863	Notice to Proceed	0 days	Mon 3/17/25	Mon 3/17/25
864	**Corrective Measures Implementation – Construction (CMI-C) - Field Work**	**1172 days**	**Fri 1/15/21**	**Mon 8/25/25**
865	Subcontractor Procurement	31 days	Mon 4/28/25	Mon 6/9/25
866	Baseline Groundwater Sampling	10 days	Tue 6/10/25	Mon 6/23/25
867	Laboratory Analysis	30 days	Tue 6/24/25	Mon 8/4/25
868	Data Validation	15 days	Tue 8/5/25	Mon 8/25/25
869	Demobilization	1 day	Fri 1/15/21	Fri 1/15/21
870	**Corrective Measures Implementation Report (CMIR)**	**470 days**	**Tue 8/26/25**	**Sat 5/22/27**
871	Prepare and Develop Draft CMIR	90 days	Tue 8/26/25	Mon 12/29/25
872	Army Review of Draft CMIR	21 days	Tue 12/30/25	Tue 1/27/26
873	OPSEC Review of Draft CMIR	21 days	Tue 12/30/25	Tue 1/27/26
874	Respond to Army Comments on Draft CMIR	54 days	Wed 1/28/26	Thu 12/31/26
875	Army approve of Draft CMIR	0 days	Thu 12/31/26	Thu 12/31/26
876	Submit Draft Final CMIR to ADEM / EPA	1 day	Fri 1/1/27	Fri 1/1/27
877	ADEM / EPA Review of Draft Final CMIR	85 days	Mon 1/4/27	Wed 4/21/27
878	Develop response to ADEM / EPA Comments on Draft Final CMIR	10 days	Thu 4/22/27	Sat 5/1/27
879	Army Review of RTCs	10 days	Sun 5/2/27	Tue 5/11/27
880	Submit Final (Revision 1) CMIR	1 day	Wed 5/12/27	Wed 5/12/27
881	ADEM / EPA Approval of Final (Revision 1) CMIR	0 days	Sat 5/22/27	Sat 5/22/27
1071	**Achieve Corrective Measures Implementation – Operations (CMI-O) Option Year 1 for site RSA-008**	**282 days**	**Tue 4/14/26**	**Thu 4/29/27**
1072	**RSA-008**	**282 days**	**Tue 4/14/26**	**Thu 4/29/27**
1073	Notice to Proceed	1 day	Tue 4/14/26	Tue 4/14/26
1074	**CMI-O Field Work**	**251 days**	**Wed 5/27/26**	**Thu 4/29/27**
1075	**Annual Sampling and Reporting**	**159 days**	**Wed 5/27/26**	**Mon 1/4/27**



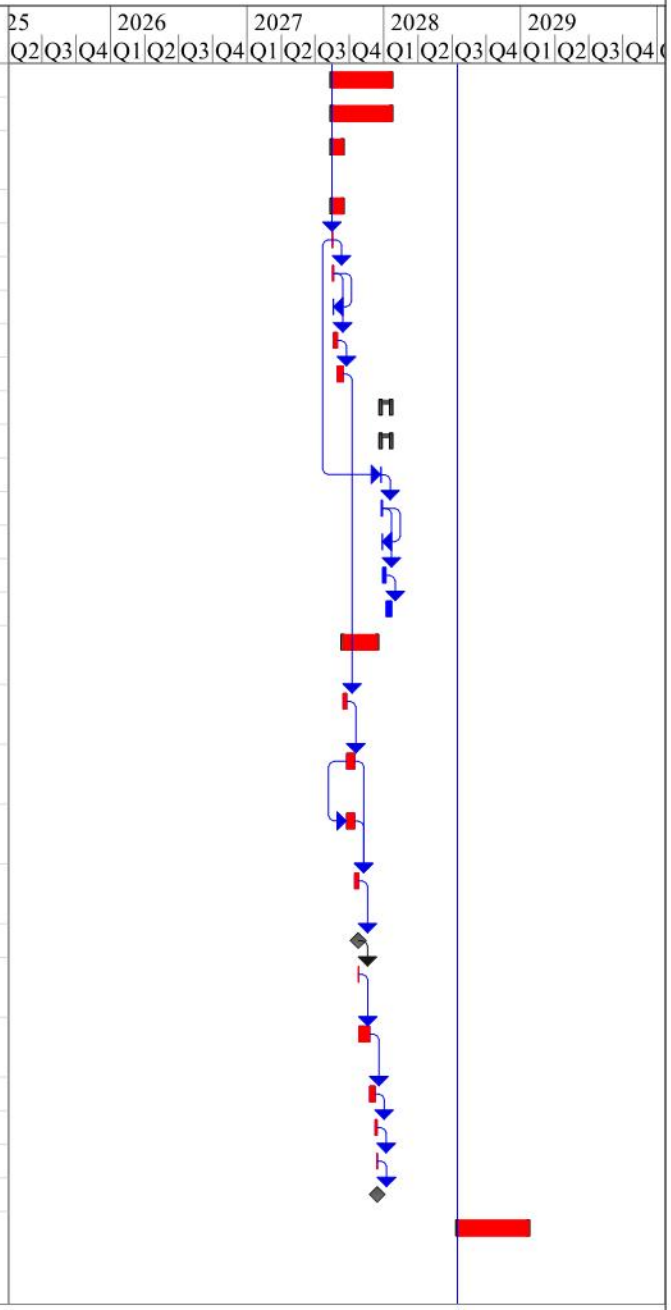
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Critical path activities are displayed as red bars

ID	Task Name	Duration	Start	Finish
1076	**Semi-Annual Groundwater Sampling Event 1**	**29 days**	**Wed 5/27/26**	**Mon 7/6/26**
1077	**Field Work**	**29 days**	**Wed 5/27/26**	**Mon 7/6/26**
1078	Mobilization	1 day	Wed 5/27/26	Wed 5/27/26
1079	Groundwater Monitoring	3 days	Thu 5/28/26	Mon 6/1/26
1080	Demobilization	1 day	Mon 6/1/26	Mon 6/1/26
1081	Laboratory Analysis	10 days	Tue 6/2/26	Mon 6/15/26
1082	Data Validation	15 days	Tue 6/16/26	Mon 7/6/26
1083	**Semi-Annual Sampling Event 2**	**29 days**	**Wed 11/25/26**	**Mon 1/4/27**
1084	**Field Work**	**29 days**	**Wed 11/25/26**	**Mon 1/4/27**
1085	Mobilization	1 day	Wed 11/25/26	Wed 11/25/26
1086	Groundwater Monitoring	3 days	Thu 11/26/26	Mon 11/30/26
1087	Demobilization	1 day	Mon 11/30/26	Mon 11/30/26
1088	Laboratory Analysis	10 days	Tue 12/1/26	Mon 12/14/26
1089	Data Validation	15 days	Tue 12/15/26	Mon 1/4/27
1090	**Annual Corrective Measures Implementation Operations (CMI-O) Report**	**92 days**	**Tue 1/5/27**	**Thu 4/29/27**
1091	Prepare and Develop Draft Annual CMI-O Report	10 days	Tue 1/5/27	Mon 1/18/27
1092	Army Review of Draft Annual CMI-O Report	21 days	Tue 1/19/27	Tue 2/16/27
1093	OPSEC Review of Draft Annual CMI-O Report	21 days	Tue 1/19/27	Tue 2/16/27
1094	Respond to Army Comments on Draft Annual CMI-O Report	10 days	Wed 2/17/27	Tue 3/2/27
1095	Army approval of Draft CMI-O Report	0 days	Tue 3/2/27	Tue 3/2/27
1096	Submit Draft Final Annual CMI-O Report to ADEM / EPA	1 day	Wed 3/3/27	Wed 3/3/27
1097	ADEM Review of Draft Final CMI-O Report	30 days	Thu 3/4/27	Fri 4/9/27
1098	Prepare Responses to ADEM comments	14 days	Sat 4/10/27	Fri 4/23/27
1099	Army review of RTCs	5 days	Sat 4/24/27	Wed 4/28/27
1100	Submit Final CMI-O Report	1 day	Thu 4/29/27	Thu 4/29/27
1101	ADEM approval of Final annual Report	0 days	Thu 4/29/27	Thu 4/29/27
1102	**Achieve Corrective Measures Implementation – Operations (CMI-O) Option Year 2 for site RSA-008 (Outside of Contract POP)**	**190 days**	**Thu 4/15/27**	**Thu 10/21/27**
1103	**RSA-008**	**190 days**	**Thu 4/15/27**	**Thu 10/21/27**
1104	Notice to Proceed	1 day	Thu 4/15/27	Thu 4/15/27



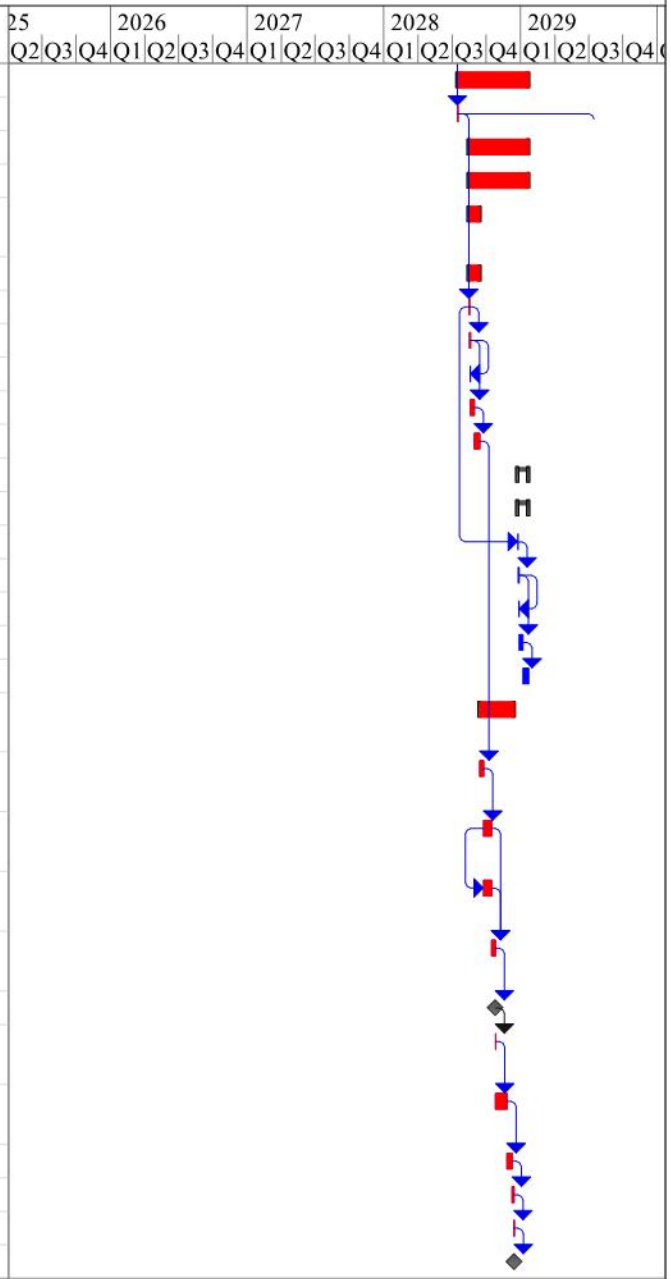
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ID	Task Name	Duration	Start	Finish
1105	**CMI-O Field Work**	**159 days**	**Sun 5/16/27**	**Thu 10/21/27**
1106	**Semi-Annual Sampling and Reporting**	**159 days**	**Sun 5/16/27**	**Thu 10/21/27**
1107	**Semi-Annual Groundwater Sampling Event 1**	**29 days**	**Sun 5/16/27**	**Sun 6/13/27**
1108	**Field Work**	**29 days**	**Sun 5/16/27**	**Sun 6/13/27**
1109	Mobilization	1 day	Sun 5/16/27	Sun 5/16/27
1110	Groundwater Monitoring	3 days	Mon 5/17/27	Wed 5/19/27
1111	Demobilization	1 day	Wed 5/19/27	Wed 5/19/27
1112	Laboratory Analysis	10 days	Thu 5/20/27	Sat 5/29/27
1113	Data Validation	15 days	Sun 5/30/27	Sun 6/13/27
1114	**Semi-Annual Sampling Event 2**	**29 days**	**Thu 9/23/27**	**Thu 10/21/27**
1115	**Field Work**	**29 days**	**Thu 9/23/27**	**Thu 10/21/27**
1116	Mobilization	1 day	Thu 9/23/27	Thu 9/23/27
1117	Groundwater Monitoring	3 days	Fri 9/24/27	Sun 9/26/27
1118	Demobilization	1 day	Sun 9/26/27	Sun 9/26/27
1119	Laboratory Analysis	10 days	Mon 9/27/27	Wed 10/6/27
1120	Data Validation	15 days	Thu 10/7/27	Thu 10/21/27
1121	**Annual Corrective Measures Implementation Operations (CMI-O) Report**	**92 days**	**Mon 6/14/27**	**Mon 9/13/27**
1122	Prepare and Develop Draft Annual CMI-O Report	10 days	Mon 6/14/27	Wed 6/23/27
1123	Army Review of Draft Annual CMI-O Report	21 days	Thu 6/24/27	Wed 7/14/27
1124	OPSEC Review of Draft Annual CMI-O Report	21 days	Thu 6/24/27	Wed 7/14/27
1125	Respond to Army Comments on Draft Annual CMI-O Report	10 days	Thu 7/15/27	Sat 7/24/27
1126	Army approval of Draft CMI-O Report	0 days	Sat 7/24/27	Sat 7/24/27
1127	Submit Draft Final Annual CMI-O Report to ADEM / EPA	1 day	Sun 7/25/27	Sun 7/25/27
1128	ADEM Review of Draft Final CMI-O Report	30 days	Mon 7/26/27	Tue 8/24/27
1129	Prepare Responses to ADEM comments	14 days	Wed 8/25/27	Tue 9/7/27
1130	Army review of RTCs	5 days	Wed 9/8/27	Sun 9/12/27
1131	Submit Final CMI-O Report	1 day	Mon 9/13/27	Mon 9/13/27
1132	ADEM approval of Final annual Report	0 days	Mon 9/13/27	Mon 9/13/27
1133	**Achieve Corrective Measures Implementation – Operations (CMI-O) Option Year 2 for site RSA-008 (Outside of Contract POP)**	**190 days**	**Sat 4/15/28**	**Sat 10/21/28**



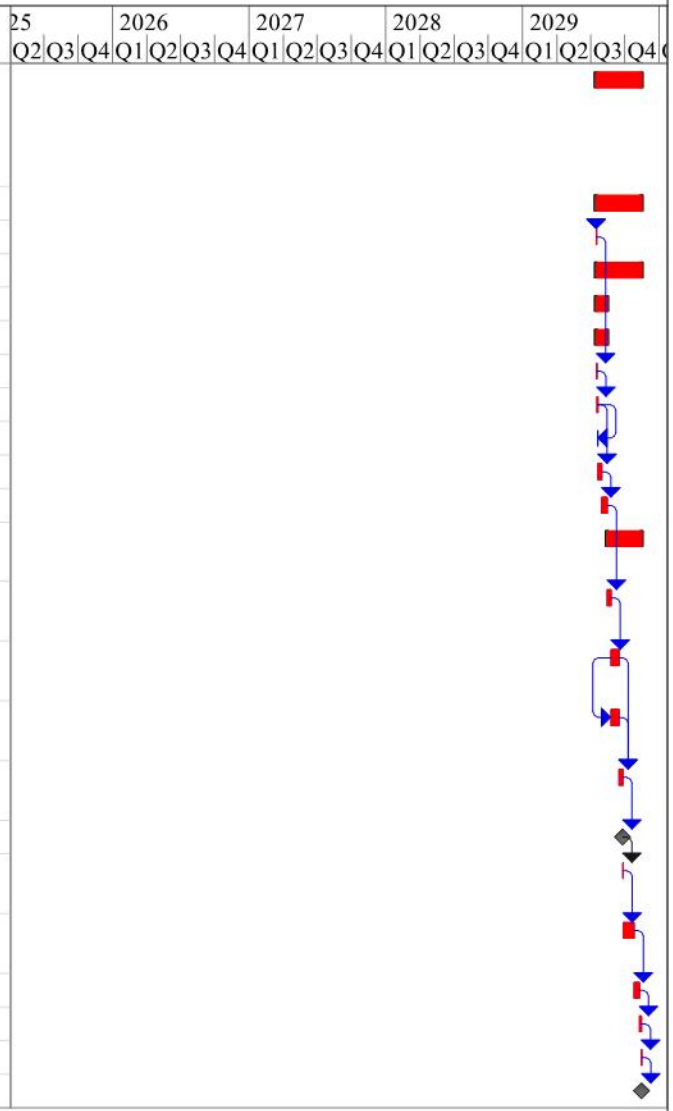
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ID	Task Name	Duration	Start	Finish
1134	**RSA-008**	**190 days**	**Sat 4/15/28**	**Sat 10/21/28**
1135	Notice to Proceed	1 day	Sat 4/15/28	Sat 4/15/28
1136	**CMI-O Field Work**	**159 days**	**Tue 5/16/28**	**Sat 10/21/28**
1137	**Semi-Annual Sampling and Reporting**	**159 days**	**Tue 5/16/28**	**Sat 10/21/28**
1138	**Semi-Annual Groundwater Sampling Event 1**	**29 days**	**Tue 5/16/28**	**Tue 6/13/28**
1139	**Field Work**	**29 days**	**Tue 5/16/28**	**Tue 6/13/28**
1140	Mobilization	1 day	Tue 5/16/28	Tue 5/16/28
1141	Groundwater Monitoring	3 days	Wed 5/17/28	Fri 5/19/28
1142	Demobilization	1 day	Fri 5/19/28	Fri 5/19/28
1143	Laboratory Analysis	10 days	Sat 5/20/28	Mon 5/29/28
1144	Data Validation	15 days	Tue 5/30/28	Tue 6/13/28
1145	**Semi-Annual Sampling Event 2**	**29 days**	**Sat 9/23/28**	**Sat 10/21/28**
1146	**Field Work**	**29 days**	**Sat 9/23/28**	**Sat 10/21/28**
1147	Mobilization	1 day	Sat 9/23/28	Sat 9/23/28
1148	Groundwater Monitoring	3 days	Sun 9/24/28	Tue 9/26/28
1149	Demobilization	1 day	Tue 9/26/28	Tue 9/26/28
1150	Laboratory Analysis	10 days	Wed 9/27/28	Fri 10/6/28
1151	Data Validation	15 days	Sat 10/7/28	Sat 10/21/28
1152	**Annual Corrective Measures Implementation Operations (CMI-O) Report**	**92 days**	**Wed 6/14/28**	**Wed 9/13/28**
1153	Prepare and Develop Draft Annual CMI-O Report	10 days	Wed 6/14/28	Fri 6/23/28
1154	Army Review of Draft Annual CMI-O Report	21 days	Sat 6/24/28	Fri 7/14/28
1155	OPSEC Review of Draft Annual CMI-O Report	21 days	Sat 6/24/28	Fri 7/14/28
1156	Respond to Army Comments on Draft Annual CMI-O Report	10 days	Sat 7/15/28	Mon 7/24/28
1157	Army approval of Draft CMI-O Report	0 days	Mon 7/24/28	Mon 7/24/28
1158	Submit Draft Final Annual CMI-O Report to ADEM / EPA	1 day	Tue 7/25/28	Tue 7/25/28
1159	ADEM Review of Draft Final CMI-O Report	30 days	Wed 7/26/28	Thu 8/24/28
1160	Prepare Responses to ADEM comments	14 days	Fri 8/25/28	Thu 9/7/28
1161	Army review of RTCs	5 days	Fri 9/8/28	Tue 9/12/28
1162	Submit Final CMI-O Report	1 day	Wed 9/13/28	Wed 9/13/28
1163	ADEM approval of Final annual Report	0 days	Wed 9/13/28	Wed 9/13/28



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

ID	Task Name	Duration	Start	Finish
1164	**Achieve Corrective Measures Implementation – Operations (CMI-O) Option Years 4 to 10 for site RSA-115 & CCSWMU-116, only dates for year 3, subsequent years will have same durations)**	**122 days**	**Sun 4/15/29**	**Tue 8/14/29**
1165	**RSA-008**	**122 days**	**Sun 4/15/29**	**Tue 8/14/29**
1166	Notice to Proceed	1 day	Sun 4/15/29	Sun 4/15/29
1167	**CMI-O Field Work**	**121 days**	**Mon 4/16/29**	**Tue 8/14/29**
1168	**Annual Groundwater Sampling Event 1**	**29 days**	**Mon 4/16/29**	**Mon 5/14/29**
1169	**Field Work**	**29 days**	**Mon 4/16/29**	**Mon 5/14/29**
1170	Mobilization	1 day	Mon 4/16/29	Mon 4/16/29
1171	Groundwater Monitoring	3 days	Tue 4/17/29	Thu 4/19/29
1172	Demobilization	1 day	Thu 4/19/29	Thu 4/19/29
1173	Laboratory Analysis	10 days	Fri 4/20/29	Sun 4/29/29
1174	Data Validation	15 days	Mon 4/30/29	Mon 5/14/29
1175	**Annual Corrective Measures Implementation Operations (CMI-O) Report**	**92 days**	**Tue 5/15/29**	**Tue 8/14/29**
1176	Prepare and Develop Draft Annual CMI-O Report	10 days	Tue 5/15/29	Thu 5/24/29
1177	Army Review of Draft Annual CMI-O Report	21 days	Fri 5/25/29	Thu 6/14/29
1178	OPSEC Review of Draft Annual CMI-O Report	21 days	Fri 5/25/29	Thu 6/14/29
1179	Respond to Army Comments on Draft Annual CMI-O Report	10 days	Fri 6/15/29	Sun 6/24/29
1180	Army approval of Draft CMI-O Report	0 days	Sun 6/24/29	Sun 6/24/29
1181	Submit Draft Final Annual CMI-O Report to ADEM / EPA	1 day	Mon 6/25/29	Mon 6/25/29
1182	ADEM Review of Draft Final CMI-O Report	30 days	Tue 6/26/29	Wed 7/25/29
1183	Prepare Responses to ADEM comments	14 days	Thu 7/26/29	Wed 8/8/29
1184	Army review of RTCs	5 days	Thu 8/9/29	Mon 8/13/29
1185	Submit Final CMI-O Report	1 day	Tue 8/14/29	Tue 8/14/29
1186	ADEM approval of Final annual Report	0 days	Tue 8/14/29	Tue 8/14/29



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-008 PROJECT QUALITY CONTROL PLAN

ENVIRONMENTAL REMEDIATION SERVICES

REDSTONE ARSENAL

June 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 W9124J22F0045

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RSA-008 PROJECT QUALITY CONTROL PLAN

ENVIRONMENTAL REMEDIATION SERVICES REDSTONE ARSENAL

June 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 W9124J22F0045

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QUALITY CONTROL PLAN

ENVIRONMENTAL REMEDIATION SERVICES AT

REDSTONE ARSENAL

W9124J-18-D-0004

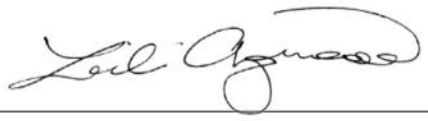
I hereby certify that the enclosed Quality Control Plan (QCP) is in compliance with contract specifications and is submitted for Army approval. Once approved, the QCP will be implemented during the project W9124J-18-D-0004 execution of "*Environmental Remediation Services at Redstone Arsenal, Alabama".*

Approvals

Pamela Foti

Date: June 15, 2023

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



Date: June 14, 2023

Quality Assurance/Quality Control Manager,
Leili Arjomand, Professional Engineer (PE), PMP, Quality Control Manager (QCM)

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Figure 2-1 Project Quality Control Plan Organizational Structure

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ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
CHHM	Certified Hazardous Materials Manager
COC	Chain of Custody
COR	Contracting Officer's Representative
CMI	Corrective Measures Implementation
CQM	Certified Quality Manager
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-008:

- Procurement and Subcontracting
- Mobilization/Demobilization
- Utility Marking / Dig Permits
- Vegetation Clearing
- Groundwater Monitoring
- Record Keeping
- 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.

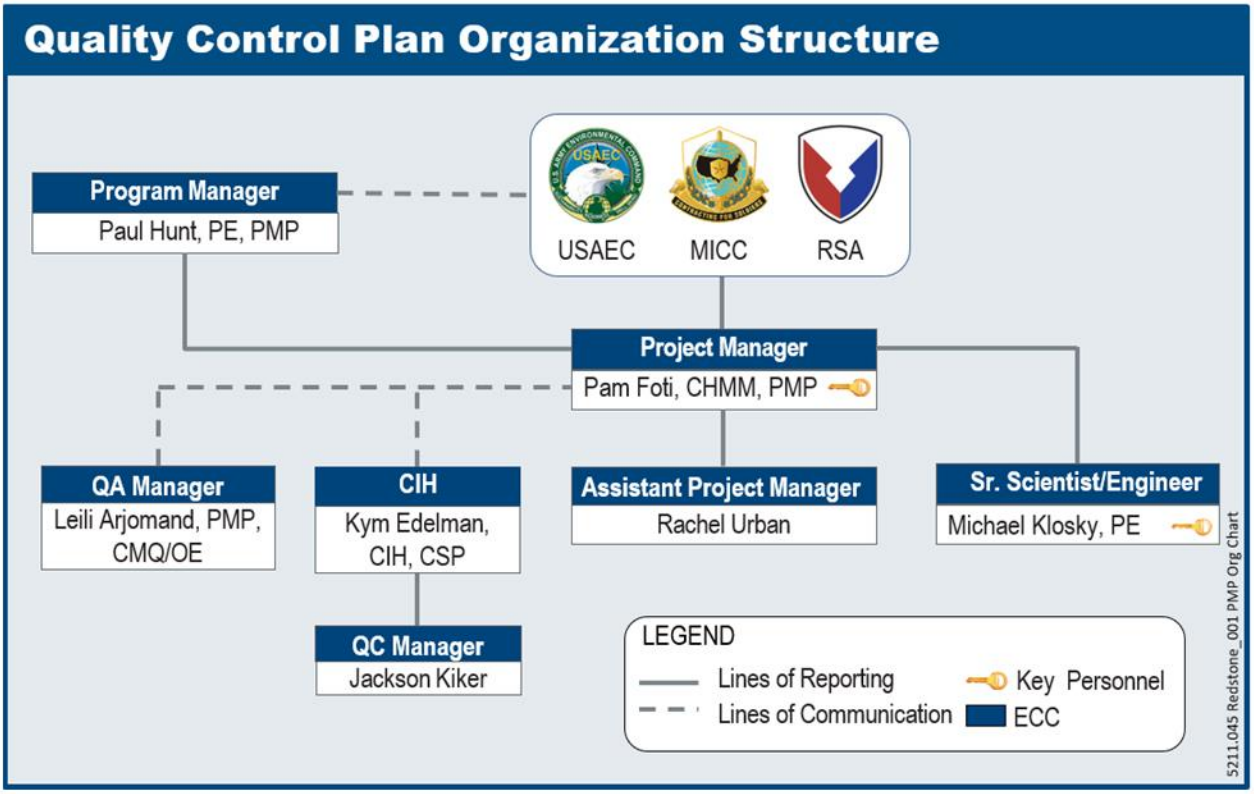
2.0 QUALITY CONTROL ORGANIZATION

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, Professional Engineer (PE), Certified Quality Manager (CQM), PMP, 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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Appendix B

ECC Causal Analysis System

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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 W9124J22F0045

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-008
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 W9124J0F0014. This Site Safety and Health Plan is in compliance with contract specifications and is submitted for Government approval.

Plan Preparer:

Courtney Bigelow	06/09/2023	415-404-5375
Courtney Bigelow, Associate Staff Scientist Assistant Project Manager	Date	Phone Number

Plan Reviewer:

Kym Edelman Digitally signed by Kym Edelman Date: 2023.06.10 12:03:57 +03'00'		757-435-5384
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 W9124J20F0014 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 008, Inactive Sewage Treatment Plant #4, is located in the northeastern portion of RSA, north of Martin Road and east of Patton Road. RSA 008 comprises approximately 7.96 acres. The sewage plant was constructed in 1959 and removed from active service in 1992. This plant was used for the treatment of domestic sewage and wastewater generated in the northern portion of RSA. Floor wash liquids from research laboratories and motor pools and water separated by the oil/water separators in the northern portion of RSA were treated at this plant. Site features include the digester, sludge drying beds, primary and secondary clarifiers, trickling filter, sewage lift station, and six small concrete aboveground storage tank saddles. Two diesel underground storage tanks that were used to operate generators as a backup power source for the plant were removed in 1995. Environmental site RSA 048 (Inactive Sanitary Landfill, Area G), an uncovered, closed landfill, which requires corrective action under the conditions of the Permit, adjoins the southern boundary of RSA 008. There are no plans to resume active treatment of sewage at RSA 008 (Aptim 2020).

The findings of the RSA 008 Rev. 4 RFI (Aptim 2020) recommended no further action (NFA) for soil/surface media but recommended development of corrective measures for the underlying groundwater at this site. Specifically, the findings of the Rev.

The corrective measures selected involves the following components:

- Groundwater MNA
- Land Use Controls

The provisions of this plan are mandatory for all contractor and subcontractor onsite personnel engaged in activities at RSA-008 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 and LUC inspections
- Groundwater, surface water, and spring sampling
- Site Land Use Control Inspections
- Site Landfill Cap Repair and Maintenance

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	
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	

	Applicable to this Project?	If Required, Location or Reference
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 SOP HS-5.9	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-008, specific potential contaminants are listed below:

- VOC- TCE
- Pesticides- 4,4'-DDD, alpha-BHC, and dieldrin
- Metal- Arsenic

Table 2-2 outlines the chemical hazards for sites RSA-008, respectively, including Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs) for the applicable chemicals.

Table 2-2: Toxicological and Physical Properties of Chemicals, RSA-008

Chemical	TWA[(a)]	STEL/ C (b)	Source (c)	IDLH (NIOSH) [(d)]	Route	Symptoms of Exposure
RSA-008						
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.
Arsenic	0.01 mg/m^3 0.01 mg/m^3 0.01 mg/m^3	Ca 0.002 mg/m^3	PEL TLV REL	5 mg/m^3	Inh, Ing, Con	Cough, diarrhea, shortness of breath, vomiting, grey skin. Redness.
4,4'-DDD	0.5 mg/m3 0.5 mg/m3	NA	REL PEL	Ca [500 mg/m3]	Inh, Abs, Ing, Con	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise, headache, lassitude; convulsions; paresis hands; vomiting.
alpha-BHC	0.5 mg/m3 0.5 mg/m3	NA	REL PEL	50 mg/m3	Inh, Abs, Ing, Con	irritation eyes, skin, nose, throat; headache; nausea; clonic convulsions; resp difficulty; cyanosis; aplastic anemia; muscle spas.
dieldrin	0.25 mg/m 0.25 mg/m	NA	REL PEL	Ca [50 mg/m3]	Inh, Abs, Ing, Con	headache, dizziness; nausea, vomiting, malaise, sweating; myoclonic limb jerks; clonic, tonic convulsions; coma.

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 exceed 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
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.

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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		
ISEB injection			Nitrile or Leather palm work gloves; adhere to manufacturer requirements for PPE specified in the SDS.			
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.

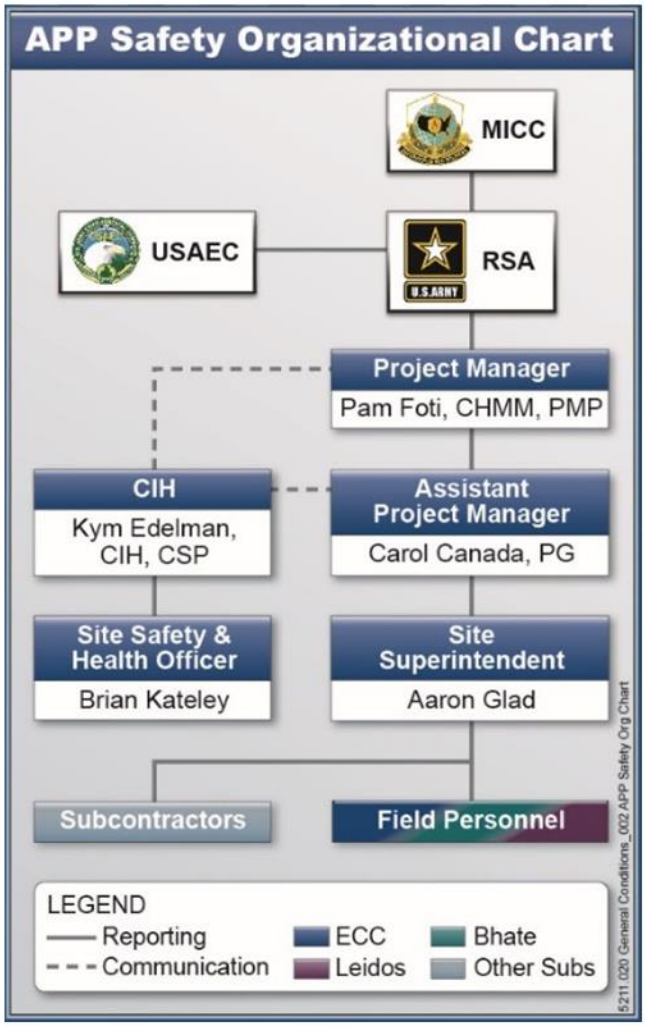
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6.0 ORGANIZATION, RESPONSIBILITIES, AND LINES OF AUTHORITY

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 PLAN

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

ADEM. 2020. "ADEM Review and Concurrence: Revision 4 RCRA Facility Investigation Report, RSA 008, Inactive Sewage Treatment Plant #4, dated April 13, 2020" letter. July. ADEM. 2021. *Redstone Arsenal's Alabama Hazardous Wastes Management and Minimization Act Hazardous Waste Storage Facility, Thermal Treatment, Solid Waste Management Unit Corrective Action Permit.* July 19.

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		**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
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)	**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

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.

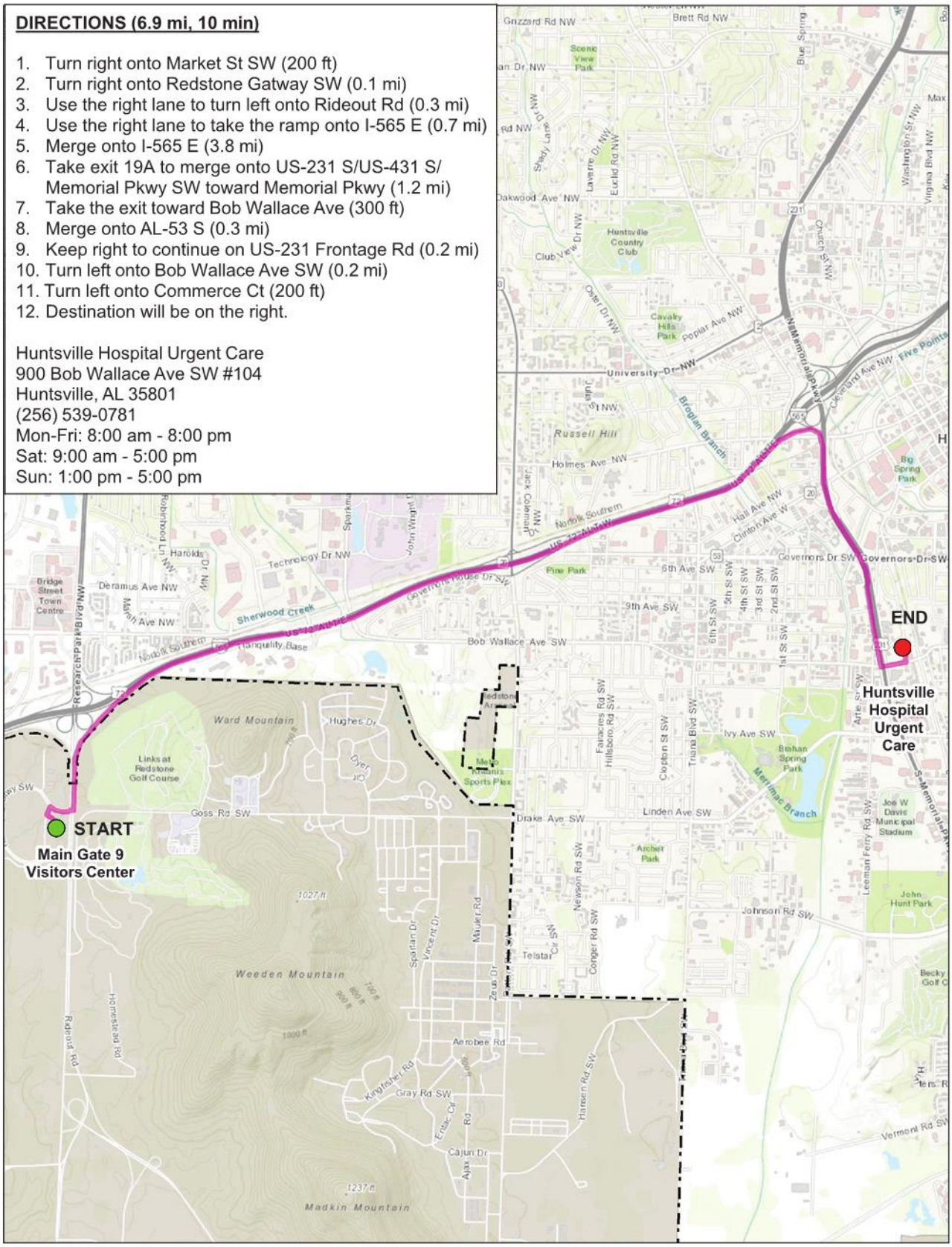
Each will have current certification in First Aid and CPR from the American Red Cross, the American Heart Association, or from an organization whose training adheres to the standards of the International Liaison Committee on Resuscitation (as stated in writing), or from a Licensed Physician. Certification 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

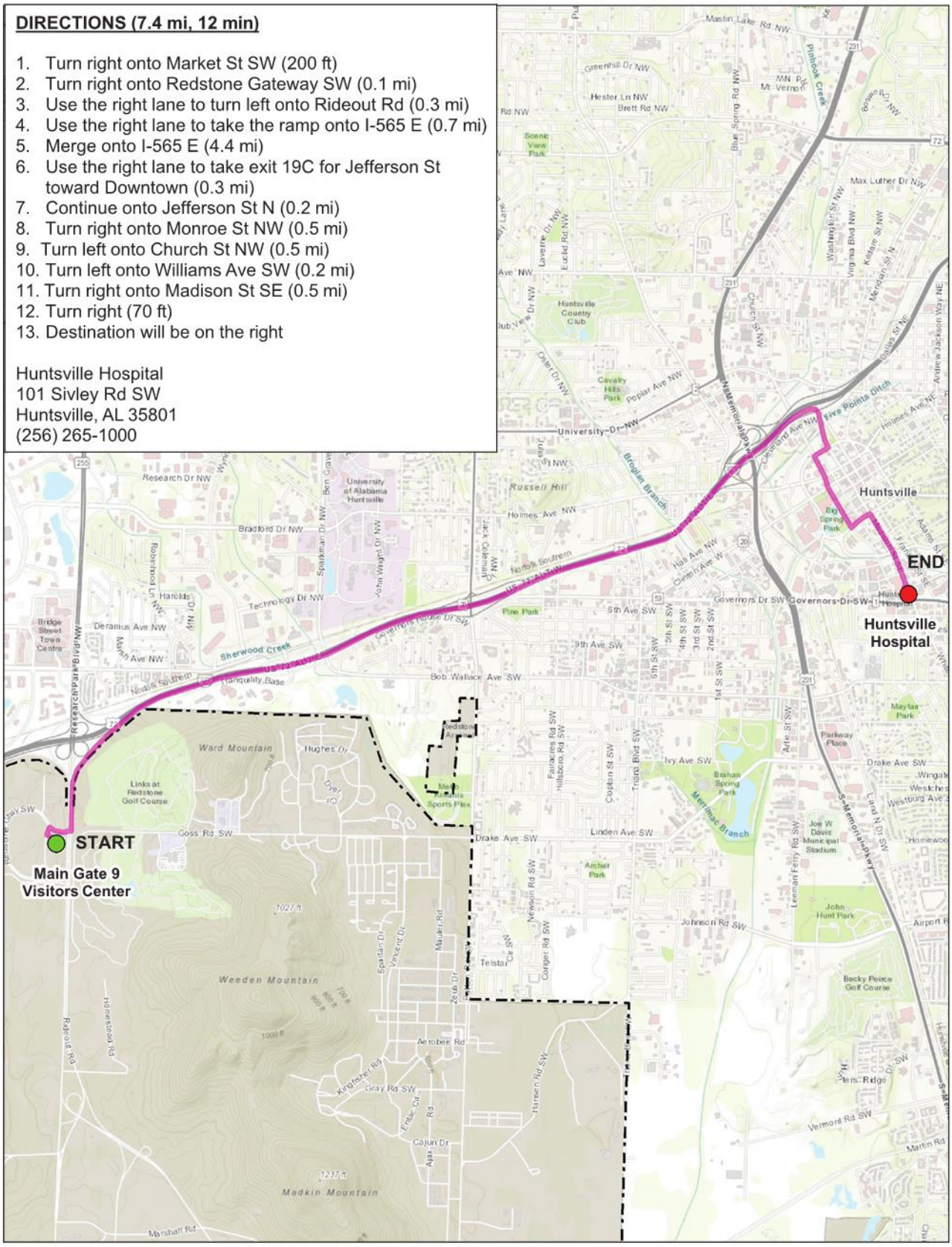
DISCLAIMER- The data represent the results of data collection/processing for a specific Redstone Arsenal activity and indicates the general existing conditions. As such, it is only valid for its intended use, content, time, and accuracy specifications. The user is responsible for the results of any application 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

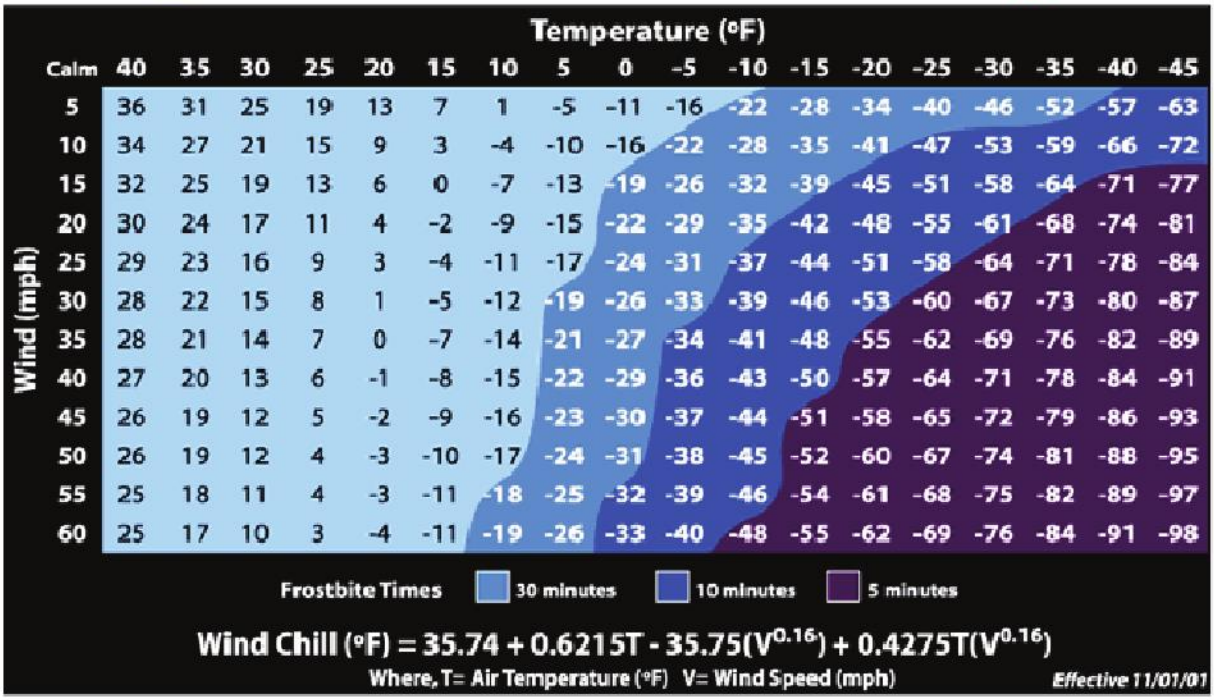
Cold stress hazards are most likely to occur at low temperatures or low wind chill factors, with wet, windy conditions contributing to risk. Where cold stress is a potential hazard (temperatures less than 40 degrees Fahrenheit [ºF]) workers will be trained on the information in the attached Cold Weather 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)

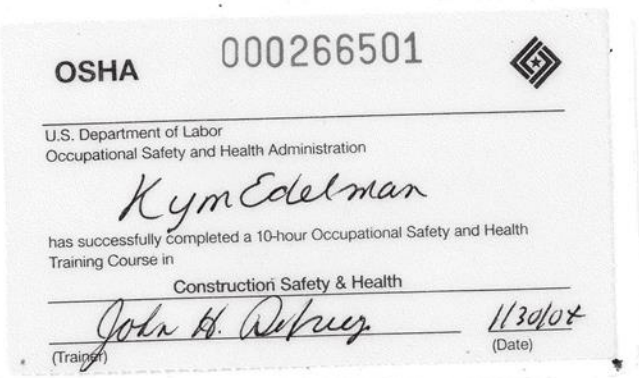
Jack M. Peterson
CSP, CIH

November 10, 1989
Date of Completion

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OSHA 000266501

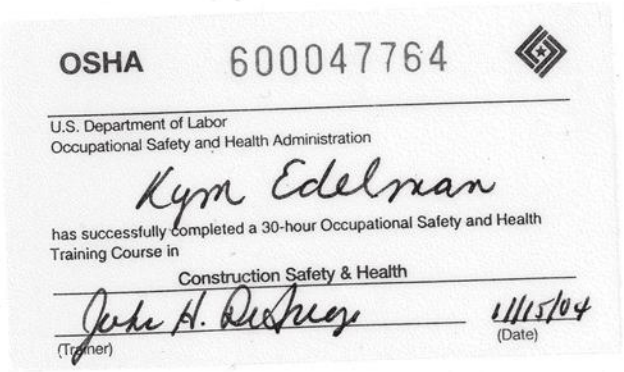
U.S. Department of Labor
Occupational Safety and Health Administration

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

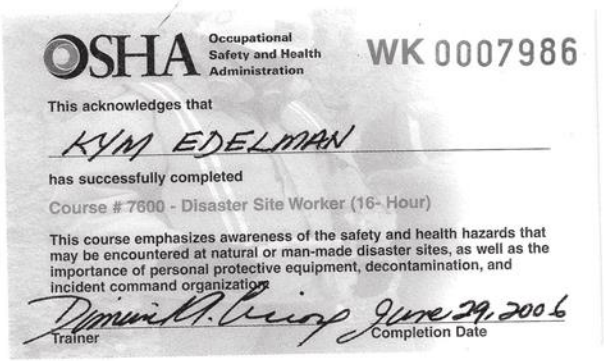
U.S. Department of Labor
Occupational Safety and Health Administration

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

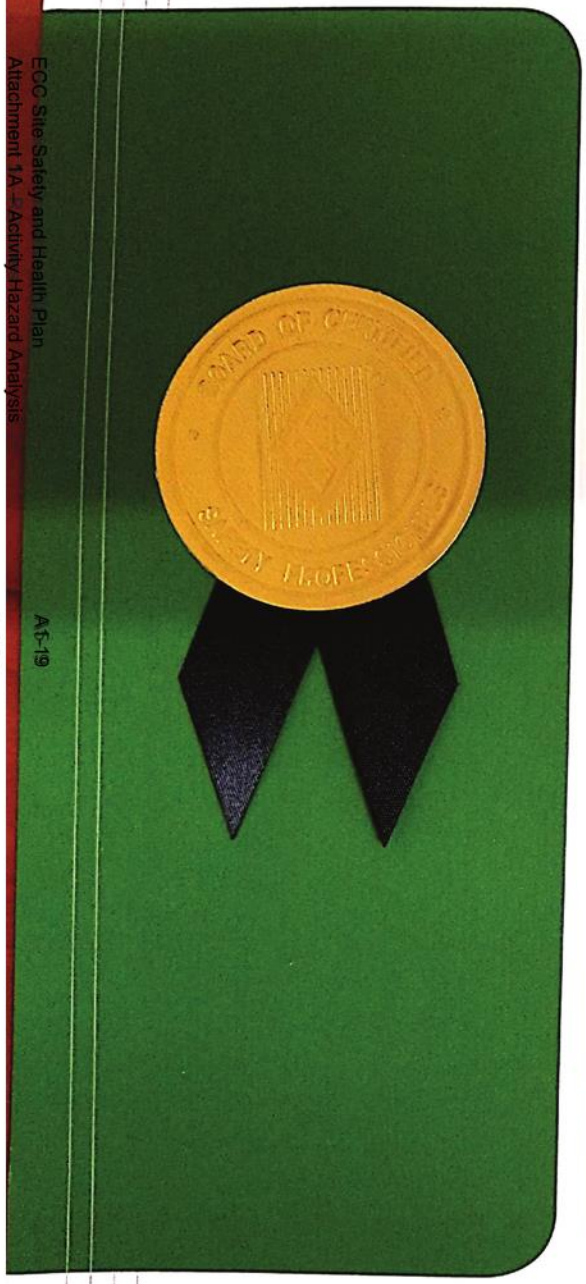
KYM EDELMAN

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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OSHA Occupational Safety and Health Administration

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APPENDIX F

GROUNDWATER MONITORING PLAN

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Rev 1

GROUNDWATER MONITORING PLAN
RSA-008, INACTIVE SEWAGE TREATMENT PLANT #4, OPERABLE UNIT 02

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

CONTRACT NUMBER W9124J-18-D-004
DELIVERY ORDER W9124J21F0045

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:

September 2024

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LIST OF ACRONYMS AND ABBREVIATIONS

AAC	Alabama Administrative Code
ADEM	Alabama Department of Environmental Management
AHWMMA	Alabama Hazardous Wastes Management and Minimization Act
amsl	Above Mean Sea Level
APP	Accident Prevention Plan
bgs	Below Ground Surface
BHC	Hexachlorocyclohexane
CG	Cleanup Goal
CLP	Contract Laboratory Program
CMI	Corrective Measures
CMO	Corrective Measure Objective
CMS	Corrective Measures Study
COC	Chemical of Concern
DDD	Dichlorodiphenyldichloroethane
DO	Dissolved Oxygen
EDD	Electronic Data Deliverable
GWMP	Groundwater Monitoring Plan
HI	Hazard Index
IDW	Investigation-Derived Waste
IW-QAPP	Installation-Wide Quality Assurance Program Plan
IWWP	Installation-Wide Work Plan
MAG	Monitoring Acceptance Goal
MCL	Maximum Contaminant Level
mg/L	Milligrams per Liter
mgd	Millions of Gallons per Day
MNA	Monitored Natural Attenuation
NFA	No Further Action
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
OWS	Oil/Water Separator
PSV	Preliminary Screening Value
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
REG	Regular Sample
RFI	RCRA Facility Investigation
RSA	Redstone Arsenal
SOPP	Standard Operating Project Procedure
SPC	Specific Conductance
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

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1.0 INTRODUCTION

This Groundwater Monitoring Plan (GWMP) has been developed in support of the Redstone Arsenal (RSA)-008 Corrective Measures Implementation (CMI) Work Plan. This document provides details for implementation of groundwater monitoring as a component of the corrective measures for RSA-008 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 measures to be implemented at RSA-008 is groundwater monitored natural attenuation (MNA) to achieve the corrective measure objectives (CMOs) for groundwater at RSA-008.

1.1 OBJECTIVE AND SCOPE

The primary objective of the groundwater monitoring program for RSA-008 is to determine whether the corrective measures reduce concentrations of chemicals of concern (COCs). These COCs include one metal (arsenic), three pesticides (4,4′-dichlorodiphenyldichloroethane [4,4′-DDD], alpha- hexachlorocyclohexane [BHC], and dieldrin), and one volatile organic compound (VOC) (trichloroethene [TCE]), 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 toward attaining the CGs for groundwater and if the site can be released for unrestricted use.

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2.0 DESCRIPTION OF RSA-008

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 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 largely 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-008, Inactive Sewage Treatment Plant #4, is located in the northeastern portion of RSA, north of Martin Road southwest and west of the southern end of Triana Boulevard Southwest. RSA-008 comprises approximately 8 acres. The sewage treatment plant was constructed in 1959 and removed from active service in 1992. This plant was used for the treatment of domestic sewage and wastewater generated in the northern portion of RSA. Floor wash liquids from research laboratories and motor pools and water separated by the oil/water separators (OWSs) in the northern portion of RSA were treated at this plant.

RSA-008 was initially constructed with a design capacity of 1.0 million gallons per day (mgd). In 1977, several plant upgrades were performed, and a National Pollutant Discharge Elimination System permit allowing for a capacity of up to 2.0 mgd was issued. The plant underwent additional upgrades in 1982 to provide for a capacity of up to 6.0 mgd. After the upgrade, effluent from RSA-008 was discharged through a manifold force main system to a Parshall flume near Shields and Buxton Roads. Prior to the upgrade in 1982, treated effluent was discharged to McDonald Creek (USAEHA 1970) via an unlined drainage ditch, which flowed east just outside the southern site boundary toward McDonald Creek. Treated sludge from the various plant units was collected and dried in eight onsite sludge drying beds and disposed of in a sanitary landfill on RSA. The sludge drying beds were equipped with a collection system to divert filtrate to the trickling filter unit (Shaw 2012).

Environmental investigations conducted at RSA-008 include the following documents:

- Interim facility assessment report (A.T. Kearney 1989)
- Final identification and evaluation of potential solid waste management units (SWMUs) and areas of concern (Geraghty & Miller, Inc. 1991)
- Site investigation (SAIC 1996)
- Remedial investigation (SAIC 2001)
- RSA-145 potential source area investigation (Shaw 2005)
- Resource Conservation and Recovery Act (RCRA) facility assessment (ADEM 2008)
- Rev. 0 RCRA Facility Investigation (RFI) for RSA-008 (Shaw 2012)
- Rev. 1 RFI for RSA-008 (CB&I 2017)
- Rev. 2 RFI for RSA-008 (APTIM 2018)
- Rev. 4 RFI for RSA-008 (APTIM 2020).

These investigations generated usable analytical results from 53 surface soil samples, 133 subsurface soil samples, 12 sediment samples, and 44 groundwater samples. Detailed discussions of these investigations and the associated results are described in the Rev. 4 RFI report (APTIM 2020).

Arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE are identified as groundwater COCs requiring action at RSA-008. For relevant COCs in groundwater with maximum contaminant levels (MCLs), the MCLs are selected as the CGs (arsenic and TCE). 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. The target cancer risks shown for 4,4′-DDD, alpha-BHC, and dieldrin are set to achieve a cumulative cancer risk of 1E-05. The chemicals with MCLs (arsenic and TCE) are not included in the risk-based evaluation because their regulatory values are based on other considerations in addition to risk. The Rev. 4 RFI (APTIM 2020) concluded that 4,4′-dichlorodiphenyldichloroethylene (DDE) would be included in the CMI Work Plan due to the single exceedance of its groundwater preliminary screening value (PSV). Therefore, 4,4′-DDE will be included in the site's groundwater monitoring program and monitoring results compared to the monitoring acceptance goals (MAGs). The U.S. Environmental Protection Agency (USEPA) RSL for 4,4′-DDE of 0.046 milligrams per liter (mg/L) was used to develop the MAG (USEPA 2022).

The CGs for RSA-008 groundwater are summarized below:

Summary of Groundwater Cleanup Goals, RSA-008

COC Requiring Action	Groundwater CG (µg/L)	Basis
Arsenic	10	MCL
4.4′-DDD	0.093	Risk[a]
alpha-BHC	0.025	Risk[a]
Dieldrin	0.0060	Risk[a]
TCE	5	MCL
COC Requiring Monitoring Only	**MAG (µg/L)**	**Basis**
4,4′-DDE	0.23	Risk [b]

Notes:

[a]See Table 3-2 in the CMS report (ECC 2022).
[b]USEPA (2022). Regional Screening Levels, May. Value based on oral RSL at a cancer risk of 1E-06.

µg/L = Micrograms per Liter
BHC = Hexachlorocyclohexane
CG = Cleanup Goal
COC = Chemical of Concern
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethylene
MAG = Monitoring Acceptance Goal
MCL = Maximum Contaminant Limit
RSL = Regional Screening Level
TCE = Trichloroethene

The CMO for RSA-008 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-008 is provided in the Rev. 4 RFI report (APTIM 2020). The RFI report was completed in April 2020, and the report was approved by the Alabama Department of Environmental Management (ADEM) on July 8, 2020.

2.2 SITE HISTORY

RSA-008, Inactive Sewage Treatment Plant #4, is located in the northeastern portion of RSA. RSA-008 comprises approximately 7.96 acres. The sewage plant was constructed in 1959 and removed from active service in 1992. This plant was used for the treatment of domestic sewage and wastewater generated in the northern portion of RSA. Floor wash liquids from research laboratories and motor pools and water separated by the OWSs in the northern portion of RSA were treated at this plant. Site features include the digester, sludge drying beds, primary and secondary clarifiers, trickling filter, sewage lift station, and six small concrete aboveground storage tank saddles. Two diesel underground storage tanks that were used to operate generators as a backup power source for the plant were removed in 1995. Environmental site RSA-048 (Inactive Sanitary Landfill, Area G), an uncovered, closed landfill that requires corrective action under the conditions of the Permit, adjoins the southern boundary of RSA-008.

RSA-008 was initially constructed with a design capacity of 1.0 mgd. In 1977, several plant upgrades were performed and a National Pollutant Discharge Elimination System permit allowing for a capacity of up to 2.0 mgd was issued. Treated effluent was discharged to McDonald Creek (USAEHA 1970) via an unlined drainage ditch, which flowed east just outside the southern site boundary toward McDonald Creek. The plant underwent additional upgrades in 1982 to provide for a capacity of up to 6.0 mgd. After the upgrade, effluent from RSA-008 was discharged through a manifold force main system to a Parshall flume near Shields and Buxton Roads.

The sewage treatment plant at RSA-008 was taken out of service in 1992. Currently, raw sewage enters RSA-008 through an 18-inch-diameter gravity influent pipe that passes through a wet well in the southwestern corner of the site area and briefly daylights in an open, concrete-lined Parshall flume before it enters an underground piping system. An effluent pumping station sends this flow through a force main system to the active sewage treatment system on Buxton Road. Sewage does not routinely flow through the former treatment structures of the plant.

Most of the former process tanks and structures (e.g., digester tank, primary clarifier, trickling filter, secondary clarifiers, and sludge drying beds) remain onsite. These structures are maintained such that they may be used to provide additional storage capacity for untreated wastewater in the event of an emergency affecting the current wastewater treatment system. If an emergency event causes the influent capacity of the current treatment system to be exceeded or repairs to that system require a temporary diversion of the influent flow from the current treatment system, several inactive treatment structures at RSA-008 (e.g., primary clarifier, trickling filter, and secondary clarifiers) will be used to provide temporary storage capacity for untreated sewage influent. After repairs are completed, the raw sewage stored at RSA-008 would be transferred to the active central sewage treatment plant for treatment. There are no plans to resume active treatment of sewage at RSA-008 (APTIM 2020).

RSA currently operates under an Alabama Hazardous Wastes Management and Minimization Act (AHWMMA) Hazardous Waste Storage Facility/Thermal Treatment/SWMU Corrective Action Permit (ADEM 2021). The corrective action requirements in the RCRA Permit apply to SWMUs and areas of concern identified at RSA. Prior to implementation of the RCRA Permit, RSA was added to the National Priorities List on May 31, 1994, effective June 30, 1994.

The Rev. 4 RFI report for RSA-008 was completed in April 2020 (APTIM 2020). The Army requested that ADEM move RSA-008 from Table VI.2 (sites requiring investigation) to Table VI.6 (sites requiring corrective measures) and list it as a no further action (NFA) site for soil/surface media but with corrective measures to be performed for the COCs in groundwater (arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE).

ADEM issued a concurrence letter on July 8, 2020, agreeing to move RSA-008 to Table VI.6 in RSA's AHWMMA permit during the next modification. In addition, ADEM stated "The constituents that need to be addressed as part of the remedial action include alpha-benzenehexachloride; arsenic; 4,4′-dichlorodiphenyldichloroethane; 4,4′-dichlorodiphenyldichloroethylene; dieldrin; and trichloroethylene in groundwater" (ADEM 2020).

The Corrective Measures Study (CMS) (ECC 2022) will be used as the basis of the corrective measures presented in the CMI Work Plan required for RSA-008 in the Permit (Permit Condition VI.E.2).

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.

The natural topography in the RSA-008 area has been heavily modified, and all surface drainage is controlled by engineered drainages. The topography in the vicinity of RSA-008 generally slopes downward from higher elevations in the northern part of the site toward lower elevations in the southern portions of the site. Surface elevations within the site boundary range from a high of 598 feet above mean sea level (amsl) at an engineered mound surrounding the inactive digester tank in the northeastern corner of the site to a low of approximately 572 feet amsl adjacent to a drainage ditch near the southwestern corner of the site boundary. Outside of these two extremes, surface elevations across the site generally lie between 580 and 574 feet amsl. The digester tank is located at the highest elevation on the site.

2.4 GEOLOGY

The soil beneath RSA-008 consists of low-permeability layers of red, brown, and yellowish silty clay and clayey silt, which are underlain over most of the site by a thin layer of highly plastic clay. Beneath these silt and clayey layers, the site is underlain by a rocky, clayey epikarst stratum with intervals of chert and chert fragments.

2.4.1 Bedrock

Together, these three stratums represent the overburden layer at RSA-008. The overburden layer was formed by in situ chemical weathering of the underlying limestone bedrock. The thickness of the overburden layers found beneath RSA-008 generally is variable over short lateral distances due to the irregular karst surface of the underlying bedrock material.

The depth to bedrock varies across RSA-008 from approximately 45 feet to greater than 80 feet below ground surface (bgs). Lithologic data from bedrock wells installed across this portion of RSA indicate that the shallow bedrock first encountered correlates with the lower Tuscumbia Limestone Formation, which 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 Formation, which consists of thinly bedded, fossiliferous limestones interbedded with chert. The Fort Payne Formation is underlain by the Chattanooga Shale Formation, a dark gray to black, fissile shale.

2.4.2 Hydrogeology

Groundwater at RSA-008 generally occurs in the unconsolidated overburden and the upper portion of the carbonate bedrock. Depth to groundwater in nearby monitoring wells ranged from 1.10 to 11.54 feet bgs in December 2015 and historically has ranged from 0.36 feet above ground surface to 14.85 feet bgs, with an overall average depth of approximately 7.91 feet bgs. Groundwater elevations for the onsite monitoring wells have ranged historically from 565.66 to 571.21 feet amsl, with an overall average of 569.30 feet amsl. The overburden and upper bedrock comprise a single interconnected, unconfined water table aquifer throughout most of RSA. The localized groundwater flow direction is influenced by a persistent mounded area in the central portion of the site, and groundwater generally flows outward in a northeasterly, westerly, and south-southeasterly direction from this mounded area.

During drilling for soil sampling, boring logs indicated semiconfined conditions and a perched water table. An average depth to water of 22 feet based on the depth to water reported on the boring logs is used in this report to define the limit of vadose zone soils for most soil boring locations.

2.4.3 Surface Water Drainage

The surface topography of the site is contoured to direct surface water runoff toward an unlined open ditch that originates near the center of the site, north of the sludge drying beds, and flows south and east before discharging into McDonald Creek, southeast of the site. No permanent or seasonal surface water is present within RSA-008.

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3.0 GROUNDWATER MONITORING PROGRAM

The groundwater monitoring program for RSA-008 specifies a network of eight 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 9 of the CMI Work Plan. The duration of monitoring is estimated at 10 years for the RSA-008 site, or until CGs are achieved or confirmed. Subject to ADEM approval, if COC concentrations for action in each of the eight monitoring wells have reached CGs before that time, groundwater monitoring will be proposed for early termination. Proposed modifications to the groundwater monitoring program will be provided in the recommendations section of the 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-008 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-008 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 24.0, Field Equipment Calibration.

3.3 RSA-008 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-008 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: Worksheets #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 is provided in the Project Management Plan (ECC 2021a) and the Quality Control Plan provided as Appendix D of the CMI Work Plan.

3.4 MONITORING WELLS PROPOSED FOR GROUNDWATER MONITORING

The following existing monitoring wells at RSA-008 are scheduled for groundwater monitoring:

Location	Zone	Screen Intervals (ft bgs)		Installed Well Depth (ft bgs)	Rationale
		Top	Base		
B8-RS1041	OVB	33.8	43.8	44.2	Monitor MNA Effectiveness (arsenic CG exceedance)
B8-RS1043	OVB	32.1	42.1	42.44	Monitor MNA Effectiveness (historical dieldrin PSV exceedance)
B8-RS1046	OVB	35.6	45.7	46	Monitor MNA Effectiveness (historical 4,4′-DDD PSV exceedance)
B8-RS1047	OVB	43.0	53.0	53.4	Monitor MNA Effectiveness (historical alpha-BHC and 4,4′-DDD PSV exceedance)
B8-RS1280	OVB	24.5	39.5	39.5	Monitor MNA Effectiveness (historical 4,4′-DDD PSV exceedance)
008-RS2585	OVB	33.1	43.1	43.5	Monitor MNA Effectiveness (historical TCE CG exceedance)
008-RS2586	OVB	28.6	38.6	39.0	Monitor MNA Effectiveness (sentinel well for 008-RS2585)
008-RS2588	OVB	20.2	30.2	30.6	Monitor MNA Effectiveness (historical 4,4′-DDE, 4,4′-DDD, and zinc PSV exceedance)

bgs = Below Ground Surface
BHC = Hexachlorocyclohexane
CG = Cleanup Goal
DDD = Dichlorodiphenyldichloroethane
ft = Feet
MNA = Monitored Natural Attenuation
OVB = Overburden
PSV = Preliminary Screening Value
TCE = Trichloroethene

Well locations included in the groundwater monitoring program are presented in Figure 9 of the CMI Work Plan.

3.5 CONSTITUENT LIST AND SAMPLING FREQUENCY

The MNA program will include analysis of COCs identified for groundwater (arsenic, 4,4′-DDD, alpha-BHC, dieldrin, and TCE), in addition to the MNA parameters: pH, nitrate, sulfate, total organic carbon (TOC), alkalinity, and dissolved gases (methane, ethane, and ethene). 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:

- Baseline sampling and reporting: Year 0
- Semiannual sampling and annual reporting: Years 1 through 3
- Annual sampling and reporting: Years 4 through 10, or until CGs are achieved and confirmed.
- MNA optimization will be considered complete when CGs are achieved and confirmed, at which time the monitoring well network would be decommissioned. All groundwater monitoring for MNA will be discontinued if CGs are attained for all COCs in each of the monitoring wells for three consecutive years (individual wells may be removed from the program earlier if this criterion is satisfied).

As determined by an evaluation of previous monitoring results, 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 USEPA Solid Waste (SW)-846 methods as presented in the IW-QAPP (HGL 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-008 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 eight existing groundwater monitoring wells, as shown in Figure 9 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, semiannual, and annual sampling events. Semiannual sampling will be performed for Years 1 through 3, and annual sampling will be performed for Years 4 through 10 (anticipated to be the end of the corrective measures).

The primary objective of the groundwater monitoring program for RSA-008 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-008 groundwater conditions:

- ***Hydrographs***: Graph 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***: Map 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 three 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. Record keeping 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-008 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) after the 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).

A groundwater monitoring well will not be removed from the monitoring program without an approved permit modification from ADEM. If a groundwater monitoring well is deleted from the monitoring program, it will be abandoned within 90 calendar days after deletion using procedures to be approved by ADEM. Within 30 calendar days after the well is abandoned, the Army will submit a written notification to ADEM that the well abandonment activities were conducted in accordance with the approved procedures.

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. Measurement of Performance Criteria
Redstone Arsenal, Madison County, Alabama

Worksheet #12 Measurement of Performance Criteria

Analytical Group: Metals, VOCs, Pesticides
Concentration Level: Low

Analytical Method and SOP	DQIs	MPC	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for S, A or both (S&A)
SW3010A/6020A & MET-002/MET-016	Precision	RPD from **Worksheet #28**	Laboratory duplicates and LCS/LCSD	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	Field blanks and/or equipment blanks	S&A
	Completeness	Laboratory analysis	>90%	S&A
	Representativeness	Sampling per QAPP/SOP	Field notes	S
	Comparability	Use of promulgated methodology	QAPP compliance, data review	A
	Sensitivity	PQL/EDL to meet project objectives	ICAL level acceptable, MB acceptable, MRL acceptable	A
SW5030C/8260C & VOC-001/VOC-003	Precision	RPD from **Worksheet #28**	Laboratory duplicates and/or LCS/LCSD, if MS/MSD not performed	A
		Sampling per QAPP/SOP	FD and MS/MSD	S&A
	Accuracy/Bias	% Rec. from **Worksheet #28**	LCS	A
	Accuracy/Bias (contamination)	Acceptable blanks levels	MB	
		Sampling per QAPP/SOP	EB and TB	S&A
	Completeness	Laboratory analysis	>90%	
	Representativeness	Sampling per QAPP/SOP	Blank samples and DUA	S
	Comparability	Use of promulgated methodology	QAPP compliance, data review	A
	Sensitivity	LOQ or LOD to meet project objectives	ICAL level acceptable, MB acceptable	
SW3510C/8081B & SVOC-001/ SVOC-008	Precision	RPD from **Worksheet #28**	Laboratory duplicates and LCS/LCSD	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	Field blanks and/or equipment blanks	S&A
	Completeness	Laboratory analysis	>90%	S&A
	Representativeness	Sampling per QAPP/SOP	Field notes	S

Table F-1. Measurement of Performance Criteria
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #12 Measurement of Performance Criteria (Continued)

Analytical Method and SOP	DQIs	MPC	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for S, A or both (S&A)
SW3510C/8081B & SVOC-001/ SVOC-008	Comparability	Use of promulgated methodology	QAPP compliance, data review	A
	Sensitivity	PQL/EDL to meet project objectives	ICAL level acceptable, MB acceptable	A
RSK-175 & VOC-013	Precision	RPD from Worksheet #28	Lab duplicates and LCS/LCSD	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	Field blanks and/or equipment blanks	S&A
	Completeness	Laboratory analysis	>90%	S&A
	Representativeness	Sampling per QAPP/SOP	Field notes	S
	Comparability	Use of promulgated methodology	QAPP compliance, data review	A
	Sensitivity	PQL/EDL to meet project objectives	ICAL level acceptable, MB acceptable	A

Notes:

> = Greater than
% = Percent
% Rec. = Percent Recovery
A = Analytical
DQI = Data Quality Indicator
DUA = Data Usability Assessment
EB = Equipment Blank
EDL = Estimated Detection Limit
FD = Field Duplicate
ICAL = Initial Calibration
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOD = Limit of Detection
LOQ = Limit of Quantitation
MB = Method Blank
MET = Metals
MPC = Measurement Performance Criteria
MRL = Method Reporting Limit
MS = Matrix Spike
MSD = Matrix Spike Duplicate
PQL = Practical Quantification Limits
QAPP = Quality Assurance Project Plan
QC = Quality Control
RPD = Relative Percent Difference
S = Sampling
SOP = Standard Operating Procedure
SVOC = Semivolatile Organic Compound
SW = Solid Waste 846
TB = Trip Blank
VOC = Volatile Organic Compound

Table F-2. Preliminary Screening Values and Laboratory-Specific Limits – Groundwater
Redstone Arsenal, Madison County, Alabama

Worksheet #15 Preliminary Screening Values and Laboratory-Specific Limits – Groundwater

Hazardous Constituent	CAS Number	CG*	CG Reference	MAG	MAG Reference	Units	Laboratory-Specific LOQ	Laboratory-Specific LOD	Laboratory-Specific DL
Long-Term Monitoring									
Metals by SW846 6020A									
Arsenic	7440-38-2	10	MCL	--	--	µg/L	1	0.5	0.25
VOCs by SW846 8260C									
cis-1,2-Dichloroethene	156-59-2	70	MCL	--	--	µg/L	2	1	0.5
trans-1,2-Dichloroethene	156-60-5	100	MCL	--	--	µg/L	2	1	0.5
Trichloroethene	79-01-6	5	MCL	--	--	µg/L	1	0.5	0.25
Vinyl chloride	75-01-4	2	MCL	--	--	µg/L	1	0.5	0.25
Pesticides by SW846 8081B									
4,4′-DDD	72-54-8	0.093	Risk	--	--	µg/L	0.0200	0.0100	0.0050
4,4′-DDE*	72-55-9	--	--	0.23	Risk/USEPA RSL	µg/L	0.0200	0.0100	0.0050
alpha-BHC	319-84-6	0.025	Risk	--	--	µg/L	0.0200	0.0100	0.0050
Dieldrin	60-57-1	0.006	Risk	--	--	µg/L	0.0200	0.0050	0.0019
Dissolved Gases by RSK-175									
Ethane	74-84-0	N/A	Not a COC			µg/L	4.041	1.347	0.674
Ethene	74-85-1	N/A	Not a COC			µg/L	3.726	1.242	0.621
Methane	74-82-8	N/A	Not a COC			µg/L	2.151	0.717	0.358

Notes:

*Cleanup goals were established in the 2019 RCRA facility investigation (Aptim 2020).

µg/L = Micrograms per Liter
CAS = Chemical Abstracts System
CG = Cleanup Goal
COC = Constituent of Concern
DL = Detection Limit
LOD = Limit of Detection
LOQ = Limit of Quantitation
MAG = Monitoring Acceptance Goal
MCL = Maximum Contaminant Level
N/A = Not Applicable
RSL = Regional Screening Value
SW = Solid Waste
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

Table F-3. Sampling Design and Rationale
Redstone Arsenal, Madison County, Alabama

Worksheet # 17 Sampling Design and Rationale

Sample Locations	Sample Media	Sample Location Rationale*
Overburden: 008-RS2585 008-RS2586 008-RS2588 B8-RS1041 B8-RS1043 B8-RS1046 B8-RS1047 B8-RS1280	Groundwater **Baseline** **Semiannually** (Years 1 to 3) **Annually** (Years 4 to 10)	This groundwater monitoring program will be used to monitor the passive reduction in the concentrations of COCs as part of a groundwater MNA program. Monitoring would be implemented to track the COCs (arsenic, trichloroethene and daughter products, 4,4′-DDD, dieldrin, and alpha-BHC) in groundwater until the CGs are attained, while 4,4′-DDE will be monitored for attainment of the MAG. Groundwater monitoring activities include depth-to-water gauging, groundwater sample collection, and inspection of the condition of the monitoring wells in the monitoring well network. Groundwater samples are to be collected from these seven monitoring wells, and the analytical program will monitor for parameters detailed on Worksheet #15.

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 the Alabama Department of Environmental Management. Permit modifications will be made in accordance with Permit Condition I.J.

CG = Cleanup Goal
COC = Chemical of Concern
MAG = Monitoring Acceptance Goal
MNA = Monitored Natural Attenuation

Table F-4. Sample Locations, Analytical Parameters, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama

Worksheet #18 Sample Locations, Analytical, and SOPP Requirements

Sample Location	Sample Name[c]	Sample Depth (ft bgs)	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
			FD	MS/MSD		
RSA-008 Sample Locations – Baseline						
008-RS2585	008-RS2585-GW-AHK-4000-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4001-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4002-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4003-REG	33.8-43.8	B8-RS1041-GW-AHK-4004-FD			
B8-RS1043	B8-RS1043-GW-AHK-4005-REG	32.1-42.1		B8-RS1043-GW-AHK-4005-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4006-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4007-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4008-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7000-TB	N/A			VOC **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8000-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9000-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 1, First Semiannual						
008-RS2585	008-RS2585-GW-AHK-4009-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4010-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4011-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4012-REG	33.8-43.8	B8-RS1041-GW-AHK-4013-FD			
B8-RS1043	B8-RS1043-GW-AHK-4014-REG	32.1-42.1		B8-RS1043-GW-AHK-4014-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4015-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4016-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4017-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7001-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8001-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9001-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 1, Second Semiannual						
008-RS2585	008-RS2585-GW-AHK-4018-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4019-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4020-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4021-REG	33.8-43.8	B8-RS1041-GW-AHK-4022-FD			
B8-RS1043	B8-RS1043-GW-AHK-4023-REG	32.1-42.1		B8-RS1043-GW-AHK-4023-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4024-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4025-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4026-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7002-TB	N/A			VOC **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8002-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9002-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0

Table F-4. Sample Locations, Analytical Parameters, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #18 Sample Locations, Analytical, and SOPP Requirements (Continued)

Sample Location	Sample Name[c]	Sample Depth (ft bgs)	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
			FD	MS/MSD		
RSA-008 Sample Locations – Year 2, First Semiannual						
008-RS2585	008-RS2585-GW-AHK-4027-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4028-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4029-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4030-REG	33.8-43.8	B8-RS1041-GW-AHK-4031-FD			
B8-RS1043	B8-RS1043-GW-AHK-4032-REG	32.1-42.1		B8-RS1043-GW-AHK-4032-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4033-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4034-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4035-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7003-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8003-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9003-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 2, Second Semiannual						
008-RS2585	008-RS2585-GW-AHK-4036-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4037-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4038-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4039-REG	33.8-43.8	B8-RS1041-GW-AHK-4040-FD			
B8-RS1043	B8-RS1043-GW-AHK-4041-REG	32.1-42.1		B8-RS1043-GW-AHK-4041-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4042-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4043-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4044-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7004-TB	N/A			VOC **(Worksheet #15)**	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8004-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9004-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 3, First Semiannual						
008-RS2585	008-RS2585-GW-AHK-4045-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4046-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4047-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4048-REG	33.8-43.8	B8-RS1041-GW-AHK-4049-FD			
B8-RS1043	B8-RS1043-GW-AHK-4050-REG	32.1-42.1		B8-RS1043-GW-AHK-4050-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4051-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4052-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4053-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7005-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8005-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]

Table F-4. Sample Locations, Analytical Parameters, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #18 Sample Locations, Analytical, and SOPP Requirements (Continued)

Sample Location	Sample Name[c]	Sample Depth (ft bgs)	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
			FD	MS/MSD		
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9005-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 3, Second Semiannual						
008-RS2585	008-RS2585-GW-AHK-4054-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4055-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4056-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4057-REG	33.8-43.8	B8-RS1041-GW-AHK-4058-FD			
B8-RS1043	B8-RS1043-GW-AHK-4059-REG	32.1-42.1		B8-RS1043-GW-AHK-4059-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4060-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4061-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4062-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7006-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8006-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9006-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 4, Annual						
008-RS2585	008-RS2585-GW-AHK-4063-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4064-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4065-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4066-REG	33.8-43.8	B8-RS1041-GW-AHK-4067-FD			
B8-RS1043	B8-RS1043-GW-AHK-4068-REG	32.1-42.1		B8-RS1043-GW-AHK-4068-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4069-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4070-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4071-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7007-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8007-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9007-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 5, Annual						
008-RS2585	008-RS2585-GW-AHK-4072-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4073-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4074-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4075-REG	33.8-43.8	B8-RS1041-GW-AHK-4076-FD			
B8-RS1043	B8-RS1043-GW-AHK-4077-REG	32.1-42.1		B8-RS1043-GW-AHK-4077-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4078-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4079-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4080-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7008-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8008-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]

Table F-4. Sample Locations, Analytical Parameters, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #18 Sample Locations, Analytical, and SOPP Requirements (Continued)

Sample Location	Sample Name[c]	Sample Depth (ft bgs)	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
			FD	MS/MSD		
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9008-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 6, Annual						
008-RS2585	008-RS2585-GW-AHK-4081-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4082-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4083-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4084-REG	33.8-43.8	B8-RS1041-GW-AHK-4085-FD			
B8-RS1043	B8-RS1043-GW-AHK-4086-REG	32.1-42.1		B8-RS1043-GW-AHK-4086-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4087-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4088-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4089-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7009-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8009-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9009-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 7, Annual						
008-RS2585	008-RS2585-GW-AHK-4090-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4091-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4092-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4093-REG	33.8-43.8	B8-RS1041-GW-AHK-4094-FD			
B8-RS1043	B8-RS1043-GW-AHK-4095-REG	32.1-42.1		B8-RS1043-GW-AHK-4095-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4096-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4097-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4098-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7010-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8010-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9010-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 8, Annual						
008-RS2585	008-RS2585-GW-AHK-4099-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4100-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4101-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4102-REG	33.8-43.8	B8-RS1041-GW-AHK-4103-FD			
B8-RS1043	B8-RS1043-GW-AHK-4104-REG	32.1-42.1		B8-RS1043-GW-AHK-4104-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4105-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4106-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4107-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7011-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8011-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]

Table F-4. Sample Locations, Analytical Parameters, and SOPP Requirements
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #18 Sample Locations, Analytical, and SOPP Requirements (Continued)

Sample Location	Sample Name[c]	Sample Depth (ft bgs)	QC Sample Designation[c]		Analytical Suite See Worksheet #15	Field SOPP
			FD	MS/MSD		
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9011-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 9, Annual						
008-RS2585	008-RS2585-GW-AHK-4108-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4109-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4110-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4111-REG	33.8-43.8	B8-RS1041-GW-AHK-4112-FD			
B8-RS1043	B8-RS1043-GW-AHK-4113-REG	32.1-42.1		B8-RS1043-GW-AHK-4113-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4114-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4115-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4116-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7012-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8012-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9012-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0
RSA-008 Sample Locations – Year 10, Annual						
008-RS2585	008-RS2585-GW-AHK-4117-REG	33.1-43.1			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	SOPP 7.0
008-RS2586	008-RS2586-GW-AHK-4118-REG	28.6-38.6				
008-RS2588	008-RS2588-GW-AHK-4119-REG	20.2-30.2				
B8-RS1041	B8-RS1041-GW-AHK-4120-REG	33.8-43.8	B8-RS1041-GW-AHK-4121-FD			
B8-RS1043	B8-RS1043-GW-AHK-4122-REG	32.1-42.1		B8-RS1043-GW-AHK-4122-MS/MSD		
B8-RS1046	B8-RS1046-GW-AHK-4123-REG	35.6-45.7				
B8-RS1047	B8-RS1047-GW-AHK-4124-REG	43.0-53.0				
B8-RS1280	B8-RS1280-GW-AHK-4125-REG	24.5-39.5				
Trip Blanks						
RSA-008	RSA-008-WA-TB-7013-TB	N/A			VOC (**Worksheet #15**)	See notes[a]
Equipment Rinsate Sample						
RSA-008	RSA-008-BW-A-8013-ER	N/A			Metals, VOCs, Pesticides, MEE **(Worksheet #15)**	See notes[b]
IDW Water Sample[d]						
RSA-008	RSA-008-WA-A-9013-REG	N/A			Metals, VOCs, Pesticides **(Worksheet #15)**	SOPP 4.0

Notes:

[a]TBs are laboratory provided VOC vials filled with hazardous constituent 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-008 groundwater VOC samples.
[b]ERs are collected by pouring deionized water (obtained from the onsite deionized water treatment system) over non-dedicated decontaminated sampling equipment. One ER will be collected per sampling event.
[c]The MS/MSD and FD locations are subject to change due to field conditions.
[d]Optionally, groundwater sample results may be used instead of IDW sampling, which is contingent upon receiving facility.
[e]The last four digits in the sample name are sequential.

bgs = Below Ground Surface
ER = Equipment Rinsate
FD = Field Duplicate
ft = Feet
GW = Groundwater
IDW = Investigation-Derived Waste
MEE = Methane, Ethane, Ethene
MS = Matrix Spike
MSD = Matrix Spike Duplicate
N/A = Not Applicable
QC = Quality Control
REG = Regular Sample
SOPP = Standard Operating Project Procedure
TB = Trip Blank
VOC = Volatile Organic Compounds

Table F-5. Sample Containers, Preservation, and Hold Times
Redstone Arsenal, Madison County, Alabama

Worksheet #19 & 30 Sample Containers, Preservation, and Hold Times

Analyte/ Analyte Group	Matrix	Analytical Method	Accreditation Expiration Date	Sample Container/Preservation Requirements	Holding Time	Data Package Turnaround
Groundwater Samples						
Metals	Water	SW6020A	31 July 2025	1 – 500 mL poly HNO_3 to pH <2	Preparation – 180 days Analysis – 180 days	15 days
VOCs		SW8260C	31 July 2025	1 – 40 mL vials, HCl to pH <2 2 – 40 mL vials, unpreserved	Preserved – 14 days Unpreserved – 7 days	
Pesticides		SW8081B	31 July 2025	1 – 1 liter amber	Extraction – 7 days Analysis 40 days	
Dissolved Gases (MEE)		RSK-175	31 July 2025	1 – 40 mL vials, HCl to pH <2 2 – 40 mL vials, unpreserved	Preparation – 14 days Analysis – 14 days	
IDW Water						
Metals	Water	SW6020A	31 July 2025	1 – 500 mL poly HNO_3 to pH <2	Preparation – 180 days Analysis – 180 days	15 days
VOCs		SW8260C	31 July 2025	1 – 40 mL vials, HCl to pH <2 2 – 40 mL vials, unpreserved	Preserved – 14 days Unpreserved – 7 days	
Pesticides		SW8081B	31 July 2025	1 – 1 liter amber	Extraction – 7 days Analysis 40 days	

Notes:

a) All samples should be cooled to 4 ± 2°C in conjunction with preservation requirements noted prior to shipment to the laboratory.
b) See **Worksheet #15** for the analyte list per method.
c) Sample deliverables should include a Level IV, Contract Laboratory Program (CLP)-like data package and Electronic Data Deliverable (EDD) for all samples except for IDW samples that require certificates of analysis and EDD only.

< = Less Than
°C = Degrees Celsius
HCl = Hydrochloric Acid
HNO_3 = Nitric Acid
IDW = Investigation-Derived Waste
MEE = Methane, Ethane, Ethene
mL = Milliliter
SW = Solid Waste
VOC = Volatile Organic Compound

Table F-5. Sample Containers, Preservation, and Hold Times
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #19 & 30 Sample Containers, Preservation, and Hold Times (Continued)

Laboratory Point of Contact:

Mr. Craig Meyers
Advanced Environmental Laboratories (AEL) Client Services Manager
Voice: 904-363-9350 Ext. 202
FAX: 904-363-9354
After Hours/Emergency: 904-710-7158

Laboratory Addresses:

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 laboratory:

Attn: AEL
FedEx Shipping Center
3736 N Salisbury Rd
Jacksonville, Florida 32216
800-463-3339

Table F-6. Field Quality Control Sample Summary
Redstone Arsenal, Madison County, Alabama

Worksheet #20 Field Quality Control Sample Summary

Parameters[a]	Analytical Method	Matrix	Total # of Samples	FD	MS	MSD	ER (1/event)	TB (1/cooler)[b]	TAT Needed[a]	Sample Container/Preservation Requirements [c]	Holding Time	Total # of Containers
Semiannual & Annual Samples/Event												
Metals	SW6020A	Water	8	1	1	1	1	0	Normal	1 – 500 mL poly HNO_3 to pH <2	Preparation – 180 days Analysis – 180 days	12
VOCs	SW8260C	Water	8	1	1	1	1	1	Normal	1 – 40 mL vials, HCl to pH <2 2 – 40 mL vials, unpreserved	Preserved – 14 days Unpreserved – 7 days	13
Pesticides	SW8081B	Water	8	1	1	1	1	0	Normal	1 – 1 Liter amber glass	Extraction – 7 days Analysis – 40 days	12
Dissolved Gases (MEE)	RSK-175	Water	8	1	1	1	1	0	Normal	1 – 40 mL vials, HCl to pH <2 2 – 40 mL vials, unpreserved	Preparation – 14 days Analysis – 14 days	12
IDW Water/Event[d]												
Metals	SW6020A	Water	1	0	0	0	0	0	Normal	1 – 500 mL poly HNO_3 to pH <2	Preparation – 180 days Analysis – 180 days	1
VOCs	SW8260C	Water	1	0	0	0	0	0	Normal	1 – 40 mL vials, HCl to pH <2 2 – 40 mL vials, unpreserved	Preserved – 14 days Unpreserved – 7 days	1
Pesticides	SW8081B	Water	1	0	0	0	0	0	Normal	1 – 1 Liter amber glass	Extraction – 7 days Analysis – 40 days	1

Notes:

[a]Sample deliverables should include a Department of Defense (DoD) Quality Systems Manual (QSM) Stage 3-4 data package and Environmental Chemical Corporation (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]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.

< = Less Than
°C = Degrees Celsius
ER = Equipment Rinsate
FD = Field Duplicate
HCl = Hydrochloric Acid
HNO_3 = Nitric Acid
IDW = Investigation-Derived Waste
MEE = Methane, Ethane, Ethene
mL = Milliliter
MS = Matrix Spike
MSD = Matrix Spike Duplicate
SW = Solid Waste 846
TAT = Turnaround Time
TB = Trip Blank
VOC = Volatile Organic Compound

Table F-7. Analytical Laboratory Standard Operating Procedures
Redstone Arsenal, Madison County, Alabama

Worksheet #23 Analytical Laboratory Standard Operating Procedures

SOP Reference Number	Title, Revision, Date	Definitive or Screening Data	Analytical Group	Matrix	Instrument	Organization Performing Analysis	Modified for Project Work (Yes/No)?
Admin-005	Sample Receipt, Handling, Storage, and Log in Rev.09, Eff. 2022-07-27	Definitive	Samples	N/A	N/A	AEL	No
Admin-018	Waste Disposal and Pollution Prevention Admin-018 Rev.10 Eff 2020-10-09	Definitive	Samples	N/A	N/A	AEL	No
AEL QSM 10.4	Quality Manual, Rev. 10.4, Eff 2022-03-31	Definitive	Quality Systems	N/A	N/A	AEL	No
MET-002	Method USEPA SW3010A: Acid Digestion of Aqueous Samples and Extracts, Rev. 17, Eff. 2023-03-03	Definitive	Metals Aqueous Sample Preparation	Water	N/A	AEL	No
MET-016	Method SW 6020A and B: Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry, Rev.16, Eff. 2023-03-06	Definitive	Metals Aqueous and Solid Sample Analysis	Water	ICP/MS	AEL	No
SVOC-001	Method 3510C: Separatory Funnel Liquid-Liquid Extraction, Rev. 09, Eff. 2023-01-17	Definitive	Pesticides	Water	N/A	AEL	No
SVOC-008	Method 8081B: Organochlorine Pesticides by Gas Chromatography, Rev. 12, Eff. 2021-02-02, Last Reviewed 2022-03-21	Definitive	Pesticides	Water	GC-ECD	AEL	No
VOC-001	Method 5030C: Purge-and-Trap for Aqueous Samples, Rev. 06, Eff. 2020-08-10	Definitive	VOCs	Water	Purge and Trap	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
VOC-013	Dissolved Gas Analysis in Water Samples by Headspace-Gas Chromatography (HS-GS) with Flame Ionization Detection (FID) Rev 05, Eff. 2024-05-14	Definitive	Dissolved Gases	Water	GC/FID	AEL	No

Notes:

AEL = Advanced Environmental Laboratories
Eff. = Effective
FID = Flame Ionization Detector
GC/ECD = Gas Chromatography/Electron Capture Detector
GC/FID = Gas Chromatography/Flame Ionization Detector
GC/MS = Gas Chromatography/Mass Spectrometry
ICP/MS = Inductively Coupled Plasma-Mass Spectrometry
MET = Metals
N/A = Not Applicable
Rev. = Revision
SOP = Standard Operating Procedure
SVOC = Semivolatile Organic Compound
SW = Solid Waste
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

Table F-8. Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama

Worksheet #24 Analytical Instrument Calibration

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
Metals ICP/MS	LDR	High standard(s) at the upper limit of the range.	At initial setup and every 6 months	To establish an upper limit where true value ±10%.	Data cannot be reported above upper limit within qualification or running a higher passing standard.	Analyst	MET-016, Sections 13
	Tune Check	N/A	Daily before ICAL	Mass calibration less than or equal to 0.1 amu from the true value; resolution <0.9 amu full width at 10% peak height.	Retune instrument	Analyst	
	IS	All QC and samples.	All QC and samples	30-120% of intensity in ICAL blank.	All samples out of range are to be diluted and rerun until IS returns to calibration range	Analyst	
	ICAL	Low point varied per analyte. Lead and iron are at 10000, 20000, and 100000 ppb. Remaining analytes are at 10, 20, and 100 ppb.	Daily	Linear least squares regression for each analyte ≥0.99.	Correct problem, rerun ICAL.	Analyst	
	ICV	Lead and iron at 50,000 ppb. All other analytes at 50 ppb.	Daily after ICAL	All target elements ± 10% of true value.	Correct problem, rerun ICV. If that fails, repeat ICAL.	Analyst	
	CCV	Lead and iron at 20,000 ppb. All other analytes at 20 ppb.	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 one fails, repair problem, rerun samples with new passing CCV. May require new ICAL. If reanalysis not possible, data must be qualified with case narration.	Analyst	
	LLCCV	Varied per element.	Daily after ICAL	All target elements ±20% of true value.	Correct problem, rerun ICAL.	Analyst	

Table F-8. Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #24 Analytical Instrument Calibration (Continued)

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
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 repeats ICAL.		VOC-003, Sections 10, 13
	RT windows verification	N/A	At ICAL at midpoint and daily at beginning CCV	IS shift ≤10 seconds otherwise reset. Analytes reported within ± 0.06 RRT.	N/A		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 one 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.		

Table F-8. Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #24 Analytical Instrument Calibration (Continued)

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
Pesticides GC/ECD	Liner degradation check	Degradation of DDT ≤20%.	Every 12 hours and beginning of the analytical batch	Degradation of DDT and endrin ≤15%.	Correct problem (change liner and/or trim column).	Analyst	SVOC-008 Section 12.5
	ICAL	For pesticides: 0.02 to 0.2 µg/mL. For chlordane/toxaphene: 0.2 to 2.0 µg/mL.	At instrument set-up and after ICV or CCV failure, prior to sample analysis	Either RSD for each analyte ≤20% or linear least squares regression for each analyte ≥0.99.	Correct problem then repeat ICAL.		
Pesticides GC/ECD	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	Analyst	SVOC-008 Section 12.5
	RT Windows Verification	N/A	At ICAL at midpoint and daily at beginning CCV	ISs shift ≤10 seconds otherwise reset. Analytes reported within ± 0.03 min.	N/A	Analyst	
	CCV	At concentration level ±25-50% of curve range.	Daily before sample analysis, every 10 field samples, and close of analysis	All target analytes within ± 20% of true value.	Immediately analyze two additional CCVs. If both pass, samples can be reported. If either one fails, repair problem, rerun samples with new passing CCV. May require new ICAL. If reanalysis not possible, data must be qualified with case narration.	Analyst	
Volatiles (MEE) GC/FID	ICAL	Varied per analyte.	At instrument set-up and after ICV or CCV failure, prior to sample analysis	Either RSD for each analyte ≤20%; linear or quadratic regression for each analyte ≥0.99.	Correct problem, then repeat ICAL.	Analyst	VOC-013, Sections 10, 12, 13, 24
	RT Windows Verification	N/A	Before ICAL and daily before IB	Set at ±3 times standard deviation of 72-hour study.	N/A	Analyst	VOC-013, Section 12, 24
	ICV	Varied per analyte.	Once after ICAL	All target analytes within ±20% of true value.	Correct problem. Rerun ICV. If fails, repeat ICAL.	Analyst	

Table F-8. Analytical Instrument Calibration
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #24 Analytical Instrument Calibration (Continued)

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
	CCV	Varied per analyte.	Daily before sample analysis, every 4 hours thereafter, and close of analysis	All target analytes within ±20% of true value.	Immediately analyze two additional CCVs. If both pass, samples can be reported. If either one fails, repair problem, rerun samples with new passing CCV. May require new ICAL. If reanalysis not possible, data must be qualified with case narration.	Analyst	VOC-013, Sections 10, 12, 13, 24

Notes:

± = Plus or Minus
< = Less Than
≤ = Less Than or Equal To
> = Greater Than
≥ = Greater Than or equal to
% = Percent
µg/L = Micrograms per Liter
µg/mL = Micrograms per Milliliter
amu = Atomic Mass Unit
BFB = Bromofluorobenzene
CA = Corrective Action
CCV = Continuing Calibration Verification
DDT = Dichlorodiphenyltrichloroethane
GC/ECD = Gas Chromatography/Electron Capture Detector
GC/FID = Gas Chromatography/Flame Ionization Detector
GC/MS = Gas Chromatography/Mass Spectrometry
IB = Instrument Blank
ICP/MS = Inductively Coupled Plasma-Mass Spectrometry
ICAL = Initial Calibration
ICV = Initial Calibration Verification
IS = Internal Standard
LDR = Linear Dynamic Range
LLCCV = Low Level Calibration Check Standard
MET = Metals
N/A = Not Applicable
ppb = Parts per Billion
QC = Quality Control
RRT = Relative Retention Time
RSD = Relative Standard Deviation
RT = Retention Time
SIM = Select Ion Mode
SOP = Standard Operating Procedure
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Table F-9. Analytical Instrument and Equipment Maintenance, Testing, and Inspection
Redstone Arsenal, Madison County, Alabama

Worksheet# 25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity/Preventive Maintenance	Frequency	Acceptance Criteria	CA	Title/ Position Responsible for CA	Reference
ICP/MS	Pump/tubing	ICV and CCV	• Checked daily • Replaced every 2 to 3 days.	As listed with inspection	Method blanks < DL, ICAL, ICV, CCV, peak shape, LCS, area counts, and surrogate limits, as shown on Worksheet #28	Normal replacement	Analyst	MET-016
	Sample introduction	ICV and CCV	• All sample introduction items, nebulizer, injector tip, spray chamber and torch are cleaned and sonicated in a HNO_3 and HCl aqua-regia solution as needed. Dependent on sample load and sample concentrations.	As listed with inspection	MB, CCB, and QC passing criteria	Normal maintenance	Analyst	
	Cones	ICV and CCV	• Cones are removed and cleaned in HNO_3 and sonicated. Replaced with new as needed.	As listed with inspection	Passing tunes and QC criteria	Clean or replace as needed		
	Interference checks	ICV and CCV	• Performance maintenance.	As needed	MB, CCB, and QC passing criteria	Performance maintenance	Manufacturer's instrument technician	
	Chiller/compressor	ICV and CCV	• Clean screens check and add fluid monthly • Drain and replace compressor oil monthly.	As listed with inspection	Set to proper fluid levels	Set to proper fluid levels	Analyst	

Table F-9. Analytical Instrument and Equipment Maintenance, Testing, and Inspection
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet# 25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity/Preventive Maintenance	Frequency	Acceptance Criteria	CA	Title/ Position Responsible for CA	Reference
VOC Purge and Trap System	Concentrating trap	ICAL and CCVs	• Purge flow rate (40 mL/m) at least weekly • Bake flow rate (80-120 mL/min) at least monthly • Shape and tailing of chromatographic peaks continuously • Monitor trending in surrogate and standard recoveries continuously • Changes in tuning daily • IB baselines continuously.	As Listed with Inspection	MBs < DL, ICAL, ICV, CCV, and surrogate limits, as shown on Worksheet #28	Trap replacement, sparge tube cleaning and replacement, trap conditioning, check for leaks by flow	Analyst/Supervisor	VOC-001
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		MB < DL, ICAL, ICV, CCV, peak shape, LCS, internal area counts, and surrogate limits, as shown on Worksheet #28	Trim or replace column		VOC-001
	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	Analyst/Supervisor	VOC-001
	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		

Table F-9. Analytical Instrument and Equipment Maintenance, Testing, and Inspection
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet# 25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity/Preventive Maintenance	Frequency	Acceptance Criteria	CA	Title/ Position Responsible for CA	Reference
	Filament		• Check filaments condition (filaments are replaced through the year as needed).		Passing tune criteria, passing QC, area counts and sensitivity.			VOC-003
Pesticides GC/ECD	Column/liner performance	ICV and CCV	• Calculate DDT and endrin breakdown, • Shape and tailing of chromatographic peaks continuously • Monitor trending in surrogate and standard recoveries continuously • Monitor instrument blank baselines continuously.	As listed with inspection	MB < DL, ICAL, ICV, CCV, peak shape, LCS, area counts, breakdown ≤20%, and surrogate limits, as shown on Worksheet #28	Trim or replace column. Replace liner.	Analyst	SVOC-008
	Detector	ICV and CCV	• Shape and tailing of chromatographic peaks continuously • Monitor trending in surrogate and standard recoveries continuously • Instrument blank baselines continuously.		MB < DL, ICAL, ICV, CCV, peak shape, LCS, area counts, and surrogate limits, as shown on Worksheet #28	Clean or replace as needed.		
Dissolved Gases GC/FID	Column/liner performance	ICV and CCV	• Shape and tailing of chromatographic peaks continuously • Monitor trending in standard recoveries continuously • Instrument blank baselines continuously.	As listed with inspection	Method blanks < DL, ICAL, ICV, CCV, peak shape, LCS, and area counts, as shown on Worksheet #28	Trim or replace column, replace liner	Analyst	VOC-013
	Detector	ICV and CCV	• Shape and tailing of chromatographic peaks continuously		Method blanks < DL, ICAL, ICV, CCV, peak shape, LCS, and	Clean or replace as needed	Analyst	VOC-013

Table F-9. Analytical Instrument and Equipment Maintenance, Testing, and Inspection
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet# 25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity/Preventive Maintenance	Frequency	Acceptance Criteria	CA	Title/ Position Responsible for CA	Reference
			• Monitor trending in standard recoveries continuously • Instrument blank baselines continuously.		area counts, as shown on Worksheet #28			

Notes:

% = Percent
< = Less Than
CA = Corrective Action
CCB = Continuing Calibration Blank
CCV = Continuing Calibration Verification
DDT = Dichlorodiphenyltrichloroethane
DL = Detection Limit
GC/MS = Gas Chromatography/Mass Spectrometry
GC/ECD = Gas Chromatography/Electron Capture Detector
GC/FID = Gas Chromatography/Flame Ionization Detector
HCl = Hydrochloric Acid
HNO_3 = Nitric Acid
IB = Instrument Blank
ICAL = Initial Calibration
ICP/MS = Inductively Coupled Plasma/Mass Spectrometry
ICV = Initial Calibration Verification
L/m = Liters per Minute
LCS = Laboratory Control Sample
MB = Method Blank
mL/min = Milliliters per Minute
MS = Mass Spectrometry
QC = Quality Control
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Table F-10. Sample Handling, Custody, and Disposal
Redstone Arsenal, Madison County, Alabama

Worksheet #26 Sample Handling, Custody, and Disposal

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/Laboratory Courier, FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): AEL Laboratory Personnel
Sample Custody and Storage (Personnel/Organization): AEL Laboratory Personnel
Sample Preparation (Personnel/Organization): AEL Laboratory Personnel
Sample Determinative Analysis (Personnel/Organization): AEL Laboratory Personnel
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): N/A
SAMPLE DISPOSAL
Personnel/Organization: AEL Laboratory Personnel
Number of Days from Analysis: 30 days from submittal of Final report or 60 days from receipt, whichever is longer

Notes:

AEL = Advanced Environmental Laboratories
ECC = Environmental Chemical Corporation
N/A = Not Applicable
TBD = To be Determined

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 provided 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 filled out 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.

Table F-11. Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama

Worksheet #28 Analytical Quality Control and Corrective Action

Analytical Group: Metals
Analytical Method/SOP Reference: USEPA 3010A/6020A by MET-002 and MET-016

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	CA	Title of Person Responsible for Corrective Action	Project-Specific MPC
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
ICB/CCB	Immediately after the ICV and immediately after every CCV	The absolute values of all analytes must be >½ LOQ.	ICB: Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL. All samples following the last acceptable calibration blank must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated sample and CCV(s).	Analyst with Department Supervisor review.	Same as Method/SOP
ICS	After ICAL and prior to sample analysis	Absolute value of concentration for all non-spiked target analytes <½ LOQ (unless there are a verified trace impurity from one of the spiked analytes).	Stop analysis and locate problem. Correct problem and reanalyze ICS and all associated samples.	If corrective action fails and reanalysis cannot be performed, qualify data accordingly and notify client and or case narrate.	
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 are 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.	Analyst with Department Supervisor and QA Officer review.	

Table F-11. Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #28 Analytical Quality Control and Corrective Action (Continued)

Analytical Group: Metals
Analytical Method/SOP Reference: USEPA 3010A/6020A by MET-002 and MET-016

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	CA	Title of Person Responsible for Corrective Action	Project-Specific MPC
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 are 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 are 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.	Analyst with Department Supervisor review.	
Dilution Test	When MS or MSD fails	Five-fold dilution must agree within ±10% of original measurement.	No specific corrective action unless a stated project requirement. Flag accordingly.	Analyst with Department Supervisor review.	
PDS	When MS or MSD fails using same parent sample of failure	Recovery within ±80-120%.	No specific corrective action unless a stated project requirement. Flag accordingly.	Analyst with Department Supervisor review.	Same as Method/SOP

Table F-11. Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #28 Analytical Quality Control and Corrective Action (Continued)

Analytical Group: VOCs
Analytical Method/SOP Reference: USEPA 5030B/8260C by VOC-001 and VOC-003

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	CA	Title of Person Responsible for CA	Project-Specific MPC
MB	Once every prep/analytical batch of 20 or fewer samples	No analyte detected ≥ 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		QC limits set in QSM 5.4 LCS tables or in-house generated limits when DoD limits are 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 20 or fewer samples	QC limits set in QSM 5.4 LCS tables or in-house generated limits when DoD limits are 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.	Analyst with Department Supervisor review.	Same as Method/SOP
MSD					
Surrogate	All samples and QC (except tune)	QC limits set in QSM 5.4 tables or in-house generated limits when DoD limits are unavailable.	Action dependent upon type. If MB or LCS, correct problem and reprep/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.		

Table F-11. Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #28 Analytical Quality Control and Corrective Action (Continued)

Analytical Group: Pesticides
Analytical Method/SOP Reference: USEPA 3510C/8081B by SVOC-001 and SVOC-008

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	CA	Title of Person Responsible for CA	Project-Specific MPC
MB	Once every prep/analytical batch of 20 or fewer samples	No analyte detected equal to or above the detection limit (DL) or > 1/10 the regulatory limit, whichever is greater (DoD: No analytes > ½ LOQ; common lab 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 20 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 20 or fewer samples	QC limits set in QSM 5.4 LCS tables or in-house generated limits when DoD limits are 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.	Analyst with Department Supervisor review.	Same as Method/SOP
Surrogate	All samples and QC (except tune)	QC limits set in QSM 5.4 tables or in-house generated limits when DoD limits unavailable.	Action dependent upon type. If MB or LCS, correct problem and reprep-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.		

Table F-11. Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #28 Analytical Quality Control and Corrective Action (Continued)

Analytical Group: Dissolved Gases (MEE)
Analytical Method/SOP Reference: RSK-175/VOC-013

QC Sample	Number/Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Title of Person Responsible for Corrective Action	Project-Specific MPC
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.	Same as Method/SOP
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 are 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.	Analyst with Department Supervisor and QA Officer review.	Same as Method/SOP
MS	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 are unavailable.	When outside limits, examine project-specific requirements and/or contact client. Flag data appropriately.	Analyst with Department Supervisor and QA Officer review.	Same as Method/SOP
MSD	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. RPD of all target compounds ≤20% between MS and MSD.	When outside limits, examine project-specific requirements and/or contact client. Flag data appropriately.	Analyst with Department Supervisor and QA Officer review.	Same as Method/SOP

Table F-11. Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #28 Analytical Quality Control and Corrective Action (Continued)

Notes:

% = Percent
< = Less Than
≤ = Less Than or Equal To
> = Greater Than
≥ = greater than or equal to
CA= Corrective Action
CCB = Continuing Calibration Blank
CCV = Continuing Calibration Verification
DL = Detection Level
DoD = U.S. Department of Defense
ICAL = Initial Calibration
ICB = Initial Calibration Blank
ICS = Interference Check Solutions
ICV = Initial Calibration Verification
LCS = Laboratory Control Spike
LOQ = Limit of Quantitation
MB = Method Blank
MEE = Methane, Ethane, Ethene
MPC = Measurement Performance Criteria
MS = Matrix Spike
MSD = Matrix Spike Duplicate
PDS = Post Digestion Spike
QA = Quality Assurance
QC = Quality Control
QSM = Quality Systems Manual
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
SVOC = Semivolatile Organic Compound
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

Table F-11. Analytical Quality Control and Corrective Action
Redstone Arsenal, Madison County, Alabama (Continued)

Worksheet #28 Analytical Quality Control and Corrective Action (Continued)

Data validation is an analyte and sample-specific process for evaluating compliance with contract requirements, methods/SOPs, and MPC.

All project field samples will undergo a Tier 1 Plus (DoD QSM Stage 2B) data validation using laboratory limits as the MPC. IDW samples will be reviewed for completeness only.

Data validation will be documented on ECC DVWs. Project EDDs (ECC EDMS EDD and ERIS) will be updated with 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	Metals, VOCs, Pesticides, Dissolved Gases	Low/Medium	Laboratory MPC evaluated in accordance with applicable USEPA National Functional Guidelines as applicable to analytical methods listed in this Site Monitoring Report	ECC Project Chemist or designate

Notes:

DoD = U.S. Department of Defense
DVW = Data Validation Worksheet
ECC = Environmental Chemical Corporation
EDD = Electronic Data Deliverable
EDMS = Environmental Data Management System
ERIS = Environmental Remediation Information System
IW-QAPP = Installation-Wide Quality Assurance Project Plan
MPC = Measurement Performance Criteria
QSM = Quality Systems Manual
SOP = Standard Operating Procedure
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

ATTACHMENT 1

FIELD DOCUMENTATION

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Table 1

Water Level Survey Log
RSA-008
Redstone Arsenal, Madison County, Alabama

Date: _____

Personnel: _____

Weather: _____

Other Comments: _____

Well ID	Headspace PID (ppm)	Time	Depth to Water (ft btoc)
008-2585			
008-2586			
008-2588			
B8-RS1041			
B8-RS1043			
B8-RS1046			
B8-RS1047			
B8-RS1280			

Notes:

ft btoc = Feet Below Top of Casing
ID = Identifier
PID = Photoionization Detector
ppm = Parts per Million

Table 2

Monitoring Well Sampling Log
RSA-008
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 btoc)	Screened Interval (ft bgs)	Date Sampled	Time	Depth to Water (ft btoc)
008-2585	582.97	580.65	33.1-43.1				
008-2586	578.22	575.88	28.6-38.6				
008-2588	577.44	577.90	20.2-30.2				
B8-RS1041	583.23	580.55	33.8-43.8				
B8-RS1043	582.27	579.65	32.1-42.1				
B8-RS1046	573.53	570.85	35.6-45.7				
B8-RS1047	579.25	576.87	43.0-53.0				
B8-RS1280	580.11	577.96	24.5-39.5				

Insert Groundwater Purge Form
Page 1 of 2

SAMPLE COLLECTION LOG

Site _____ **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	Preservative

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)

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	NA	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: NA - 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

PHOTO IONIZATION 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	
			Isobuty lene / 100ppm	

Notes:
ppm = Parts per Million

Vision Integrity Results	**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:

AHA = Activity Hazard Analysis
EHS = Environment, Health, and Safety
HASP = Health and Safety Plan
PPE = Personal Protective Equipment

ECG-Never Compromising Safety