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Fifth Five-Year Remedy Review Report for Savannah River Site Operable Units with Engineered Cover Systems (U)

Aiken, South Carolina

SRNS-RP-2016-00609

Revision 1.1

November 2017

SAVANNAH RIVER SITE • AIKEN, SOUTH CAROLINA

DISCLAIMER

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Prepared for
U.S. Department of Energy
and
Savannah River Nuclear Solutions, LLC
Aiken, South Carolina

1/8/18
Date

A. A. Holmes
Angelia A. Holmes
Acting Assistant Manager for Infrastructure
and Environmental Stewardship
U. S. Department of Energy
Savannah River Operations Office

1/23/18
Date

Daphne D. Neel
Daphne G. Neel
Bureau Chief
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control

1/30/18
Date

Franklin E. Hill
Director
Superfund Division
U. S. Environmental Protection Agency - Region 4

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EXECUTIVE SUMMARY

This document presents the results of a technical evaluation of ten environmental remedies that implemented engineered cover systems at Savannah River Site (SRS). The remedies are evaluated to determine whether they are functioning as designed and whether they are protective of human health and the environment. This evaluation is required under Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986. CERCLA requires that remedial actions that result in any hazardous substances, pollutants, or contaminants remaining at the site be subject to a remedy review every five years.

Previous five-year remedy review reports combined all SRS operable units (OUs) that had implemented a remedial action into a single document. A recommendation was made by SRS in the Fourth Five-Year Remedy Review Report that future reviews should be conducted in phases based on OU groupings with similar remedies. This phased approach not only reduces the volume of future remedy reports, but also is more effective in identifying and resolving issues for similar remedies. For this reason, the Fifth Five-Year Remedy Review Report will be conducted in five phases with OUs grouped by the following remedy types: (1) native soil covers and/or land use controls; (2) groundwater; (3) engineered cover systems; (4) geosynthetic or stabilization/solidification cover systems; and (5) operating equipment. This report presents the third phased review for SRS OUs that selected engineered cover systems as the final remedy.

According to the data reviewed and the site inspections, the ten remedies evaluated in this report are functioning as intended. The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection are still valid. No new information has come to light that calls into question the protectiveness of any of the remedies evaluated. The ten remedies have been determined to be protective of human health and the environment. No issues or recommendations resulted from the remedy review.

Five-Year Review Summary Form

SITE IDENTIFICATION			
Site Name: Savannah River Site			
EPA ID: SC1890008989			
Region: 4	**State:** SC	**City/County:** Aiken/Aiken	
SITE STATUS			
NPL Status: Final			
Multiple OUs?: Yes	**Has the Site achieved Construction Completion?:** No		
REVIEW STATUS			
Lead Agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency Name:** U.S. Department of Energy			
Author Name (Federal or State Project Manager): N/A			
Author Affiliation: Savannah River Nuclear Solutions, LLC			
Review Period: May 1, 2016 – January 21, 2018 (Phase 3: SRS OUs with Engineered Cover Systems)			
Date of Site Inspections: August 2016 - November 2016 (Phase 3: SRS OUs with Engineered Cover Systems)			
Type of Review: Statutory			
Review Number: 5			
Triggering Action Date: January 21, 2014			
Due Date (Five Years after Triggering Action Date): January 21, 2019 (includes all 5 Phases)			

ISSUES/RECOMMENDATIONS				
OU(s) without Issues/Recommendations Identified in the Five-Year Review				
CERCLIS #: 1, 2, 6, 7, 15, 33, 40, 47, 50, 58				
Issues and Recommendations Identified in the Five-Year Review				
OU(s): N/A	**Issue Category:** N/A			
	Issue: None			
	Recommendation: None			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
N/A	N/A	N/A	N/A	N/A

Five-Year Review Summary Form *(continued)*

PROTECTIVENESS STATEMENT(S)		
Operable Unit: Central Shops Burning/Rubble Pits (631-1G and 631-3G) (CSBRP) OU CERCLIS # 50	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the CSBRP OU is protective of human health and the environment.		
Operable Unit: D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) OU CERCLIS # 15	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the DBRP OU is protective of human health and the environment		
Operable Unit: F-Area Hazardous Waste Management Facility (HWMF) (904-41G, 904-42G, and 904-43G) OU CERCLIS #6	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the F-Area HWMF OU is protective of human health and the environment.		
Operable Unit: Ford Building Seepage Basin (904-91G) (FBSB) OU, CERCLIS #58	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the FBSB OU is protective of human health and the environment.		
Operable Unit: H-Area HWMF (904-44G, 904-45G, 904-46G, and 904-56G) OU, CERCLIS #7	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the H-Area HWMF OU is protective of human health and the environment.		
Operable Unit: K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) (KBRP/KRP) OU, CERCLIS #40	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the KBRP/RP is protective of human health and the environment.		
Operable Unit: M-Area HWMF (904-112G and 904-51G) OU, CERCLIS #1	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the M-Area HWMF OU is protective of human health and the environment.		

Five-Year Review Summary Form *(continued/end)*

PROTECTIVENESS STATEMENT(S)		
Operable Unit: Metallurgical Laboratory (Met Lab) HWMF (904-110G) OU, CERCLIS #2	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the Met Lab HWMF OU is protective of human health and the environment.		
Operable Unit: Mixed Waste Management Facility (643-28E) (MWMF) OU, CERCLIS #33	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the MWMF OU is protective of human health and the environment.		
Operable Unit: Savannah River Laboratory (SRL) Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) (SRLSB) OU, CERCLIS #47	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the SRLSB OU is protective of human health and the environment.		

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
ARRA	American Recovery and Reinvestment Act of 2009
bgs	below ground surface
BRA	Baseline Risk Assessment
CA	contamination area
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
Ci	Curies
cm	centimeter
CM	contaminant migration
cm/s	centimeter per second
CMCOC	contaminant migration constituent of concern
CMS/FS	Corrective Measures Study/Feasibility Study
COC	constituent of concern
CPT	cone penetrometer technology
CSBRP	Central Shops Burning/Rubble Pits
+D	plus daughter
DBRP	D-Area Burning/Rubble Pits (431-D and 431-1D)
DNAPL	dense non-aqueous phase liquid
dpm/mL	disintegrations per minute per milliliter
DUS	dynamic underground stripping
EAROD	Early Action Record of Decision
EC&ACP	Environmental Compliance and Area Completion Projects
ECO	ecological
ECODS	Early Construction and Operational Disposal Site
EMR	Effectiveness Monitoring Report
ESD	Explanation of Significant Differences
ELLT	Engineered Low-Level Trench
FBSB	Ford Building Seepage Basin (904-91G)
FFA	Federal Facility Agreement
FHWMF	F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G)
FIPSL	F-Area Inactive Process Sewer Line
FRR	final remediation report
FY	fiscal year
ft	foot or feet
ft^3	cubic feet

LIST OF ACRONYMS AND ABBREVIATIONS *(continued)*

ft^3/min	cubic feet per minute
gal	gallon or gallons
GMZ	Groundwater Mixing Zone
GMZA	Groundwater Mixing Zone Application
HAZWOPER	hazardous waste operations
HWMF	hazardous waste management facility
HHWMF	H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G and 904-56G)
HIPSL	H-Area Inactive Process Sewer Line
in	inch or inches
IROD	Interim Record of Decision
KBRP/KRP	K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)
kg	kilogram or kilograms
km	kilometer or kilometers
km^2	square kilometer or square kilometers
L	liter or liters
lbs	pounds
LLC	Limited Liability Company
LLRWDF	Low-level Radioactive Waste Disposal Facility
LUCIP	Land Use Controls Implementation Plan
LUC	land use control
m	Meter or meters
m^3	cubic meter or cubic meters
MASB	M-Area Settling Basin
Met Lab	Metallurgical Laboratory (904-110G)
mg/L	milligram per liter
MHWMF	M-Area Hazardous Waste Management Facility (904-51G and 904-112G)
MCL	maximum contaminant level
mi	mile or miles
mi^2	square mile or square miles
mrem	millirem
MWMF	Mixed Waste Management Facility (643-28E)
µg/kg	microgram per kilogram
µg/L	microgram per Liter
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
msl	mean sea level
MZ	mixing zone

LIST OF ACRONYMS AND ABBREVIATIONS *(continued)*

MZCL	mixing zone concentration limit
N/A	not applicable
NBN	no building number
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRDC	National Resources Defense Council
NTCR	non-time critical removal
O&M	operation and maintenance
OU	operable unit
PCE	tetrachloroethylene
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyl
ρCi/g	picoCuries per gram
ρCi/mL	picoCuries per milliliter
ρCi/L	picoCuries per liter
PCR	Post Construction Report
PRG	Preliminary Remediation Goal
PTSM	principal threat source material
RAO	remedial action objective
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	remedial goal
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
RSL	regional screening level
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRL	Savannah River Laboratory
SRLSB	Savannah River Laboratory Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SSHASP	site-specific health and safety plan
SVE	soil vapor extraction
SWP	southwest plume

LIST OF ACRONYMS AND ABBREVIATIONS *(continued/end)*

TCE	trichloroethylene
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WSRC	Washington Savannah River Company
WSRC	Westinghouse Savannah River Company
yd	yards
yd^3	cubic yards

SAVANNAH RIVER SITE SUMMARY

I. INTRODUCTION

Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), requires that remedial actions which result in any hazardous substances, pollutants, or contaminant remaining at the site be subject to a five-year remedy review. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) further provides that remedial actions which result in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every five years to ensure protection of human health and the environment. The purpose of five-year remedy reviews is to evaluate the implementation and performance of the selected remedy at an operable unit (OU) to determine if the remedy is protective of human health and the environment. The evaluation of the remedy and the determination of protectiveness should be based on and sufficiently supported by data and visual inspections. The methods, findings, and conclusions of remedy reviews are documented in Five-Year Remedy Review Reports. The reports also identify any issues found during the review and provides recommendations to address the issues.

The U.S. Department of Energy (USDOE) prepared this fifth five-year remedy review for Savannah River Site (SRS) OUs that selected engineered cover systems as the remedial action pursuant to CERCLA Section 121 and as amended by SARA and the NCP. During implementation of the five-year remedy review process at the SRS, the U.S. Environmental Protection Agency (USEPA), the South Carolina Department of Health and Environmental Control (SCDHEC), and the USDOE recognized that remedial action decision document(s) would be issued for multiple OUs. Rather than generate individual five-year remedy review reports for each OU, the USDOE and regulatory agencies determined that it would be more cost effective to conduct a remedy review for all applicable OUs on the same five-year cycle. The First Five-Year Remedy Review was issued in August 1997 (WSRC 1997)

and evaluated 23 remedy decision documents. The Second Five-Year Remedy Review was issued in February 2004 (WSRC 2003) and evaluated 30 remedy decision documents. Forty-five remedy decision documents were evaluated in the Third Five-Year Remedy Review issued in January 2009 (WSRC 2008). The Fourth Five-Year Remedy Review was issued in February 2014 (SRNS 2014) and evaluated 52 remedy decision documents.

The size of each report has grown considerably since 1997 due to the number of OU remedies evaluated, and the level of detail required for data reviews, site inspection reporting, and document formatting based on USEPA guidance. To allow for a more even distribution of resources, a recommendation was made by SRS in the Fourth Five-Year Remedy Review Report (SRNS 2014) that future reviews should be conducted in phases based on OU groupings with similar remedies. In addition to a reduction in the total volume for future remedy review reports, evaluating similar remedies in the same review period would support easier identification and resolution of similar issues and allow for more efficient implementation of similar initiatives. The USDOE, USEPA, and SCDHEC agreed to segregate the Fifth Five-Year Remedy Review Report into five OU groupings (grouped by remedy similarity) with a different group submitted annually on a five-year cycle. The SRS OUs are grouped by the following remedy types:

(1) Native Soil Covers and/or Land Use Controls (LUCs);
(2) Groundwater;
(3) Engineered Cover Systems;
(4) Geosynthetic or Stabilization/Solidification Cover Systems; and
(5) Operating Equipment.

The trigger date for submittal of the next five-year remedy review report to the regulatory agencies is based on the USEPA signature date of the previous report. The final signature for the last grouping of the Fifth Five-Year Remedy Review Report is due no later than January 21, 2019. Prior to implementing the five annual remedy review submittals, a transitional period is necessary to prevent exceeding the five year limit required between decision document reviews in order to remain in compliance with CERCLA and the NCP. Issuance dates for the Fifth Five-Year Remedy Review Report during the transitional

period will occur over a four-year period (2016 to 2019). The first five-year phased report for native soil covers and LUCs was issued in 2015 (SRNS 2015a). The second five-year phased report for groundwater remedial actions was issued in 2017 (SRNS 2015b). A more detailed discussion of the phased reviews and transition schedule are provided in Appendix A.

This report documents the Fifth Five-Year Remedy Review for the third grouping of OUs with engineered cover systems selected as the final remedy and includes a review of ten remedy decision documents for ten USEPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) units at the SRS. CERCLIS is a database maintained by the USEPA as part of the Superfund program that assigns a unique tracking number to hazardous waste sites considered for cleanup under CERCLA. Remedy decision documents may include more than one CERCLIS unit and/or SRS OU. For this remedy review, the ten CERCLIS units are equivalent to the ten remedy decision documents reviewed.

The SRS OUs evaluated in this document were grouped together because of similar remedies. Table 1 identifies the OU name, CERCLIS number, remedial action(s), and issuance date of the remedy decision document for each of the OUs reviewed in this document. The issuance date represents the date the public was notified that the signed remedy decision document was available. Figure 1 identifies the location of the SRS OUs evaluated in this document. The data evaluation and visual inspections for the SRS OUs with engineered cover systems were conducted from August 2016 through November 2016.

This report was prepared using the *Comprehensive Five-Year Review Guidance* (USEPA 2001) and is supplemented by the *Recommended Evaluation of Institutional Controls: Supplement to the "Comprehensive Five-Year Review Guidance"* (USEPA 2011a) and *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA 2012). The updated USEPA Five-Year Review Summary Form was

implemented (USEPA 2011b). This report summarizes common elements for the entire SRS. The ten remedy reviews are included as Appendix C through Appendix L.

II. SITE CHRONOLOGY

The National Resources Defense Council (NRDC) Consent Decree (Civil Action No. 1:85-2583-6) was an agreement between the NRDC and other interested parties, SCDHEC, and USDOE to amend Parts A and B of the Resource Conservation and Recovery Act (RCRA) Permit Application to include the Metallurgical Laboratory Basin (904-11G) and associated Carolina Bay, the Acid/Caustic Basin (904-74G, 904-75G, 904-78G, and 904-80G), and the Mixed Waste Management Facility (904-28G) to include closure, groundwater monitoring and post-closure activities. The Savannah River Laboratory Seepage Basins (904-53G, 904-54G, and 904-55G) and New TNX Basin (904-120G) were also included in the Consent Decree for closure in a RCRA-like manner. The Consent Decree was signed on May 26, 1988. On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established RCRA Facility Investigation program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 United States Code Section 9620, the USDOE has negotiated a Federal Facility Agreement (FFA) (FFA 1993) with the USEPA and the SCDHEC to coordinate remedial activities at SRS into one comprehensive program which fulfills these dual regulatory requirements. USDOE functions as the lead agency for remedial activities at SRS, with concurrence by the USEPA-Region 4 and the SCDHEC.

A chronology of site events including the effective dates for the Consent Decree, the FFA, and the NPL Listing is provided in Appendix A. Table 1 provides a chronology of the decision documents for the SRS OUs with engineered cover systems evaluated in this report. Chronologies of significant activities and regulatory milestones for individual OUs are included in the site specific remedy review reports (Appendix C through Appendix L).

III. BACKGROUND

The primary mission of SRS has been to produce tritium, plutonium, and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense program was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed of at SRS. Past disposal practices have resulted in soil and groundwater contamination.

Hazardous waste materials handled at SRS are managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities require SCDHEC operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from the SCDHEC, which was most recently renewed on February 11, 2014. Module VIII of the Hazardous and Solid Waste Amendments portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

Physical Characteristics

SRS occupies approximately 802.9 km^2 (310 mi^2) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 40 km (25 mi) southeast of Augusta, Georgia, and 32 km (20 mi) south of Aiken, South Carolina. Approximately 90 percent of SRS land consists of natural and managed forests. The locations at SRS where nuclear materials were produced, stored, and disposed are clustered into distinct industrial areas that are separated by large areas of forest. OUs are generally contained within or adjacent to these industrial areas.

SRS is located on the Atlantic Coastal Plain. Subsurface and groundwater contamination associated with OUs is located in unconsolidated sands and clays. The depth to the water table at SRS varies from just below the surface in wetlands and near streams to approximately 39 m (130 ft) below ground surface. Recharge to the aquifers underlying

the SRS is primarily through rainfall. Groundwater flows toward and discharges into site streams and the floodplain of the Savannah River.

Land and Resource Use

For nearly 40 years, USDOE and its predecessor agencies produced nuclear materials for the nation's defense programs at SRS. Today, the focus of the USDOE has shifted to environmental stewardship, clean energy initiatives, and national security.

The future land use for all of the OUs at SRS is anticipated to be industrial with the USDOE maintaining control of the land. According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of SRS land should be prohibited.

SRS manages its own drinking and process water supply from groundwater located beneath the SRS. SRS domestic and process water systems are supplied from a network of approximately 40 wells in widely scattered locations across the site, of which eight wells supply the primary drinking water system. Virtually all site process and drinking water is pumped from the deeper Crouch Branch and McQueen Branch aquifers. The SRS domestic water systems meet state and federal drinking water standards. There is no current or projected future use of surface water or shallow aquifer groundwater as a drinking water source at the SRS.

History of Contamination

During the early 1950s, SRS began to produce materials used in nuclear weapons, primarily tritium, plutonium-239, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases disposed of at SRS. Hazardous substances, as defined by the CERCLA, are currently present in the environment at SRS, with past disposal practices resulting in soil and groundwater contamination.

Initial Response

After SRS was placed on the NPL in 1989, the SRS Site Evaluation program was initiated to identify potential release sites present at SRS that would require investigation and potential remediation under CERCLA. Five hundred fifteen (515) potential release sites have been identified. The FFA includes a schedule for the investigation and remedial action (if needed) for each potential release site.

A core team process for sharing and interpreting information and working together to reach agreement on key remedial decisions among USDOE, USEPA, and SCDHEC was implemented at SRS in 2000. The core team process has made environmental cleanup at SRS efficient and has allowed remediation at many OUs to be accomplished on an accelerated schedule.

The collaborative efforts of the USDOE, USEPA, and SCDHEC support a consistent approach to site characterization, human health and ecological risk analyses, remedy selection, establishment of remedial goals and remedy implementation for individual OUs at SRS. Technical and administrative protocols have been established to promote the consistent implementation of USEPA guidance at OUs across SRS. An environmental database is used to track sampling, analysis, and results of environmental characterization and monitoring. An SRS Area Completion Strategy (WSRC 2006) was developed which allowed for the simultaneous characterization and cleanup of multiple OUs and potential sources of contamination in congested industrial areas.

During the period from April 2009 to September 2012, funds for accelerated environmental cleanup became available as part of the national economic stimulus package authorized by the American Recovery and Reinvestment Act of 2009 (ARRA). To take advantage of this additional funding, environmental cleanup under CERCLA was expedited by performing removal actions at a number of OUs using the administrative vehicle of Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis reports. Early action remedial decisions were also implemented under ARRA.

Table 1 provides a summary of the remedial actions implemented to date for the OUs with engineered cover systems evaluated in this report. Remedial actions include removal actions and remedial actions conducted prior to an interim or final Record of Decision (ROD).

Basis for Taking Action

The most prevalent soil contaminants at SRS are cesium-137 and organic chemicals (volatile or semivolatile). Other radionuclides, metals, polychlorinated biphenyls, and pesticides are present, but less common, at levels that exceed human health risk-based standards at a variety of units.

Based on the remedial investigations and technical evaluations, the OUs addressed in this remedy review were determined to contain hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. The specific contaminants and remedial actions for each OU are described in greater detail in the OU-specific appendices (Appendix C through Appendix L).

IV. REMEDIAL ACTIONS

Remedial actions may target source areas, soil, vadose zone, and/or groundwater. Remedial goals are defined for individual OUs, but in general, remedial action objectives (RAOs) at SRS are:

- Prevent exposure of trespassers, industrial workers, and hypothetical residents to soils or groundwater containing unacceptable levels of contaminants.
- Prevent exposure of ecological receptors to soils or groundwater containing unacceptable levels of contaminants.
- Prevent or minimize the migration of contaminants to groundwater at levels that exceed maximum contaminant levels (MCLs).
- Prevent or minimize the discharge of contaminated groundwater to surface water at levels that exceed MCLs.

As previously discussed, the Fifth Five-Year Remedy Review Report will be conducted in five phases based on the remedy type. A general description of the five remedy types is provided in Appendix A.

Systems Operation and Maintenance

A site-wide maintenance program is in place to care for cover systems, signs, monitoring wells, and other infrastructure associated with environmental remediation. Operation and maintenance (O&M) of cover systems consist of growing grass, mowing, managing surface stormwater drainage, inspections, and repair of erosion or subsidence as necessary. Identifying signs must remain legible.

The costs of the O&M activities for the individual OUs have been compiled as part of this five-year remedy review. As part of the process of selecting the most appropriate action for each OU, the cost of implementing each of the remedies was estimated and reported in the respective remedy decision documents. Table 2 compares the actual costs incurred at SRS OUs with engineered cover systems over the time period from fiscal year (FY) 2012 to FY2016 to the estimated costs from the remedy decision documents projected for the same time period. The review for the actual costs incurred (i.e., FY2012 to FY2016) is based on the time-period since the last review for these OUs was conducted in the Fourth Five-Year Remedy Review Report (SRNS 2014). Site-specific details concerning costs incurred are included for each OU in Appendix C through Appendix L.

V. PROGRESS SINCE LAST REVIEW

For the ten remedy reviews evaluated, the previous protectiveness statements from the Fourth Five-Year Remedy Review Report (SRNS 2014) concluded that the remedies for these OUs were protective.

Recommendations from the Fourth Five-Year Remedy Review Report that impact the OUs evaluated in this report that selected engineered covered systems are as follows:

- Five-year remedy reviews will be conducted in phases with OUs grouped by remedy types. This report presents the third phased review for OUs that selected engineered cover systems as the final remedy.

- SRS recommended monitoring of 1,4-dioxane for some OUs and reporting of the results in the OU-specific groundwater reports. For the K-Area Burning/Rubble Pit (131-K) (KBRP) and K-Area Rubble Pile (631-25G) (KRP) OU, wells were sampled during 4Q2013 and reported in the 2013 annual groundwater report. Based on the monitoring results, USEPA, SCDHEC, and USDOE determined that continued monitoring for 1,4-dioxane at the KBRP/KRP OU (Appendix H) was not needed.

VI. FIVE-YEAR REMEDY REVIEW PROCESS

USDOE has implemented the Fifth Five-Year Remedy Review for SRS OUs with Engineered Cover Systems. The review specifically evaluated remedies by comparing them to the OU-specific decision documents. The following actions were taken to perform the Fifth Five-Year Remedy Review for this category:

- Conducted a scoping meeting on August 30, 2016 with USDOE, USEPA, and SCDHEC to discuss the scope of the report and to establish the review and approval schedule for the report;

- Publication of an announcement on September 22, 2016 that the USDOE is conducting the Fifth Five-Year Remedy Review in phases;

- Reviewed appropriate data, documentation (i.e., including RODs, Early Action RODs, Interim RODs [IRODs], Explanation of Significant Differences), and Land Use Control Implementation Plan required field inspection checklists, etc. The specific data and document references used to review each remedy decision are listed in the OU-specific reports located in Appendix C through Appendix L;

- Confirmed protectiveness of the remedial actions through inspections and interviews. Cognizant personnel were interviewed as to the status and success of the current remedial systems. The results of the inspections and interviews are documented in the

Site Inspection Checklist included with the OU-specific reports located in Appendix C through Appendix L;

- Reviewed changes in standards and to-be-considered guidance that would call into question whether the prescribed remedy was meeting the newer standards or guidance. Any problems or discrepancies are reported in the Section VII (Technical Assessment), Section VIII (Issues), and Section IX (Recommendations and Follow-up Actions) of the OU-specific appendices; and
- Submitted an initial Fact Sheet for review with Revision 0 of the Fifth Five-Year Remedy Review Report for SRS OUs with Engineered Cover Systems.

USEPA and SCDHEC performed site inspections of OUs with engineered cover systems with issued RODs or IRODs on February 22, 23, and 28, 2017. The Revision 0 report was submitted on December 20, 2016. USDOE addressed comments received from USEPA and SCDHEC on the Revision 0 report and provided the Revision 1 report for USEPA and SCDHEC approval. After the USEPA and SCDHEC approve the report and USDOE, USEPA, and SCDHEC sign this report, a notice of its availability will be published in newspapers in Aiken, Columbia, Barnwell, and Allendale, South Carolina, and in Augusta, Georgia. Additionally, the availability of the report will be announced in *The Savannah River Site Environmental Bulletin*, which will be sent to the SRS mailing list. The report will be made available to the public at four information repositories. A briefing to the Citizens Advisory Board will be conducted prior to finalizing the report.

VII. TECHNICAL ASSESSMENT

The technical assessment of the environmental cleanup program at SRS in general and each of the OU-specific remedies evaluated in this report (Appendices C through L) is described by answers to the following three questions posed by the USEPA.

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs still valid?

- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Question A: Is the remedy functioning as intended by the decision documents?

SRS engineered cover remedies and related activities are functioning as intended as demonstrated below.

- Contaminated material has been excavated and consolidated or left in place under protective cover systems breaking the pathway for worker exposure and for the migration of contaminants to groundwater.
- The cover system maintenance program and LUCs have been effective in maintaining the integrity of the cover systems at SRS OUs. The inspection reports indicate no significant deficiencies.
- Thermal technologies have been successful at SRS in removing volatile organic compounds from subsurface zones characterized by very high concentrations and dense non-aqueous phase liquid. Dynamic Underground Stripping was successfully used at the M-Area Hazardous Waste Management Facility as discussed in Appendix I.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs still valid?

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid for all of the OUs included in this report. An evaluation of changes in chemical and radiological standards that were in place when the last five-year remedy review was initiated in 2012 to the standards applicable in 2016 was conducted to determine if there were any changes that would affect the protectiveness of the selected remedies. There were no changes in chemical and radiological specific standards that would affect the protectiveness of the remedies. There were no changes in action-specific or location-specific requirements that would impact any remedy. This evaluation is included in Appendix B and described in the OU-specific appendices.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information that could call into question the protectiveness of the selected remedies and no outstanding issues have been identified in this Fifth Five-Year Remedy Review. For all OUs, land use at SRS remains consistent with assumptions in the respective decision documents.

Technical Evaluation Summary

According to the data reviewed, the site inspections, and interviews, the remedies selected for the SRS OUs included in this report are functioning as intended by the decision documents. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid for all of the OUs included in this report. No new information has come to light that calls into question the protectiveness of the ten environmental remedies that implemented engineered cover systems.

VIII. ISSUES

Remedial actions evaluated in this Five-Year Remedy Review for SRS remain protective of human health and the environment and are functioning as intended. No issues were identified for the ten environmental remedies that implemented engineered cover systems.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

There are no recommendations or follow-up actions.

X. PROTECTIVENESS STATEMENT(S)

The protectiveness statements for each remedy are based on the recommended language from the *Comprehensive Five-Year Review Guidance* (USEPA 2001) and the supplemental guidance, *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA 2012).

For the OUs evaluated in this Five Year Remedy Review, the engineered cover system remedies have been determined to be protective of human health and the environment. LUCs are part of all remedial actions where hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unlimited use and unrestricted exposure. For the OUs evaluated in this report, pathways for contaminants to reach human and ecological receptors have been successfully broken by the selected remedies including LUCs.

A protectiveness statement for the OUs evaluated in this report is included in the OU-specific remedy review located in Appendix C through Appendix L. The protectiveness statements are also provided in the Five-Year Review Summary Form located in the Executive Summary.

XI. NEXT REVIEW

As established in Section 121 of CERCLA, as amended by the SARA and the NCP, periodic reviews are required at least every five years for sites where hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure following the completion of all remedial actions. Barring a change in the governing laws, another review should be completed within five years from the signature date of this document. The Fifth Five-Year Remedy Review will be conducted in five phases. The final signature date for the last grouping of the Fifth Five-Year Remedy Review Report is due no later than January 21, 2019.

XII. OU-SPECIFIC FIVE-YEAR REMEDY REVIEW REPORTS

The OU-specific Five-Year Remedy Reviews for the remedies evaluated in this document are included in Appendix C through Appendix L.

XIII. REFERENCES

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket Number 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2014. *Fourth Five-Year Remedy Review Report for the Savannah River Site (U) Aiken, South Carolina*, SRNS-RP-2012-00011, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2015a. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Native Soil Covers and/or Land Use Controls (U) Aiken, South Carolina*, SRNS-RP-2014-00902, Revision 1, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2015b. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Groundwater Remedies (U) Aiken, South Carolina*, SRNS-RP-2015-00609, Revision 1, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540-R-01-007, OSWER No. 9355.7-03B-P, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response

USEPA, 2011a. *Recommended Evaluation of Institutional Controls: Supplement to the "Comprehensive Five-Year Review Guidance"*, OSWER Directive 9355.7-18, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response

USEPA, 2011b. *Transmittal of the Updated Five-Year Review Summary Form*, OSWER Directive 9200.2-105, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response

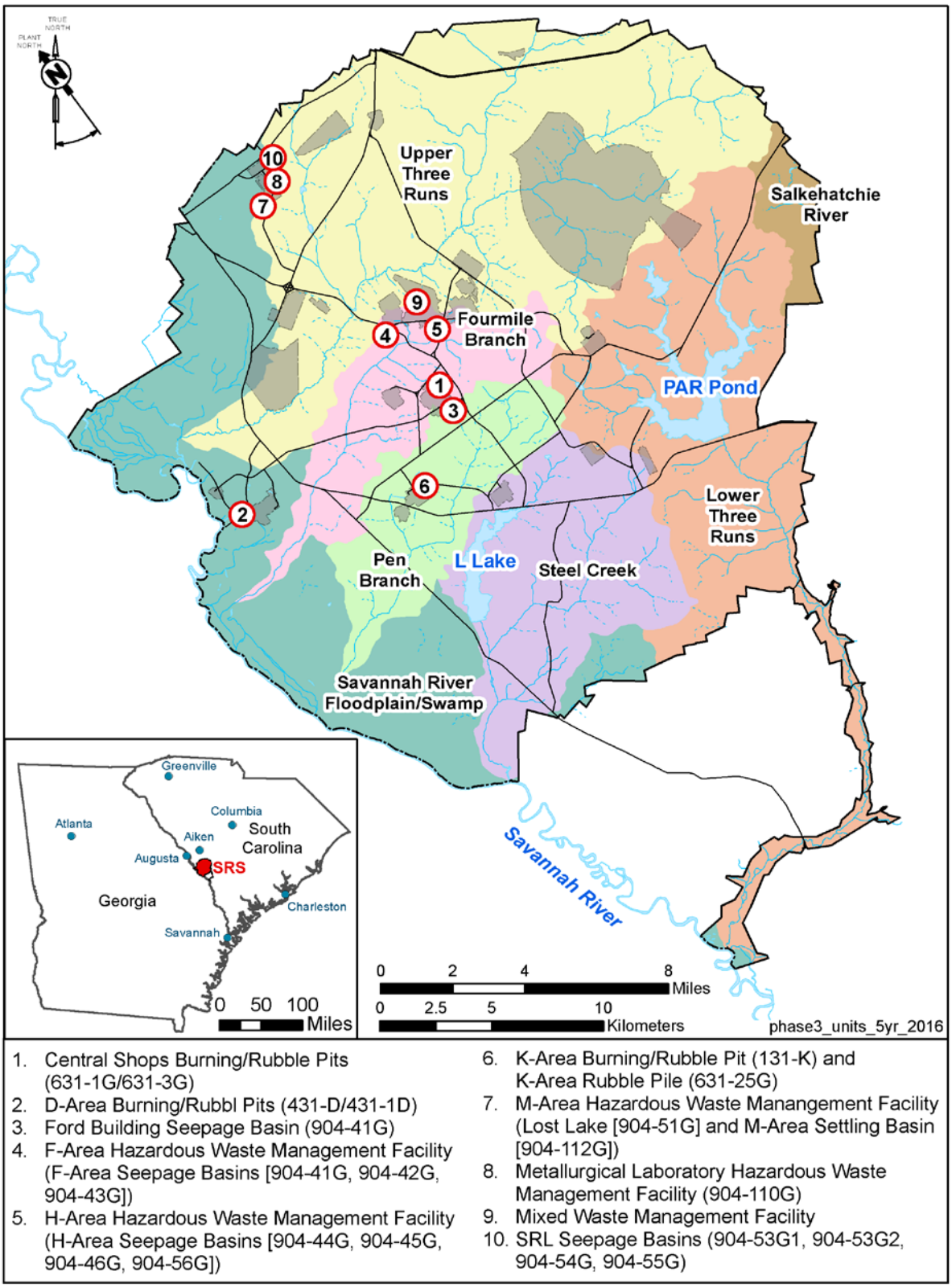
USEPA, 2012. *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews*, OSWER Directive 9200.2-111, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response

WSRC, 1997. *Five-Year Review of Records of Decision Report (U)*, WSRC-RP-97-403, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Second Five-Year Review Report for the Savannah River Site (U)*, WSRC-RP-2001-4163, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006. *Area Completion Strategy for the Savannah River Site (U)*, ERD-EN-2005-0084, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Third Five-Year Remedy Review Report for the Savannah River Site (U)*, WSRC-RP-2007-4063, Revision 1.1, Washington Savannah River Company, Savannah River Site, Aiken, SC



1. Central Shops Burning/Rubble Pits (631-1G/631-3G)
2. D-Area Burning/Rubbl Pits (431-D/431-1D)
3. Ford Building Seepage Basin (904-41G)
4. F-Area Hazardous Waste Management Facility (F-Area Seepage Basins [904-41G, 904-42G, 904-43G])
5. H-Area Hazardous Waste Management Facility (H-Area Seepage Basins [904-44G, 904-45G, 904-46G, 904-56G])
6. K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-25G)
7. M-Area Hazardous Waste Manangement Facility (Lost Lake [904-51G] and M-Area Settling Basin [904-112G])
8. Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)
9. Mixed Waste Management Facility
10. SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, 904-55G)

Figure 1. Location Map for SRS OUs with Engineered Cover Systems

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Table 1. SRS OUs with Engineered Cover Systems

#	Appendix	Operable Unit	CERCLIS No.	Remedy Decision Document	Decision Document Issuance Year	Remedial Action	Area Covered (acres)	LUCs (acres)
1	C	Central Shops Burning/Rubble Pits (631-1G/631-3G)	50	ROD	2003	Stormwater Management, LUCs	0.43	2.8
2	D	D-Area Burning/Rubble Pit (431-D/431-1D)	15	ROD	1997	LUCs	0.54	0.7
3	F	Ford Building Seepage Basin (904-91G)	58	ROD	2002	Excavation, Consolidation, Low Permeability Cover, LUCs	0.22	0.3
4	E	F-Area Hazardous Waste Management Facility (F-Area Seepage Basins [904-41G, 904-42G, 904-43G])	6	ROD	1993	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	7	10
5	G	H-Area Hazardous Waste Management Facility (H-Area Seepage Basins [904-44G, 904-45G, 904-46G, 904-56G])	7	ROD	1993	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	22	25
6	H	K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)	40	ROD	2001	Soil Cover, Groundwater Mixing Zone, LUCs	0.8	1.2
7	I	M-Area Hazardous Waste Management Facility (Lost Lake [904-51G] and M-Area Settling Basin [904-112G])	1	ROD	1992	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	2.4	4.5
8	J	Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)	2	ROD	1992	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	0.2	3.5
9	K	Mixed Waste Management Facility	33	ROD	1994	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	58	85
10	L	SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)	47	ROD	2000	Excavation, Offsite Disposal, LUCs	2.1	2.6

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Table 2. Operation and Maintenance Cost Comparison for SRS OUs with Engineered Cover Systems

Operable Unit	Main Remedy	Remedy Decision Document Year	FY2012-FY2016 O&M Estimated Cost	FY2012-FY2016 O&M Actual Cost	% of Estimate	Comments
Central Shops Burning/Rubble Pits (631-1G/631-3G)	Stormwater Management, LUCs	2003	$40,000	$97,204	243%	Actual costs are higher than estimated because estimated costs in the ROD were based on annual O&M activities. O&M activities were conducted semiannually through 2014 with monthly water level measurements.
D-Area Burning/Rubble Pit (431-D/431-1D)	LUCs	1997	$3,000	$55,635	1854%	Actual costs are higher than estimated because costs for annual inspections and cover system maintenance were not included in the ROD estimate.
Ford Building Seepage Basin (904-91G)	Excavation, Consolidation, Low Permeability Cover, LUCs	2002	$50,000	$30,397	61%	Actual costs are as expected.
F-Area Hazardous Waste Management Facility (F-Area Seepage Basins [904-41G, 904-42G, and 904-43G])	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1993	0	$128,317	N/A	No estimated costs were provided in the ROD for RCRA unit.
H-Area Hazardous Waste Management Facility (H-Area Seepage Basins [904-44G, 904-45G, 904-46G, and 904-56G])	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1993	0	$273,130	N/A	No estimated costs were provided in the ROD for RCRA unit.

Table 2. Operation and Maintenance Cost Comparison for SRS OUs with Engineered Cover Systems (continued/end)

Operable Unit	Main Remedy	Remedy Decision Document Year	FY2012-FY2016 O&M Estimated Cost	FY2012-FY2016 O&M Actual Cost	% of Estimate	Comments
K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)	Soil Cover, Groundwater Mixing Zone, LUCs	2001	$27,812	$90,770	326%	Actual costs are higher than expected because groundwater monitoring continued longer than expected.
M-Area Hazardous Waste Management Facility (Lost Lake [904-51G] and M-Area Settling Basin [904-112G])	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1992	0	$54,815	N/A	No estimated costs were provided in the ROD for RCRA unit.
Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1992	0	$46,905	N/A	Estimated costs for complete remedy were not provided in the ROD for RCRA unit.
Mixed Waste Management Facility	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1994	0	$1,179,875	N/A	No estimated costs were provided in the ROD for RCRA unit.
SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)	Excavation, Offsite Disposal, LUCs	2000	$25,000	$46,200	185%	Actual costs are higher than expected because annual O&M costs were not included in the ROD estimate.

FIFTH FIVE-YEAR REMEDY REVIEW REPORT PHASED REVIEWS

I. FIVE-YEAR REMEDY REVIEW PHASES

The size of the Savannah River Site (SRS) five-year remedy review reports has grown considerably since the first report was issued in 1997 with respect to the number of operable unit (OU) remedies evaluated and the level of detail required. For the Fifth Five-Year Remedy Review Report, the U.S. Department of Energy, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) agreed to segregate the OUs into five groupings based on remedy similarity with a different group submitted annually on a five-year cycle. This phased approach not only reduces the volume of future remedy reports, but is also more effective in identifying and resolving issues for similar remedies.

The SRS OUs are grouped by the following remedy types:

(1) Native Soil Covers and/or Land Use Controls (LUCs);
(2) Groundwater Remedies;
(3) Engineered Cover Systems;
(4) Geosynthetic or Stabilization/Solidification Cover Systems; and
(5) Operating Equipment.

The trigger date for submittal of the next five-year remedy review report to the regulatory agencies is based on the USEPA signature date of the previous report. The final signature for the last grouping of the Fifth Five-Year Remedy Review Report is due no later than January 21, 2019. Prior to implementing the five annual remedy review submittals, a transitional period is necessary to prevent exceeding the five year limit required between decision document reviews in order to remain in compliance with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan. Issuance dates for the Fifth Five-Year Remedy Review Report during the transitional period are scheduled to occur over a four-year period (2016 to 2019). Table A-1 provides an overview of the number of

years between remedy reviews for the five OU remedy groupings beginning with the transitional period between the fourth, fifth, and sixth reports until the five-year cycle is fully established between the sixth and seventh year reports.

A list of the SRS OUs with remedy decision documents grouped into one of the five phased reviews is provided in Table A-2. Table A-2 will be updated in future remedy review reports as additional remedy decision documents are approved. A general description of the five remedy types is provided below.

Phase 1: Native Soil Covers and/or LUCs

For purposes of the fifth five-year phased remedy review, SRS OUs with native soil covers and/or LUCs as the selected remedy are grouped under the Native Soil Covers and/or LUCs category.

Native soil covers are often implemented at SRS to protect against human and/or ecosystem exposure to waste or contaminated material left in place. Native soil covers are appropriate when water infiltration and leaching of contaminants to groundwater is not a concern. A typical soil cover is 0.30 m to 0.61 m (12 to 24 in) thick and is usually vegetated to minimize erosion. Native soil covers are usually low in cost and construction and materials are readily available from SRS local sources. Native soil covers may be combined with other remedial actions, but require LUCs as a component of the remedy. For these units, native soil covers were in place prior to selection of the remedial action. For this reason, only LUCs were required as the final remedial action for the nine OUs with existing soil covers discussed in the Native Soil Covers and/or LUCs report.

LUCs are maintained for all OUs where hazardous substances, pollutants, or contaminants remain on-site or have been left in place above levels that are acceptable for unlimited use and unrestricted exposure. LUCs may be implemented as a stand-alone remedy or combined with other remedial actions. LUCs involve institutional controls (i.e., administrative controls) and engineering controls and can include monitoring, maintenance, reporting, access restrictions, signage, fencing, and land use restrictions. In

older SRS remedy documents, the term "institutional controls" was often used in place of the broader LUC term.

Phase 2: Groundwater Remedies

For purposes of the fifth five-year phased remedy review, SRS OUs that have similar groundwater monitoring activities, primarily associated with Monitored Natural Attenuation (MNA) or a Mixing Zone (MZ) permit, are grouped in the Groundwater category.

SRS uses a graded approach to groundwater remediation. The selection of groundwater remediation technologies for a specific contamination area is based on the size, contaminant type, contaminant concentration, and configuration of the plume. These attributes are the result of the nature and mass of the source of contamination and the subsurface characteristics in the area of the plume. Many large plumes consist of several zones that are most efficiently addressed with separate complementary corrective action/remedial technologies. The highest concentrations of contaminants are found in the source zone. The most robust, high-mass-removal technologies are best suited for remediation of the source zone. In the primary plume zone, active remedies such as pump-and-treat may be necessary to remove contaminants and exert hydraulic control of the plume. In the dilute fringe zone, contaminants are generally low in concentration and can often be treated with passive techniques.

Enhanced-passive remedial systems are used extensively at SRS for groundwater remediation. These systems are low-energy-consumption, low-carbon-emission systems that are not completely passive. These "green" technologies leverage natural systems to protect and remediate groundwater. Many existing soil vapor extraction (SVE) systems have been converted from active vacuum extraction powered by fossil fuel to enhanced-passive systems powered by natural non-fossil-fuel energy sources. BaroBall™ and MicroBlower™ systems are two types of enhanced-passive SVE systems currently in operation at SRS. BaroBalls™ rely on natural fluctuations in barometric pressure to pump volatile organic compounds (VOCs) from the subsurface to the atmosphere at individual

SVE wells. SVE wells with MicroBlowers™ are designed to use solar power to generate a vacuum that exhausts VOC vapors from individual wells. Both MicroBlowers™ and BaroBalls™ are low-energy-consumption, low-carbon-emission devices that remove VOC contaminants from the subsurface.

MNA is a passive groundwater remedial action where the fringe and dilute areas of a plume degrade by natural biogeochemical or physical processes such as biodegradation, radioactive decay, dilution, and simple dispersion. MNA remedies must be accompanied by source control and a technical justification that conditions are favorable for natural attenuation. In addition, the groundwater plume should not be expanding significantly, and surface water standards cannot be exceeded at the groundwater discharge point. MNA remedy justifications are supported by groundwater modeling and a commitment to continued monitoring and reporting. When only the uppermost aquifer is impacted, SCDHEC may issue a MZ permit that is essentially a permit for an MNA remedy. SRS has a mixture of CERCLA Record of Decisions (RODs) that require MNA as the final action for groundwater under CERCLA, and RODs that require SCDHEC MZ permits to implement the MNA remedy.

Phase 3: Engineered Cover Systems

For purposes of the fifth five-year phased remedy review, SRS OUs that selected an engineered cover system or similar cover system as the remedy are grouped in the Engineered Cover Systems category.

The function of an engineered cover system is similar to native soil covers to protect against human and/or ecosystem exposure to waste or contaminated material left in place. Although engineered covers do not prevent infiltration, they can achieve very low permeabilities if well compacted. Compaction is important to reduce damage from differential settlement and is often used at SRS to remediate OUs that contain diverse waste material such as rubble pits/piles. Another objective of using engineered cover systems is to promote more effective surface drainage and to minimize runoff.

SRS OUs were placed in this grouping if the selected cover features exceeded those of a basic native soil cover. For example, an OU with a remedy that selected cover and/or fill material with a higher clay content in order to minimize infiltration or for drainage and slope contouring was included in this category even if the clay material did not have engineering compaction requirements.

Phase 4: Geosynthetic or Stabilization/Solidification Cover Systems

For purposes of the fifth five-year phased remedy review, SRS OUs that installed a geosynthetic or stabilization/solidification cover system are grouped in the Geosynthetic or Stabilization/Solidification Cover Systems category.

Many cover systems are designed to protect groundwater by minimizing the infiltration of rainwater through the contaminated material left in place. Geosynthetic cover systems are constructed at SRS OUs when there is a concern that contamination left in place may leach to groundwater above acceptable levels. A typical cross section of a geosynthetic cover system consists of a vegetative/soil protective layer, a geosynthetic drainage layer, an impermeable geosynthetic liner, and compacted common fill placed over the contaminated material. A specific hydraulic conductivity to reduce storm water infiltration, usually 1E-07 cm/s or less, is specified in the design. Low permeability covers are often paired with SVE units that remove VOCs from the subsurface soil beneath the OU to prevent migration of contaminants to groundwater.

In some cases, radioactively contaminated soils have been stabilized with in-situ grouting followed by installation of a low permeability cover (i.e., compacted clay, concrete, etc.) to deter migration of contaminants to the groundwater. Not only does a stabilization/ solidification technology stabilize waste left in place, the in-situ containment also provides another layer of protection to prevent intrusion and exposure to contaminated material.

Phase 5: Operating Equipment

For purposes of the fifth five-year phased remedy review, SRS OUs that have ongoing active remediation systems are grouped under the Operating Equipment category.

A range of active remediation systems are used at SRS. SVE systems are used to remove VOCs from vadose zone source areas before the contaminants can migrate to the water table. Air strippers are employed to remove VOC contaminants from the source zone while active recirculation well systems remove VOC contaminants from primary VOC plume. Pump and treat systems are used to remove contaminant mass and exert hydraulic control over contaminated groundwater plumes. Thermal technologies have been employed in several areas to mobilize dense non-aqueous phase liquid (DNAPL) VOCs in the vadose zone and groundwater. Dynamic Underground Stripping is a technology employed at SRS that utilizes steam injection to enhance removal from large DNAPL source zones. Electrical Resistance Heating has been used in smaller DNAPL source zones.

A more detailed discussion of active remediation systems will be provided during Phase 5 of the fifth five-year phased remedy review.

II. SRS OUS WITH REMEDIAL DECISIONS

The following tables are included for information only and provide a tracking for all SRS OUs with approved remedial decisions, including No Action sites [i.e., RODs, Early Actions RODs (EARODs), Interim RODs (IRODs), ROD Amendments, and Explanation of Significant Differences (ESDs)].

- Table A-3 chronologically lists all SRS issued decision documents. Document numbers are provided for reference;
- Table A-4 provides a summary of the no remedial actions selected in the decision documents; and
- Table A-5 provides the OU subunits with issued remedial decision documents and their associated Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) number.

Table A-1. Phased Five-Year Remedy Review Report Schedule

Fourth Five-Year Review		Fifth Five-Year Review		Sixth Five-Year Review		Seventh Five-Year Review	
Issuance Year	Years Between Reviews	Issuance Year	Years Between Reviews	Issuance Year	Years Between Reviews	Issuance Year	Remedy Type
2014	2	2016 [a]	4	2020	5	2025	Phase 1: Native Soil Covers and/or LUCs
2014	3	2017	4	2021	5	2026	Phase 2: Groundwater Remedies
2014	4	2018 [b]	4	2022	5	2027	Phase 3: Engineered Cover Systems
2014	4	2018	5	2023	5	2028	Phase 4: Geosynthetic or Stabilization/ Solidification Cover Systems
2014	5	2019	5	2024	5	2029	Phase 5: Operating Equipment

a The Fifth Five-Year Remedy Review Report for SRS OUs with Native Soil Covers and LUCs was issued ahead of schedule in November 2015.
b Indicates the issue year for this report: Fifth Five-Year Remedy Review Report for SRS OUs with Engineered Cover Systems

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Table A-2. Fifth Five-Year Remedy Review Report Phases for SRS OUs

Native Soil Covers and/or LUCs		Groundwater		Engineered Cover Systems		Geosynthetic or Stabilization/Solidification Cover Systems		Operating Equipment	
Submittal Date[a]	***Issuance Year***	***Submittal Date[a]***	***Issuance Year***	***Submittal Date[a]***	***Issuance Year***	***Submittal Date[a]***	***Issuance Year***	***Submittal Date[a]***	***Issuance Year***
2014	**2015**	**2015**	**2017**	**2016**	**2018**	**2016**	**2018**	**2017**	**2019**
C-Area Operable Unit[b]		C-Area Groundwater		Central Shops Burning/Rubble Pits (631-1G and 631-3G)		B-Area Operable Unit		A-Area Burning/Rubble Pits (731-A/731-1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A)	
C-, K-, and L-Reactor Complexes		Chemicals, Metals, and Pesticides Pit (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G)		D-Area Burning/Rubble Pits (431-D and 431-1D)		C-Area Reactor Seepage Basins (904-66G and 904-68G)		A/M Area Groundwater	
Early Construction and Operational Disposal Site (ECODs) L-1, N-2, P-2, and R-1A, -1B, -1C		D-Area Oil Seepage Basin (631-G)		F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G)		D-Area Expanded Operable Unit (Consisting of D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D])		A-Area Miscellaneous Rubble Pile (731-6A)	
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)		L-Area Burning/Rubble Pit (131-L)		Ford Building Seepage Basin (904-91G)		E-Area Low-Level Waste Facility (643-26E)		C-Area Burning/Rubble Pits (131-C)	
Gunsite 012		L-Area Southern Groundwater		H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G)		F-Area Retention Basin (281-3F)		D-Area Operable Unit	
Heavy Equipment Wash Basin (No Building Number [NBN])		R-Area Operable Unit		K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)		F-Area Tank Farm		F-Area Groundwater Operable Unit	
K-Area Bingham Pump Outage Pit (643-1G)		R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, and 904-104G) and 108-4R Overflow Basin		M-Area Hazardous Waste Management Facility (904-51G and 904-112G)		General Separations Area Consolidation Unit		H-Area Groundwater Operable Unit	
L-Area and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)				Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)		H-Area Tank Farm[d]		M-Area Inactive Process Sewer Lines (081-M)	

Table A-2. Fifth Five-Year Remedy Review Report Phases for SRS OUs (*continued/end*)

Native Soil Covers and/or LUCs		Groundwater		Engineered Cover Systems		Geosynthetic or Stabilization/Solidification Cover Systems		Operating Equipment	
Submittal Date[a]	***Issuance Year***	***Submittal Date[a]***	***Issuance Year***	***Submittal Date[a]***	***Issuance Year***	***Submittal Date[a]***	***Issuance Year***	***Submittal Date[a]***	***Issuance Year***
2014	**2015**	**2015**	**2017**	**2016**	**2018**	**2016**	**2018**	**2017**	**2019**
PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and Lower Three Runs Integrator Operable Unit (IOU) Tail Portion (Middle and Lower Subunits)				Mixed Waste Management Facility (643-28E)		K-Area Reactor Seepage Basin (904-65G)		M-Area Operable Unit	
R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3				SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)		L-Area Oil and Chemical Basin (904-83G)		P-Area Burning/Rubble Pit (131-P)	
Silverton Road Waste Unit (731-3A)						L-Area Reactor Seepage Basin (904-64G) and C-Area Reactor Seepage Basin (904-67G)		TNX Area Operable Unit	
Wetland Area at Dunbarton Bay in Support of Steel Creek IOU[c]						Old F-Area Seepage Basin (904-49G)			
						P-Area Operable Unit			
						P-Area Reactor Seepage Basin (904-61G, 904-62G, and 904-63G)			
						R-Area Burning/Rubble Pits (131-R) and 131-1R) and R-Area Rubble Pile (631-25G)			
						T-Area Operable Unit			

a Represents December submittal date of the Revision 0 document for each five-year remedy review report.

b C-Area Operable Unit EAROD was issued in September 2015. This OU is not included in the first phase of the fifth five-year remedy review (i.e., native soil covers and/or LUCs) because the decision document was issued during development of the report and a remedy review was premature.

c ROD was approved in 2014, but document has not been issued. This OU is not included in the first phase of the fifth five-year remedy review (i.e., native soil covers and/or LUCs) because the remedy has not been implemented.

d H-Area Tank Farm (Waste Tank 16) IROD was issued in August 2016. H-Area Tank Farm (Waste Tank 12) ESD to the IROD was issued in April 2017. A remedy evaluation in this report is premature.

Table A-3. Chronological Listing of SRS Issued Decision Documents

Document Title[a]	Document Number	Rev.	Issuance Date[b]
Consent Decree Signed			***May 26, 1988***
NPL Listing Effective Date			***December 21, 1989***
A/M Area Groundwater IROD (RCRA)	WSRC-RP-92-744	0	September 16, 1992
M-Area Hazardous Waste Management Facility (904-51G and 904-112G) IROD (RCRA)	**WSRC-RP-92-743**	**0**	**September 16, 1992**
Metallurgical Laboratory Hazardous Waste Management Facility (904-110G) IROD (RCRA)	**WSRC-RP-92-745**	**0**	**September 16, 1992**
Federal Facility Agreement Declared Effective			***August 16, 1993***
F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) ROD (RCRA)	**WSRC-RP-93-1042**	**1**	**October 1, 1993**
H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) ROD (RCRA)	**WSRC-RP-93-1043**	**1**	**October 1, 1993**
Mixed Waste Management Facility (643-28E) ROD (RCRA)[c]	**WSRC-RP-93-1511**	**1**	**September 23, 1994**
Tank 105-C Hazardous Waste Management Facility ROD (RCRA)[c]	WSRC-RP-94-106	1	September 23, 1994
TNX Groundwater Operable Unit IROD[c]	WSRC-TR-94-0375	1	November 16, 1994
PAR Pond (685-G) IROD[c]	WSRC-RP-93-1549	0	February 16, 1995
F-Area Groundwater Operable Unit IROD (RCRA)[c]	WSRC-RP-94-1162	1	April 13, 1995
H-Area Groundwater Operable Unit IROD (RCRA)[c]	WSRC-RP-94-1163	1	April 13, 1995
M-Area West Unit (631-21G) ROD[c]	WSRC-RP-95-626	0	September 29, 1995
Old Radioactive Waste Burial Ground (643-E) IROD	WRSC-RP-96-102	0	July 25, 1996
Burma Road Rubble Pit (231-4F) ROD	WSRC-RP-96-101	1	July 25, 1996
D-Area Burning/Rubble Pits (431-D and 431-1D) ROD	**WSRC-RP-96-867**	**1**	**July 3, 1997**
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) ROD	WSRC-RP-96-868	1	July 3, 1997
Grace Road Site (631-22G) ROD	WSRC-RP-96-160	1	July 3, 1997
Gunsite 113 Access Road Unit (631-24G) ROD	WSRC-RP-96-833	1	July 3, 1997
Gunsite 720 Rubble Pit Unit (631-16G) ROD	WSRC-RP-96-832	1	July 3, 1997
Silverton Road Waste Unit (713-3A) ROD	WSRC-RP-96-171	1	July 3, 1997
Central Shops Burning/Rubble Pit (631-6G) ROD	WSRC-RP-96-873	1	July 3, 1997
Old F-Area Seepage Basin (904-49G) ROD	WRSC-RP-96-872	1.1	July 3, 1997

Table A-3. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
First Five-Year Remedy Review	***WSRC-RP-97-403***	***0***	***August 27, 1997***
TNX Groundwater Operable Unit ESD	WSRC-RP-97-169	1	October 10, 1997
K-Area Bingham Pump Outage Pit (643-1G) ROD	WSRC-RP-97-178	1	June 11, 1998
C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, 189-P) ROD[c]	WSRC-RP-97-850	1	November 10, 1998
L-Area Oil and Chemical Basin and L-Area Acid/Caustic Basin (904-83G and 904-79G) ROD	WSRC-RP-97-143	1	November 10, 1998
716-A Motor Shops Seepage Basin (904-101G) ROD	WSRC-RP-97-840	0	November 16, 1998
Fire Department Hose Training Facility (904-113G) ROD	WSRC-RP-97-171	1	November 16, 1998
Old F-Area Seepage Basin (904-49G) ESD	WSRC-RP-98-4123	1	December 16, 1998
D-Area Oil Seepage Basin (631-G) ROD	WSRC-RP-97-402	1	May 7, 1999
C-Area Burning/Rubble Pit (131-C) IROD	WSRC-RP-98-4039	0	May 7, 1999
F-Area Retention Basin (281-3F) ROD	WSRC-RP-97-145	1.1	May 19, 1999
Ford Building Waste Site (643-11G) ROD	WSRC-RP-98-4066	1	October 13, 1999
Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) IROD	WSRC-RP-98-4192	1.1	January 19, 2000
SRL Seepage Basins (904-51G1, 904-52G2, 904-52G, and 904-55G) ROD	**WSRC-RP-97-848**	**1.1**	**April 26, 2000**
C-Reactor Seepage Basins (904-66G, 904-67G, and 904-68G) Plug-In ROD ESD	WSRC-RP-2000-4032	0	October 18, 2000
L & P Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G) ROD	WSRC-RP-98-4015	1	October 18, 2000
Burma Road Rubble Pit (231-4F) ESD[c]	WSRC-RP-98-4170	1	February 6, 2001
A-Area Burning/Rubble Pits (731-A/731-1A) and Rubble Pit (731-2A) IROD	WSRC-RP-2000-4001	1	February 9, 2001
Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/731-5A) IROD	WSRC-RP-98-4031	1.1	February 9, 2001
West of SRL "Georgia Fields" Site (631-19G) ROD	WSRC-RP-99-4164	0	February 22, 2001
F-Area Retention Basin (281-3F) ESD[c]	WSRC-RP-2000-4079	1	June 7, 2001
K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) ROD[c]	**WSRC-RP-97-862**	**1**	**August 20, 2001**
Old Radioactive Waste Burial Ground Old Solvent Tanks (650-01E - 22E) IROD	WSRC-RP-2000-4193	1	September 27, 2001
Ford Building Seepage Basin (904-91G) ROD	**WSRC-RP-2000-4156**	**1**	**April 5, 2002**

Table A-3. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-181G, 080-182G, 080-183G, and 080-190G) IROD Amendment	WSRC-RP-2000-4158	1.2	April 8, 2002
K-Area Reactor Seepage Basin ESD[c]	WSRC-RP-99-4200	1.1	September 16, 2002
General Separations Area Consolidation Unit ROD	WSRC-RP-2002-4002	0	October 25, 2002
Central Shops Sludge Lagoon (080-24G) ROD	WSRC-RP-2000-4189	1	November 15, 2002
C-Area Reactor Seepage Basin (904-67G) & L-Area Reactor Seepage Basin (904-64G) ROD Amendment	WSRC-RP-2002-4063	1	December 5, 2002
R-Area Acid/Caustic Basin (904-77G) ROD	WSRC-RP-2002-4015	1	February 10, 2003
L-Area Burning/Rubble Pit (131-L) & L-Area Rubble Pile (131-3L) & Gas Cylinder Disposal Facility (131-2L) ROD	WSRC-RP-98-4195	1.1	February 17, 2003
A-Area Burning/Rubble Pits (731-A/731-1A) and Rubble Pit (731-2A) ESD	WSRC-RP-2001-4281	1	March 10, 2003
R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3 ROD	WSRC-RP-2001-4129	1.1	April 28, 2003
TNX Area Groundwater Operable Unit ESD[c]	WSRC-RP-2001-00764	0	May 19, 2003
Central Shops Burning/Rubble Pits (631-1G and 631-3G) ROD	**WSRC-RP-2001-4265**	**1.1**	**June 30, 2003**
P-Area Burning/Rubble Pit (131-P) ROD	WSRC-RP-2000-4197	1	August 8, 2003
A-Area Miscellaneous Rubble Pile (731-6A) ROD	WSRC-RP-2001-4197	1.3	August 11, 2003
P-Area Reactor Seepage Basin (904-61G, 904-62G, and 904-63G) Plug-In ROD ESD	WSRC-RP-2002-4105	1.1	October 2, 2003
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-181G, 080-182G, 080-183G, and 080-190G) Second IROD Amendment	WSRC-RP-2001-4232	1.1	October 21, 2003
L-Area Hot Shop (717-G) ROD	WSRC-RP-2002-4025	1.1	November 3, 2003
Road A Chemical Basin (904-111G) ROD	WSRC-RP-2002-4153	0	November 3, 2003
Second Five-Year Remedy Review[c]	***WSRC-RP-2001-4163***	***1.1***	***February 12, 2004***
R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, and 904-104G) and 108-4R Overflow Basin ROD	WSRC-RP-2003-4093	1	March 18, 2004
TNX Burying Ground (643-G), New TNX Seepage Basin, Old TNX Seepage Basin and TNX Groundwater (082-G) ROD	WSRC-RP-2003-4017	1	April 7, 2004
SRL Oil Test Site (080-16G) ROD	WSRC-RP-2003-4164	1	September 20, 2004

Table A-3. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
R-Area Burning/Rubble Pits (131-R and 131-1R) and R-Area Rubble Pile (631-25G) ROD	WSRC-RP-2004-4004	1	September 28, 2004
C-Area Reactor Groundwater IROD	WSRC-RP-2004-4022	1	October 15, 2004
D-Area Expanded Operable Unit (Consisting of D-Area Ash Basin[488-D] and D-Area Rubble Pit [431-2D]) ROD	WSRC-RP-2004-4007	1	December 17, 2004
Old F-Area Seepage Basin (904-49G) ROD Amendment	WSRC-RP-2003-4136	1	December 17, 2004
Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) ROD	WSRC-RP-2003-4185	1.1	January 28, 2005
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-181G, 080-182G, 080-183G, and 080-190G) ROD	WSRC-RP-2004-4090	1	May 10, 2005
Silverton Road Waste Unit (731-3A) ESD	WSRC-RP-2004-4092	1.1	June 16, 2005
TNX Area Operable Unit ESD	WSRC-RP-2005-4030	1	November 7, 2005
Hydrofluoric Acid Spill (631-4G) ROD	WSRC-RP-2005-4000	0	December 28, 2005
T-Area Operable Unit ROD	WSRC-RP-2004-4070	1	January 4, 2006
K-Area Sludge Land Application Site (761-4G) and PAR Pond Sludge Land Application Site (761-5G) ROD	WSRC-RP-2005-4064	1	June 30, 2006
211-FB Pu-239 Release (081-F) ROD	WSRC-RP-2005-4090	1	September 18, 2006
M-Area Inactive Process Sewer Lines (081-M) ROD	WSRC-RP-2006-4001	1	April 26, 2007
L-Area Southern Groundwater ROD	WSRC-RP-2006-4052	1.1	May 9, 2007
A-Area Burning/Rubble Pits and Rubble Pit (731-A, 731-1A, and 731-2A) and the Miscellaneous Chemical Basin/ Metals Burning Pit (731-4A and 731-5A) ROD	WSRC-RP-2005-4095	1.1	August 2, 2007
C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) ROD	WSRC-RP-2007-4082	1	July 9, 2008
Third Five-Year Remedy Review	***WSRC-RP-2007-4063***	***1.1***	***January 28, 2009***
P-Area Operable Unit EAROD	WSRC-RP-2008-4037	1.1	January 29, 2009
M-Area Operable Unit ROD	WSRC-RP-2008-4030	1	February 5, 2009
M-Area Operable Unit ESD	SRNS-RP-2009-00406	1	July 9, 2009
P-Area Operable Unit EAROD ESD	SRNS-RP-2009-00704	1	October 27, 2009
C-, K-, L- and R-Reactor Complexes EAROD	SRNS-RP-2009-00707	1	December 8, 2009
E-Area Low Level Waster Facility (Slit Trench Disposal Units 1 and 2) IROD	SRNS-RP-2009-00538	1	January 22, 2010
Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, R-1A, R-1B, R-1C ROD	SRNS-RP-2009-00072	1	March 30, 2010

Table A-3. Chronological Listing of SRS Issued Decision Documents *(continued/end)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
E-Area Low Level Waste Facility (Slit Trench Disposal Units 3 through 5) ESD to the IROD	SRNS-RP-2009-01128	1	April 22, 2010
P-Area Operable Unit ROD	SRNS-RP-2009-01368	1	July 22, 2010
Gunsite 218 Rubble Pile ROD	SRNS-RP-2010-00051	1	October 22, 2010
R-Area Operable Unit ROD	SRNS-RP-2010-01062	1	April 20, 2011
L-Area Northern Groundwater ROD	SRNS-RP-2011-00134	1	June 20, 2011
Gunsite 012 (including ECODS G-3) ROD	SRNS-RP-2010-01232	1	June 27, 2011
D-Area Operable Unit EAROD	SRNS-RP-2010-00162	1.2	September 26, 2011
PAR Pond Unit: Lower Three Runs IOU Tail Portion (Middle and Lower Subunits) ESD	SRNS-RP-2012-00121	1	September 13, 2012
B-Area Operable Unit ROD	SRNS-RP-2012-00354	1	April 16, 2013
F-Area Tank Farm (Waste Tanks 17 and 20) IROD	SRR-CWDA-2013-00111	1	April 30, 2013
TNX Area Operable Unit Second ESD to the ROD	SRNS-RP-2012-00205	1	June 12, 2013
F-Area Tank Farm (Tanks 18 and 19) ESD to the IROD	SRR-CWDA-2013-00007	1.1	September 23, 2013
Fourth Five-Year Remedy Review	***SRNS-RP-2012-00011***	***1.1***	***February 4, 2014***
Wetland Area at Dunbarton Bay in Support of Steel Creek IOU ROD	SRNS-RP-2013-00730	1	April 21, 2014[d]
L-Area Southern Groundwater Operable Unit ESD to the ROD	SRNS-RP-2012-00736	1	September 10, 2014
F-Area Tank Farm (Tanks 5 and 6) ESD to the IROD	SRR-CWDA-2014-00008	1	September 11, 2014
C-Area Operable Unit EAROD	SRNS-RP-2014-00836	1	September 2, 2015
Fifth Five-Year Remedy Review for SRS OUs with Native Soil Covers and/or LUCs	***SRNS-RP-2014-00902***	***1***	***November 30, 2015***
H-Area Tank Farm (Waste Tank 16) IROD	SRR-CWDA-2015-00157	1	August 16, 2016
Fifth Five-Year Remedy Review for SRS OUs with Groundwater Remedies	***SRNS-RP-2015-00419***	***1***	***February 2, 2017***
H-Area Tank Farm (Waste Tank 12) ESD to the IROD	SRR-CWDA-2016-00107	1	April 20, 2017

a Shaded text identifies the SRS OUs evaluated in this report for the third phase of the fifth five-year remedy review (i.e., engineered cover systems).

b Unless otherwise noted, the Issuance Date represents the date that the public was notified that the Three-Party signed document was available.

c This is the last signature date instead of the Issuance Date.

d Redline Revision 1 ROD for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit was approved on April 11, 2014 by SCDHEC and April 21, 2014 by USEPA. Date shown is for the last approval date because the ROD has not been issued.

Table A-4. Summary of No Remedial Actions at SRS OUs

Operable Unit	Remedial Action
No Action/No Further Action	
211-FB Pu-239 Release (081-F)	No Action
716-A Motor Shops Seepage Basin (904-101G)	No Action
Burma Road Rubble Pit (231-4F)	No Action
Central Shops Burning/Rubble Pit (631-6G)	No Action
Central Shops Sludge Lagoon (080-24G)	No Action
C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P)	No Further Action
Fire Department Hose Training Facility (904-113G)	No Action
Ford Building Waste Site (643-11G)	No Further Action (Removal)
Grace Road Site (631-22G)	No Action
Gunsite 113 Access Road Unit (631-24G)	No Action
Gunsite 218 Rubble Pile (621-23G)	No Action
Gunsite 720 Rubble Pit Unit (631-16G)	No Action
Hydrofluoric Acid Spill (631-4G)	No Action
K-Area and PAR Pond Sludge Land Application Site (761-4G and 761-5G)	No Action
L-Area Hot Shop (717-G)	No Further Action
L-Area Northern Groundwater (NBN)	No Action
M-Area West Unit (631-21G)	No Action
R-Area Acid/Caustic Basin (904-77G)	No Action
Road A Chemical Basin (904-111G)	No Action
SRL Oil Test Site (080-16G)	No Action
West of SRL "Georgia Fields" Site (631-19G)	No Action
No Action/No Further Action OUs Associated with OUs Requiring Remedial Action	
108-4R Overflow Basin (108-4R)[1]	No Further Action
Central Shops Burning/Rubble Pit (631-5G)[2]	No Action
ECODS B-3 and B-5 (NBN)[3]	No Further Action
ECODS G-3 (Adjacent to Gunsite 012) (NBN)[4]	No Action
Gas Cylinder Disposal Facility (131-2L)[5]	No Action
L-Area Rubble Pile (131-3L)[5]	No Action
L-Area Acid/Caustic Basin (904-79G)[6]	No Action
Rubble Pile Across from Gunsite 012 (NBN)[4]	No Action
RCRA Units that are No Further Action under CERCLA	
H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G)	No Further Action (Low Permeability Cap)
Tank 105-C Hazardous Waste Management Facility (NBN)	No Further Action
F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G)	No Further Action (Low Permeability Cap, In Situ S/S)
Mixed Waste Management Facility (643-28E)	No Further Action (Low Permeability Cap)

1 – Included with R-Reactor Seepage Basins (904-103G, 904-104G, 904-57G, 904-58G, 904-59G, and 904-60G)
2 – Included with Heavy Equipment Wash Basin (NBN)
3 – Included with B-Area Operable Unit
4 – Included with Gunsite 012
5 – Included with L-Area Burning/Rubble Pit (131-L)
6 – Included with L-Area Oil and Chemical Basin (904-83G)

Table A-5. List of OU Subunits with Remedial Actions

#	OU Subunits[a,b]	CERCLIS #
1	A-Area Burning/Rubble Pit, 731-1A	28
	A-Area Burning/Rubble Pit, 731-A	
	A-Area Rubble Pit, 731-2A	
	Miscellaneous Chemical Basin, 731-4A	
	Metals Burning Pit, 731-5A	
2	A-Area Miscellaneous Rubble Pile, 731-6A	30
3	A/M Area Groundwater	36
4	B-Area Operable Unit	53
5	C-Area Burning/Rubble Pit, 131-C	31
	Old C-Area Burning/Rubble Pit, NBN	
6	C-Area Groundwater	82
7	C-Area Process Sewer Line as Abandoned, NBN	79
	C-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN	
	C-Reactor Discharge Canal, NBN	
	ECODS C-1 (Near C-Area Reactor Discharge Canal), NBN	
	Potential Release from C-Area Disassembly Basin, NBN	
	Potential Release from C-Area Reactor Cooling Water System, 186/190-C	
8	C-Area Reactor Seepage Basin, 904-66G	60
	C-Area Reactor Seepage Basin, 904-67G	
	C-Area Reactor Seepage Basin, 904-68G	
9	Central Shops Burning/Rubble Pit, 631-1G	50
	Central Shops Burning/Rubble Pit, 631-3G	
10	CMP Pit, 080-170G	24
	CMP Pit, 080-171G	
	CMP Pit, 080-180G	
	CMP Pit, 080-181G	
	CMP Pit, 080-182G	
	CMP Pit, 080-183G	
	CMP Pit, 080-190G	
11	C-, K-, L-Reactor Complexes	79, 90, 91
12	D-Area Burning/Rubble Pit, 431-D	15
	D-Area Burning/Rubble Pit, 431-1D	
13	D-Area Ash Basin, 488-D	67
	D-Area Rubble Pit, 431-2D	
14	D-Area Oil Seepage Basin, 631-G	27
15	D-Area Coal Pile Runoff Basin, 489-D	63
	D-Area Waste Oil Facility, 484-10D	
	D-Area Asbestos Pit, 080-20G	
	Combined Spills from 483-D and Associated Areas, NBN	
	D-Area Process Sewer Lines as Abandoned, NBN	
16	E-Area Low Level Waste Facility, 643-26E	86
17	ECODS L-1, NBN	22
	ECODS P-2, NBN	
	ECODS R-1A, -1B, -1C, NBN	
	ECODS N-2, NBN	

Table A-5. List of OU Subunits with Remedial Actions *(continued)*

#	OU Subunits[a,b]	CERCLIS #
18	F-Area Burning/Rubble Pit, 231-1F	14
	F-Area Burning/Rubble Pit, 231-2F	
	F-Area Burning/Rubble Pit, 231-F	
19	F-Area Groundwater	8
20	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-41G)	6
	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-42G)	
	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-43G)	
21	F-Area Retention Basin, 281-3F	23
22	F-Area Tank Farm, Waste Tanks 17 and 20	
	F-Area Tank Farm, Waste Tanks 18 and 19	
	F-Area Tank Farm, Waste Tanks 5 and 6	
23	Ford Building Seepage Basin, 904-91G	58
24	General Separations Area Consolidation Unit including Old Radioactive Waste Burial Ground, 643-E and Old Solvent Tanks (650-01E through 650-22E)	32
	Warner's Pond, 685-23G and Spill on 03/08/1978 of Unknown Seepage Basin Pipe Leak in H-Area Seepage Basin, NBN and Spill on 02/08/1978 of Unknown H-Area Process Sewer Line Cave-In, NBN	
	H-Area Retention Basin, 281-3H and Spill on 05/01/1956 of Unknown Amount of Retention Basin Pipe Leak, NBN	
	HP-52 Ponds, NBN	
25	H-Area Tank Farm, Waste Tank 12[c]	89
	H-Area Tank Farm, Waste Tank 16[c]	
26	Gunsite 012 Rubble Pile, NBN	78
	Rubble Pile across from Gunsite 012, NBN	
27	H-Area Groundwater	9
28	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-44G)	7
	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-45G)	
	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-46G)	
	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-56G)	
29	Heavy Equipment Wash Basin, NBN	25
30	K-Area Bingham Pump Outage Pit, 643-1G	20
31	K-Area Burning/Rubble Pit, 131-K	40
	K-Area Rubble Pile, 631-20G	
32	K-Area Reactor Seepage Basin, 904-65G	55
33	L-Area Bingham Pump Outage Pit, 643-2G	26
	L-Area Bingham Pump Outage Pit, 643-3G	
	P-Area Bingham Pump Outage Pit, 643-4G	39
34	L-Area Burning/Rubble Pit, 131-L	56
35	L-Area Oil Chemical Basin, 904-83G	17
36	L-Area Reactor Seepage Basin, 904-64G	65
37	L-Area Southern Groundwater, NBN	77
38	M-Area Hazardous Waste Management Facility: Lost Lake, 904-112G	1
	M-Area Hazardous Waste Management Facility: M-Area Settling Basin, 904-51G	
39	M-Area Settling Basin Inactive Process Sewers to Manhole 1, 081-M	19

Table A-5. List of OU Subunits with Remedial Actions *(continued)*

#	OU Subunits[a,b]	CERCLIS #
40	Inactive Clay Process Sewer Lines (Including Potential Release of TCT, TET, TCE, HNO_3, U, Heavy Metals from 321-M Abandoned Sewer Line), NBN	92
	Salvage Yard, 741-A	
	M-Area Underground Sump 321-M #001	
	M-Area Underground Sump 321-M #002	
	M-Area Test Pile Facility, 305-A	
41	Metallurgical Laboratory Hazardous Waste Management Facility, 904-110G	2
42	Mixed Waste Management Facility, 643-28E	33
43	Old F-Area Seepage Basin, 904-49G	16
44	PAR Pond (including the Pre-Cooler Ponds and Canals), 685-G	35
	PAR Pond: Lower Three Runs IOU Tail Portion (Middle and Lower Subunits)	
45	P-Area Burning/Rubble Pit, 131-P	59
46	P-Area Ash Basin (including Outfall P-007), 188-P	94
	Potential Release from P-Area Disassembly Basin, NBN	
	Potential Release from P-Area Reactor Cooling Water System, 186/190-P	
	P-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN	
	P-Area Process Sewer Lines as Abandoned, NBN and Spill on 3/15/79 of 5500 Gallons of Contaminated Water, NBN	
47	P-Area Reactor Seepage Basin, 904-61G	66
	P-Area Reactor Seepage Basin, 904-62G	
	P-Area Reactor Seepage Basin, 904-63G	
48	R-Area Bingham Pump Outage Pit, 643-10G	38
	R-Area Bingham Pump Outage Pit, 643-8G	
	R-Area Bingham Pump Outage Pit, 643-9G	
	R-Area Unknown Pit #1 (Runk-1), NBN	
	R-Area Unknown Pit #2 (Runk-2), NBN	
	R-Area Unknown Pit #3 (Runk-3), NBN	
49	R-Area Burning/Rubble Pit, 131-1R	43
	R-Area Burning/Rubble Pit, 131-R	
	R-Area Rubble Pit, 631-25G	
50	Area on the North Side of Building 105-R	95
	Laydown Area North of 105-R	
	R-Area Cooling Water Effluent Sump, 107-R	
	Potential Release of $NaOH/H_2SO_4$ from 183-2R, NBN	
	R-Area Ash Basin, 188-R	
	Potential Release from R-Area Disassembly Basin, NBN	
	R-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN	
	Release from the Decontamination of R-Reactor Disassembly Basin, NBN	
	Combined Spills North of Building 105-R, NBN	
	R-Area Process Sewer Lines as Abandoned, NBN	
	R-Area Reactor Building, 105-R	

Table A-5. List of OU Subunits with Remedial Actions *(continued/end)*

#	OU Subunits[a,b]	CERCLIS #
51	R-Area Reactor Seepage Basin, 904-103G	25
	R-Area Reactor Seepage Basin, 904-104G	
	R-Area Reactor Seepage Basin, 904-57G	
	R-Area Reactor Seepage Basin, 904-58G	
	R-Area Reactor Seepage Basin, 904-59G	
	R-Area Reactor Seepage Basin, 904-60G	
52	Silverton Road Waste Unit, 731-3A	13
53	SRL Seepage Basin, 904-53G1	47
	SRL Seepage Basin, 904-53G2	
	SRL Seepage Basin, 904-54G	
	SRL Seepage Basin, 904-55G	
54	Neutralization Sump, 678-T	96
	X-001 Outfall Drainage Ditch, NBN	
	TNX Outfall Delta, Lower Discharge Gully and Swamp, NBN	
	TNX-Area Process Sewer Lines and Tile Fields as Abandoned, NBN	
55	TNX Groundwater, 082G	21
	New TNX Seepage Basin, 901-102G	29
	Old TNX Seepage Basin, 904-76G	
	TNX Burying Ground, 643-5G (Including Spill on 1/12/53 of ½ Ton of Uranyl Nitrate, NBN)	
56	Wetland Area at Dunbarton Bay[d]	71

a OU subunits include RCRA/CERCLA units and RCRA regulated units. Deactivation & Decommissioning facilities are not represented.

b Shaded text identifies the SRS OUs evaluated in this report for the third phase of the fifth five-year review (i.e., engineered cover systems).

c H-Area Tank Farm (Waste Tank 16) IROD was issued in August 2016. H-Area Tank Farm (Waste Tank 12) ESD to the IROD was issued in April 2017. A remedy evaluation is premature .

d Redline Revision 1 ROD for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit was approved on April 11, 2014 by SCDHEC and April 21, 2014 by USEPA. The ROD has not been issued.

EVALUATION OF CHANGES IN STANDARDS AND TOXICITY

This appendix provides an evaluation of changes in standards and toxicity for chemical and radiological constituents since the last five-year remedy review was initiated in 2012 for the Savannah River Site (SRS) operable units (OUs) evaluated in this report. The purpose of the evaluation is to determine if there are any changes in standards or toxicity values that would call into question the protectiveness of the remedy. No protectiveness issues with respect to changes in standards and toxicity were identified in the previous five-year remedy review report (SRNS 2014).

An evaluation was performed for analytes that were identified as constituents of concern (COCs) for the OUs discussed in Appendix C through Appendix L. These OUs were grouped in the Engineered Cover Systems category and were designed to have a lower permeability and more effective surface drainage as compared to native soil covers. The Engineered Cover Systems category includes OUs that used common fill or clayey material and had some form of engineering controls (i.e., soil material requirements, soil compaction requirements, and/or storm water management systems).

The U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for Non Radiological Constituents (May 2016), USEPA Preliminary Remediation Goals (PRGs) for Radionuclides (November 2014), and USEPA Maximum Contaminant Levels (MCLs) for radiological and chemical constituents were evaluated in this review. These values are identified as 2016 RSLs, 2016 PRGs, and MCLs in Tables B-1 through B-4 and were compared to the values available in 2012 when the last five-year remedy review for these OUs was initiated. Standards and toxicity values for both the industrial worker and hypothetical residential receptor are provided for comparative purposes for most media.

The comparison tables do not make any distinction between COCs that were the primary drivers for the selected remedial action and other analytes that were simply addressed through the same remedy. Most importantly, the values presented in Tables B-1 through B-4 are not cleanup levels and should not be considered remedial goals unless otherwise noted in the OU-specific remedy reviews. Therefore, the information in Appendix B is not stand alone, but must be considered in

context with the information and selected remedy presented in the OU-specific reviews located in Appendix C through Appendix L.

Changes to a standard or toxicity factor is unique to each analyte and is often related to revisions in exposure assumptions, reference doses, cancer potency factors, and exposure pathways used to calculate the value. For the reasons explained in the previous paragraph, the impact that more stringent RSLs or PRGs have on protectiveness must be considered with respect to the OU-specific remedy. In most cases, a change in a standard or toxicity value is irrelevant because the analyte(s) may no longer be present or is (are) significantly reduced if the selected remedy also included excavation and offsite disposal. In addition, exposure to contaminants may be controlled by a cover system.

The evaluation for each remedy to determine if exposure assumptions, toxicity data, cleanup levels, and remedial action objectives are still valid is discussed in each OU-specific review located in Appendix C through Appendix L. The evaluations shown in Tables B-1 through B-4 confirm that there have been no significant changes in standards or toxicity factors that would affect the protectiveness of the remedies evaluated in this report.

DOCUMENTS REVIEWED

SRNS, 2014. *Fourth Five-Year Remedy Review Report for the Savannah River Site (U) Aiken, South Carolina*, SRNS-RP-2012-00011, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Table B-1. Comparison of Non-Radiological Standards in Soil Media

Analyte	2012 RSLs[a]		2016 RSLs[b]		CERCLIS Number(s)[c]
	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	
Aluminum	7.7E+04	9.9E+05	7.7E+04	1.1E+06	33
Arsenic	3.9E-01	1.6E+00	6.8E-01	3.0E+00	15, 40, 58
Barium	1.5E+04	1.9E+05	1.5E+04	2.2E+05	6, 7, 33
Beryllium	1.6E+02	2.0E+03	1.6E+02	2.3E+03	33
Cadmium	7.0E+01	8.0E+02	7.1E+01	9.8E+02	6, 7, 33
Chloroform	2.9E-01	1.5E+00	3.2E-01	1.4E+00	33
Chromium	2.9E-01	5.6E+00	3.0E-01	6.3E+00	15, 47
1,1-Dichloroethane	3.3E+00	1.7E+01	3.6E+00	1.6E+01	33
1,2-Dichloroethane	4.3E-01	2.2E+00	4.6E-01	2.0E+00	33
Dioxin (2,3,7,8-TCDD)	4.5E-06	1.8E-05	4.8 E-06	2.2E-05	15
Iron	5.5E+04	7.2E+05	5.5E+04	8.2E+05	33
Lead	4.0E+02	8.0E+02	4.0E+02	8.0E+02	33
Manganese	1.8E+03	2.3E+04	1.8E+03	2.6E+04	15, 33
Mercury	1.0E+01	4.3E+01	1.1E+01	4.6E+01	6, 47
Nickel	1.5E+03	2.0E+04	1.5E+03	2.2E+04	6, 7, 33
Phenol	1.8E+04	1.8E+05	1.9E+04	2.5E+05	33
Polychlorinated biphenyls (PCBs)					
~Aroclor 1254	2.2E-01	7.4E-01	2.4E-01	9.7E-01	58
~Aroclor 1260	2.2E-01	7.4E-01	2.4E-01	9.9E-01	15
Polyaromatic Hydrocarbons (PAHs)					
~Benzo[a]anthracene	1.5E-01	2.1E+00	1.6E-01	2.9E+00	40, 50
~Benzo[b]fluoranthene	1.5E-01	2.1E+00	1.6E-01	2.9E+00	40, 50
~Benzo[a]pyrene	1.5E-02	2.1E-01	1.6E-02	2.9E-01	15, 40, 50
~Benzo[k]fluoranthene	1.5E+00	2.1E+01	1.6E+00	2.9E+01	40
~Dibenzo[a,h]anthracene	1.5E-02	2.1E-01	1.6E-02	2.9E-01	40, 50
~Indeno[1,2,3-cd]pyrene	1.5E-01	2.1E+00	1.6E-01	2.9E+00	40, 50
Tetrachloroethylene (PCE)	2.2E+01	1.1E+02	2.4E+01	1.0E+02	6, 7, 33
Trichloroethylene (TCE)	9.1E-01	6.4E+00	9.4E-01	6.0E+00	6, 7, 33
Vinyl Chloride	6.0E-02	1.7E+00	5.9E-02	1.7E+00	33
Zinc	2.3E+04	3.1E+05	2.3E+04	3.5E+05	6, 7, 33

a USEPA Nonradiological RSLs, May 2012.
b USEPA Nonradiological RSLs, May 2016.
c OUs and corresponding CERCLIS number(s) are identified in Appendix A, Table A-5.

mg/kg = milligram per kilogram

Table B-2. Comparison of Radiological Standards in Soil Media

Analyte	2012 PRGs[a]		2016 PRGs[b]		CERCLIS Number(s)[c]
	Residential Soil (pCi/g)	Industrial Worker Soil (pCi/g)	Residential Soil (pCi/g)	Industrial Worker Soil (pCi/g)	
Actinium-228	6.79E+02	9.88E+02	7.35E+02	1.1E+03	47
Americium-241	1.89E+00	4.82E+E00	2.27E+00	4.7E+00	6, 7, 47
Carbon-14	2.79E+02	1.11E+03	3.17E+02	1.1E+03	33
Cesium-137(+D)	6.23E-02	1.03E-01	6.05E-02	9.1E-02	6, 7, 47, 58
Cobalt-60	3.90E-02	5.78E-02	3.30E-02	4.8E-02	6, 7, 47, 58
Curium-243	3.33E-01	5.75E-01	3.50E-01	5.4E-01	6, 7, 47
Curium -244	7.25E+00	3.41E+01	8.76E+00	3.3E+01	6, 7, 47
Curium -246	3.69E+00	1.69E+01	2.75E+00	6.1E+00	6, 7
Europium-154	4.80E-02	7.35E-02	4.73E-02	7.0E-02	58
Tritium (H-3)	9.34E-01	1.27E+00	2.37E-01	3.0E-01	6, 7, 33
Potassium-40	1.50E-01	2.65E-01	1.44E-01	2.2E-01	47
Lead-212	3.60E+03	5.33E+03	3.40E+03	5.0E+03	47
Neptunium-239	1.26E-01	2.25E-01	1.33E-01	2.0E-01	47
Plutonium-238	3.23E+00	1.44E+01	4.28E+00	1.4E+01	47
Plutonium-239	2.82E+00	1.25E+01	3.79E+00	1.2E+01	47
Radium-226(+D)	1.27E-02	2.23E-02	1.38E-02	2.1E-02	6, 7, 15
Radium-228(+D)	3.19E-02	4.84E-02	8.82E-02	1.3E-01	6, 7, 15, 47
Strontium-90(+D)	3.71E+00	8.91E+00	4.20E+00	9.0E+00	6, 7, 47
Technetium-99	9.61E+01	7.96E+02	1.13E+02	7.7E+02	6, 7
Thorium-228(+D)	1.54E-01	2.30E-01	2.80E+01[d]	1.1E+02[d]	47
Thorium-230	3.75E+00	1.80E+01	5.07E+00	1.8E+01	47
Thorium-232	3.33E+00	1.70E+01	4.67E+00	1.7E+01	47
Uranium-233	4.70E+00	2.55E+01	5.63E+00	2.5E+01	6, 7, 47
Uranium-234	4.92E+00	2.91E+01	5.83E+00	2.8E+01	6, 7, 33, 47
Uranium-235(+D)	1.94E-01	3.48E-01	1.94E-01	3.0E-01	33, 47
Uranium-238(+D)	7.25E-01	1.49E+00	7.98E-01	1.4E+00	6, 7, 33, 47

a USEPA Radiological PRGs, August 2010.
b USEPA Radiological PRGs, November 2014.
c OUs and corresponding CERCLIS number(s) are identified in Appendix A, Table A-5.
d PRG shown for Thorium-228 only. PRG for Thorium-228 plus daughters (+D) is not published in the November 2014 update.

mg/kg = milligram per kilogram
pCi/g = picoCuries per gram

Table B-3. Non-Radiological Standards in Groundwater Media (MCLs)

Analyte	2012 RSL[a] (µg/L)	2016 RSL[b] (µg/L)	MCL (µg/L)[c]	CERCLIS Number(s)[d]
Antimony	--	--	6	6, 7
Arsenic	--	--	10	6, 7
Barium	--	--	2,000	6, 7
Benzene	--	--	5	6, 7
Beryllium	--	--	4	6, 7
Cadmium	--	--	5	6, 7
Chromium	--	--	100	6
Cyanide	--	--	200	6, 7
Lead	--	--	15	6, 7
Mercury	--	--	2	6, 7
Nickel	3.0E+02	3.9E+02	--	6, 7
Nitrate	--	--	10,000	6, 7
Phenol	4.5E+03	5.8E+03	--	6, 7
Selenium	--	--	50	6, 7
Silver	7.1E+01	9.4E+01	--	6, 7
Tetrachloroethylene (PCE)	--	--	5	2, 6, 7, 40
Trichloroethylene (TCE)	--	--	5	2, 6, 7, 40
Trichlorofluoromethane	1.1E+03	5.2E+03	--	6, 7
Trihalomethanes (Total)	--	--	80	6, 7
Vanadium	7.8E+01	8.6E+01	--	6, 7
Zinc	4.7E+03	6.0E+03	--	6, 7

a USEPA Non-Radiological RSLs for tapwater, May 2012.
b USEPA Non-Radiological RSLs for tapwater, May 2016.
c Current MCL table is provided for reference only. Comparative analysis is not shown because MCLs have not changed since the previous five-year remedy review.
d OUs and corresponding CERCLIS number(s) are identified in Appendix A, Table A-5.

Table B-4. Radiological Standards in Groundwater Media (MCLs)

Analyte	MCL (pCi/L)[a]	CERCLIS Number(s)[b]
Amercium-241	15[c]	6, 7
Carbon-14	2,000[c]	6, 7
Cesium-137	200[d]	6, 7
Cobalt-60	100[d]	6, 7
Curium-242	15[c]	6, 7
Curium-243/244	15[c]	6, 7
Curium-246	15[c]	6, 7
Iodine-129	1[c]	6, 7
Plutonium-238	15[c]	6, 7
Plutonium-239/240	15[c]	6, 7
Radium-226	5[e]	6, 7
Radium-228	5[e]	6, 7
Radium total	5[e]	6, 7
Strontium-90	8[d]	6, 7
Technetium-99	900[c]	6, 7
Thorium-228	15[c]	6, 7
Thorium-230	15[c]	6, 7
Tritium	20,000[d]	6, 7
Uranium-233/234	10[f]	6, 7
Uranium-234	10[f]	6, 7
Uranium-235	0.5[f]	6, 7
Uranium-238	10[f]	6, 7

a USEPA Implementation Guidance for Radionuclides, March 2002. Comparative analysis is not shown for MCLs because standards have not changed since the previous five-year remedy review.
b OUs and corresponding CERCLIS number(s) are identified in Appendix A, Table A-5
c Gross alpha particle activity = 15 pCi/L
d Man-made beta/gamma emitters = 4 mrem/year dose
e Combined radium-226 and radium-228 = 5 pCi/L
f Uranium values based on MCL of 30 µg/L; derived using naturally occurring isotopes of uranium in secular equilibrium

CENTRAL SHOPS BURNING/RUBBLE PITS (631-1G AND 631-3G) OPERABLE UNIT

I. Introduction

This report is the third five-year review for Central Shops Burning/Rubble Pits (631-1G and 631-3G) (CSBRP) Operable Unit (OU). This review was conducted from August 2016 through November 2016. Contaminants have been left in place at the CSBRP OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the CSBRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table C-1 lists the chronology of site events for the CSBRP OU.

III. Background

The CSBRP OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with CSBRP OU include soil and groundwater beneath the OU.

The results of the remedial investigation contained in the *RCRA Facility Investigation (RFI)/Remedial Investigation (RI) with Baseline Risk Assessment (BRA) for CSBRP (631-1G and 631-3G) OU* (WSRC 2001) included an evaluation of the soil, surface water, and groundwater. Polyaromatic hydrocarbons (PAHs) were detected in pit subsurface soils (0.3-1.2 m [1-4 ft]) as a result of burning activities. However, the conclusion of the evaluation was that the CSBRP OU has not contributed to groundwater contamination adjacent to or beneath the CSBRP OU. No constituents of concern (COCs) were identified for any of the subunits of CSBRP OU, including soil, surface water, and groundwater. However, unacceptable exposure to future human receptors could occur if contaminated

subsurface soils are excavated and brought to the surface. Therefore, it was determined that perched/trapped water associated with existing drainage conditions required mitigation to reduce the uncertainty of future contaminant migration.

Physical Characteristics

The CSBRP OU is located in the central part of the SRS, approximately 10.5 km (6.5 mi) from the nearest site boundary. It is in the northern part of N Area (Central Shops). Figure C-1 shows the location of the CSBRP OU within SRS. Figure C-2 depicts the layout of the CSBRP OU. Prior to 1951, the CSBRP OU area was farmland in an area of moderate relief. The pits are located in cleared areas adjacent to wooded lands.

Initially, the CSBRP OU was composed of two inactive burning/rubble pits, Pit 631-1G and Pit 631-3G, located along the northern and western sides of the Active Burning Area (631-2G) (Figure C-2). However, trenching performed during characterization activities identified that Pit 631-3G was composed of two adjacent pits, which were subsequently named 631-3G and 631-3GA.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates CSBRP OU as being within an industrial area. The future land use for CSBRP OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

CSBRP OU was in operation from the 1950s to about 1985. In 1973, periodic burning of waste ceased and a layer of soil was placed over the ashes. Pit 631-1G received an estimated 884 m^3 (1,156 yd^3) of asbestos, empty paint cans, ash, paper, and glass. Pit 631-3G received an estimated 10,224 m^3 (13,372 yd^3) of debris consisting of asbestos, empty paint cans, fluorescent light fixtures, paper, cans, lumber, barrels, metal pipes, metal shavings, and electrical switch gear. Additional investigations within Pit 631-3G identified

abundant stainless steel metal shavings, sheet metal, burned wood, and one crushed 208-L (55-gal). Pit 631-3GA received an estimated 10,224 m^3 (13,372 yd^3) of debris consisting of unburned materials including metal, large concrete slabs, and transite. In addition, burned materials identified in the pit included sheet metal, stainless steel shavings, wire, glass and wood. Figures C-3 and C-4 present photographs of the CSBRP OU before remediation and in the current condition.

During disposal activities, water that collected in the pits was discharged to the adjacent drainage ditches. Drainage ditches and the flow paths of stormwater runoff have changed over time.

Initial Response

After disposal activities had been completed, the pits and ditches were covered with 1.05 to 3 m (3.5 to 10 ft) of native soil backfill as needed to create a mounded profile and the area was graded to enhance stormwater management.

Basis for Taking Action

The only COCs identified for CSBRP OU based on the RFI/RI/BRA investigation (WSRC 2001) were PAHs. PAHs were detected in pit subsurface soils (0.3-1.2 m [1-4 ft]) as a result of burning activities. According to the protocols for human health risk management for the future restricted (industrial) land use scenario, the presence of PAHs below 0.3 m (1 ft) depth in soils does not pose a human health risk to the industrial worker. However, unacceptable exposure to future human receptors could occur if contaminated subsurface soils are excavated and brought to the surface. No other COCs were determined for any subunit of the CSBRP OU, including groundwater, and there are no applicable or relevant and appropriate requirements associated with CSBRP OU. However, it was determined that continued accumulation of stormwater in contact with the buried materials was an unacceptable condition. Stormwater management needed to be improved to prevent stormwater from infiltrating and accumulating in the pits, which could potentially cause PAHs to migrate to the adjacent wetland (i.e., surface water) or the groundwater. PAHs tend to be immiscible in water. The list of specific PAHs is shown in Table C-2.

Section 7.1 of the Post Construction Report (PCR) requires water level measurements to be reported in the five-year remedy review report.

No remedial goals were established.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) for CSBRP (WSRC 2002), the remedial action objectives (RAOs) for this CSBRP OU are as follows:

- Maintain restricted (industrial) land use.

The selected remedy for the CSBRP OU was institutional controls (i.e. land use controls [LUCs]) with enhanced stormwater management improvements and water level monitoring in two wells. The improved stormwater management was needed to prevent stormwater from infiltrating and accumulating at the bottom of the pits and potentially migrating to the adjacent wetland or the groundwater.

Remedy Implementation

The selected final remedy for the CSBRP OU provides the greatest level of protection to human and ecological receptors. The remedy includes the following:

- Installation of two piezometers for monitoring the water level in Pit 631-3G to determine the effects of the drainage enhancement;
- Improvements to stormwater management, which include routing surface water flow away from the pits to minimize water infiltration into the pits and vegetative covers over the pits;
- Establishment of a maintenance program for the 0.17-hectare (0.43-acre) native soil cover; and

- Establishment of LUCs for 1.14 hectares (2.81 acres) consisting of general site access controls, groundwater use restrictions, the SRS Site Use / Site Clearance program, and deed restrictions and notifications.

System Operations/Operation and Maintenance

There are no system operation requirements. The following maintenance activities are ongoing:

- The water level in Pit 631-3G is measured monthly with piezometers (CSR 14PZ and CSR 17PZ) to determine if the pit surface area improvements are reducing the water level in the pit as designed. The water level measurements are listed in Figure C-5 and the evaluations are discussed in Section IV. Five-Year Review Process.
- Site inspections (semiannual through 2014; frequency reduced to annual thereafter [USDOE 2014]) and site maintenance.
- Site controls and land use restrictions via the SRS Site Use / Site Clearance Programs, which restrict invasive and permanent installation activities at the CSBRP OU.

Table C-3 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 2002). The estimated O&M cost for FY2012 to FY2016 was $40,000 for site inspections and maintenance and LUCs. The actual O&M cost for FY2012 to FY2016 is $97,204. The O&M costs during the last five years (i.e., FY2012 to FY2016) have been higher than estimated because the estimated costs in the ROD were based on annual O&M activities whereas inspections were semiannual through 2014.

V. Progress since Last Review

The previous protectiveness statement concluded that implementation of institutional controls at the CSBRP OU is expected to remain protective of human health and the environment. Institutional controls and enhanced stormwater management have been

implemented and are functioning properly. It is recommended that water level measurements continue to be taken at the two piezometers (CSR 14PZ and CSR 17PZ).

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Referenced;
- Reviewed the water level measurement data in piezometers CSR 14PZ and CSR 17PZ at Pit 361-3G (Figure C-5);
- Confirmed the implementation of the remedial action;
- Inspected the OU and documented the results on the Inspection Checklist provided in Attachment C-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

The improved stormwater management has been moderately effective in reducing the water level in the 631-3G pit. Reduction of water elevation in the 631-3G pit since the stormwater management improvements were made indicate that the improvements have been working as designed. Data from two piezometers (CSR 14PZ and CSR 17PZ) sampled at CSBRP OU are shown in Figure C-5. Piezometer CSR 14PZ results indicate that water elevation increased above the bottom of the basin (3 m [10 ft]) due to 31.2 cm (12.27 in) of rain that fell during June 2013, and 32.4 cm (12.74 in) of rain that fell in July 2013. This increase in rainfall caused the water level increase of perched water in Pit 631-3G. The increase in water levels was not of concern for the effectiveness of the remedy since the levels were temporary and PAHs are not miscible in water.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and Steve Willingham, O&M Staff Member, on September 20, 2016 at the O&M organization offices. No issues were identified for the CSBRP OU during these interviews.

The CSBRP OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel on December 8, 2016. No issues were identified during this inspection. A site inspection was conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC) personnel, accompanied by USDOE and SRNS personnel on February 23, 2017. No significant problems regarding this OU were identified during the inspection.

On August 20, 2014, the USDOE submitted a letter (USDOE 2014) to USEPA and SCDHEC to reduce inspection frequencies from semiannual to annual for CSBRP OU. USEPA and SCDHEC approved the request October 2, 2014 and September 17, 2014, respectively. The field inspection frequency for the CSBRP OU was changed from semiannual to annual in 2015. Scheduled inspections performed at the CSBRP OU from FY2012 to FY2016 identified the following issues: overgrown grass on surveying benchmarks, broken signage, downed trees, evidence of hog rooting, and active ant mounts. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended. Institutional controls (i.e., LUCs) have been effective in maintaining restricted (industrial) land use. Semiannual/annual site inspections and site maintenance have been effective in maintaining the integrity of the soil cover. Based on the site inspections, there is no indication of potential remedy failure that could place protectiveness at risk.

The Land Use Control Implementation Plan (LUCIP) for the CSBRP OU, located in Appendix F of the PCR, governs LUC implementation, maintenance, monitoring, reporting and enforcement of LUCs (WSRC 2005). All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of final remedy selection are still valid. There have been no changes in physical conditions of the CSBRP OU that would affect the protectiveness of the remedy.

The USEPA standards and toxicity values have been updated since the last five-year remedy review as shown in Appendix B. The changes to the values for COCs at the CSBRP OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

The LUCIP for CSBRP OU is located in Appendix F of the PCR (WSRC 2005). Per the CSBRP OU LUCIP, groundwater monitoring will continue until there is a declining water level for three consecutive years.

X. Protectiveness Statement(s)

The remedy at CSBRP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e. LUCs) to prevent exposure to or ingestion of contaminated soil media. All threats to contaminated soil at the CSBRP OU have been addressed through excavation of the buried waste and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the CSBRP OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program. Potential impacts to groundwater and wetlands (i.e. surface water) are controlled through improved stormwater management.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 2014. Letter, B. T. Hennessey (USDOE) to S. B. Fulmer (SCDHEC) and R. H. Pope (USEPA), *Request to Change the Inspection Frequency for Central Shops*

Burning/Rubble Pits (631-1G and 631-3G) and Ford Building Seepage Basin (904-19G) Operable Units, CERCLIS Numbers: 50 and 58, IACD-14-186, dated August 20, 2014, Department of Energy, Savannah River Operations Office, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2001. *RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment for the Central Shops Burning/Rubble Pits (631-1G and 631-3G) (U)*, WSRC-RP-98-4043, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Record of Decision Remedial Alternative Selection for the Central Shops Burning/Rubble Pits(CSBRP) (631-1G and 631-3G) Operable Unit (U)*, WSRC-RP-2001-4265, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005. *Post-Construction Report (PCR)/Corrective Measures Implementation Report (CMIR) /Final Remediation Report (FRR) for the Central Shops Burning/Rubble Pits (631-1G and 631-3G/3GA Operable Unit (U)*, WSRC-RP-2004-4014, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various – *Inspection Data Sheets - Field Inspection Checklist for Central Shops Burning Rubble Pits Operable Units 631-1G and 631-3G*, ER-IDS-019-031, Inspection Period 2012 through 2016 (semiannual through 2014; annually thereafter)

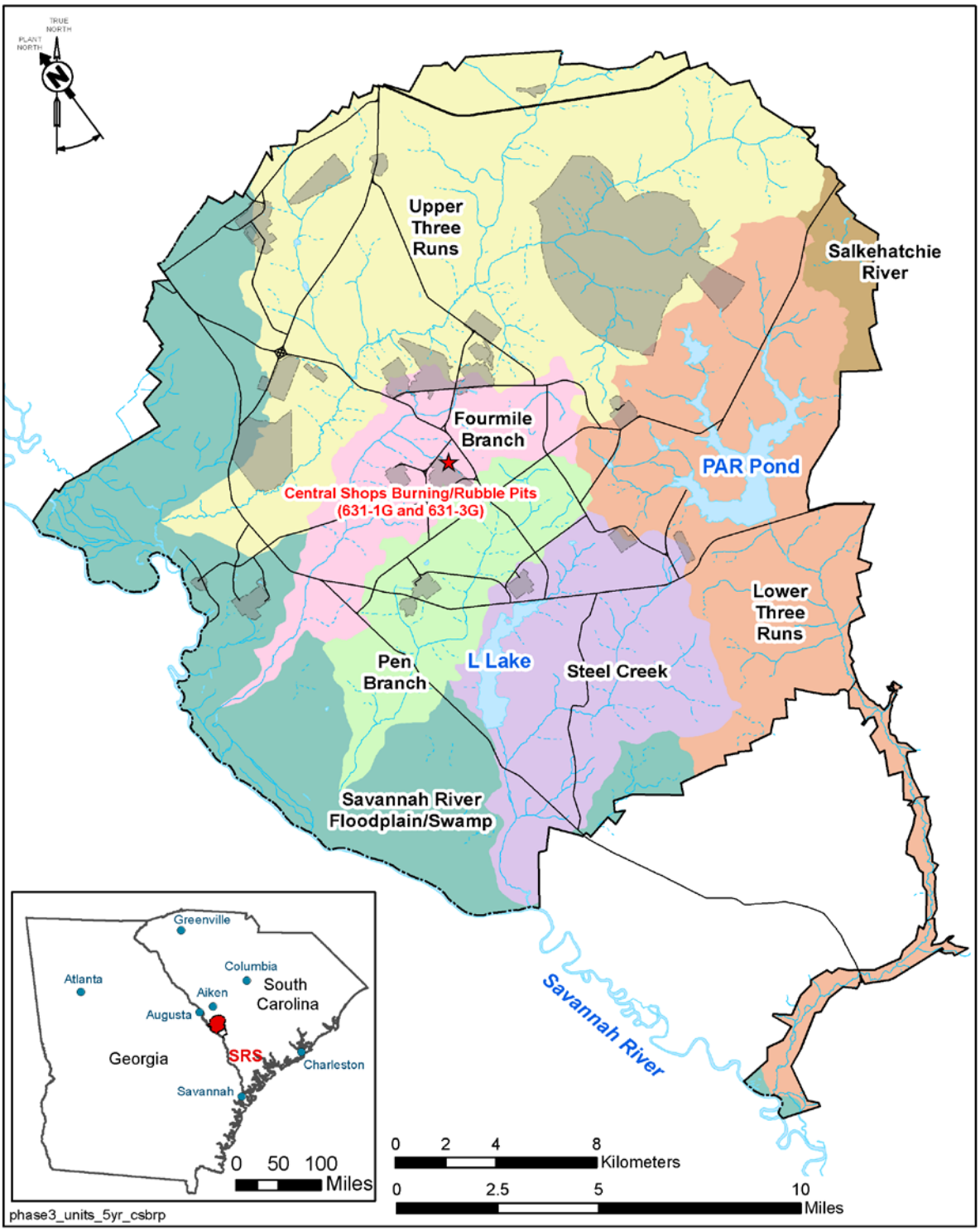

Figure C-1. Location of the CSBRP OU at SRS

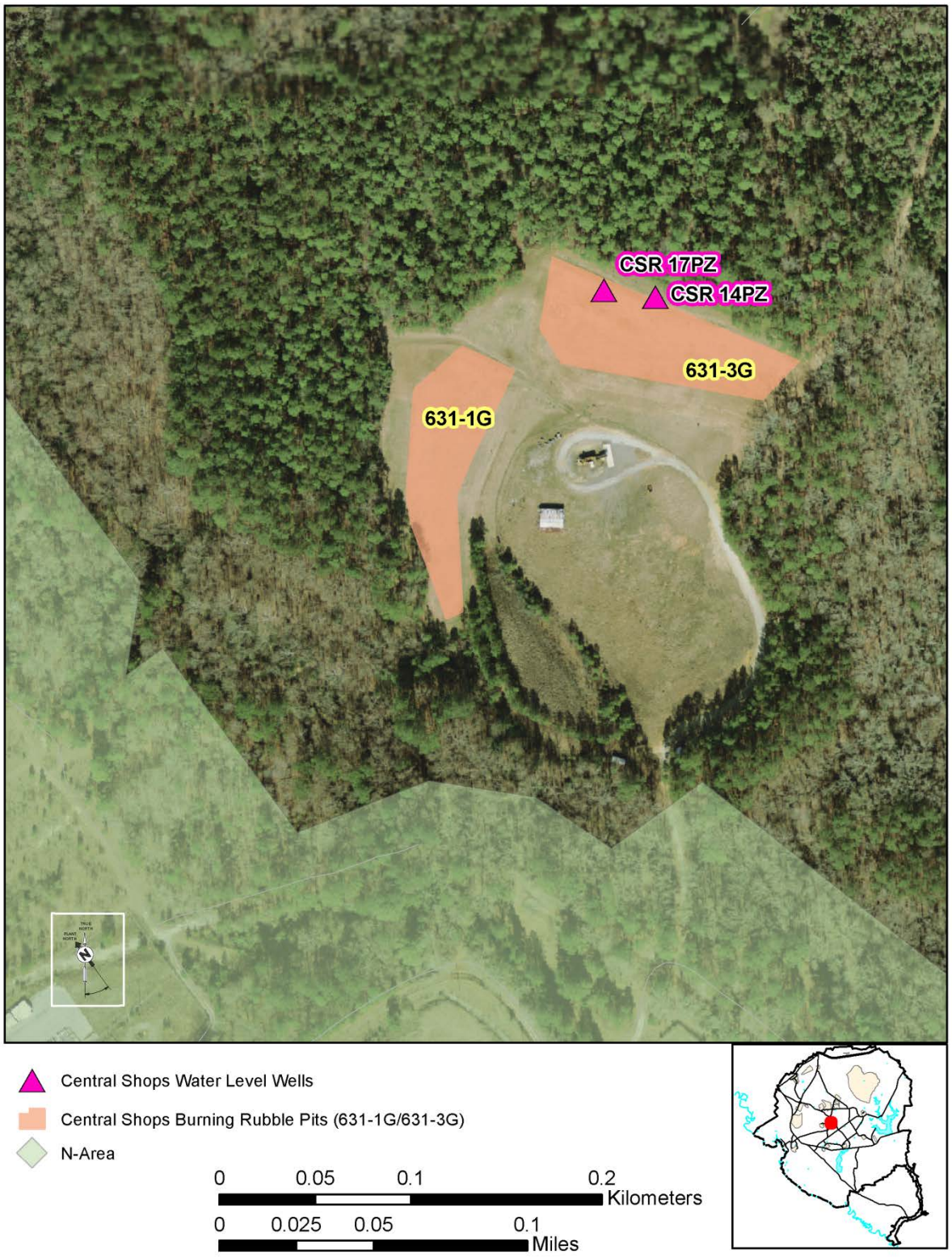

Figure C-2. Layout of the CSBRP OU

Figure C-3. Photo of CSBRP OU Before Remediation Activities (April 1985)

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Figure C-4. Current Photo of CSBRP OU (2016)

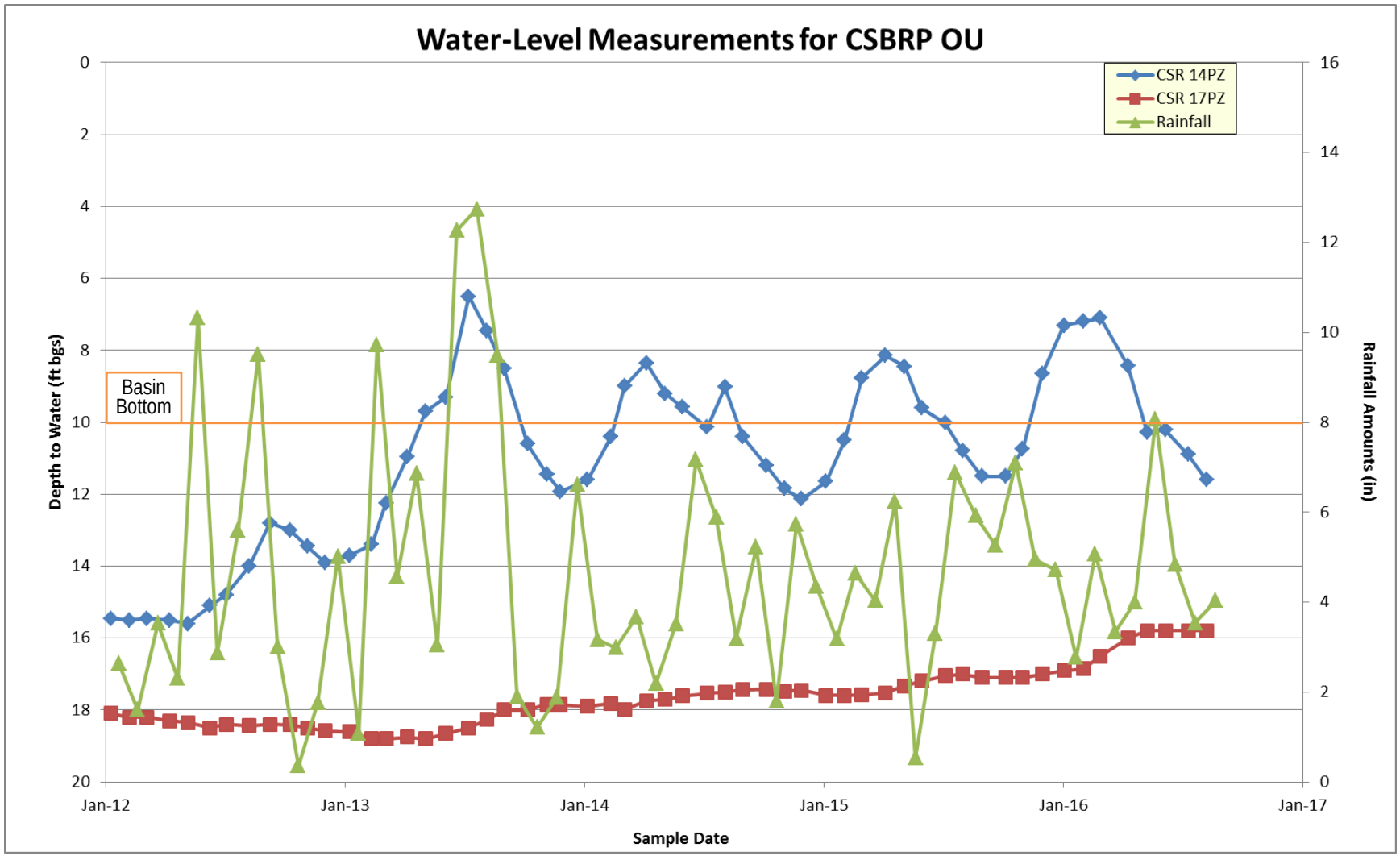

Figure C-5. Water Level Measurements from CSR 14PZ and CSR 17PZ (2011-2016)

Table C-1. Chronology of OU Events

Event	Date
RFI/RI Field Start/Complete	June 1996 / June 4, 2001
ROD Issuance	June 30, 2003
Remedial Action Start/Complete	November 17, 2003 / November 3, 2004
Previous Five-Year Reviews Issuance	January 29, 2009 / February 4, 2014

Table C-2. Constituents of Concern for Future Industrial Worker at CSBRP OU

Subunit	Medium	COC	Total Carcinogenic Risk
Pit 631-1G	0-4 ft Soil	Benzo[a]pyrene	2.1E-06
			Total Cumulative Risk = 2.1E-06
Pit 631-3G	0-4 ft Soil	Benzo[a]anthracene	3.0E-06
		Benzo[a]pyrene	1.8E-05
		Benzo[b]fluoranthene	3.8E-06
		Dibenzo[a,h]anthracene	8.9E-06
		Indeno[1,2,3-cd]pyrene	1.9E-06
			Total Cumulative Risk = 3.6E-05

Table C-3. Actual versus Estimated O&M Costs

	FY2012	FY2013	FY2014	FY2015	FY2016	5-Year Total
Total Actual O&M Costs ($)	20,893	23,585	19,039	9,639	24,048	97,204
Total ROD Estimated Direct O&M Costs* ($)	20,000	5,000	5,000	5,000	5,000	40,000

*Costs for preparation of the Fourth Five-Year Remedy Review were accounted for in FY2012.

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Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU

I. SITE INFORMATION			
Site Name:	**Central Shops Burning Rubble Pits (631-1G/631-3G) OU**	**Date of Inspection:**	**8/28/2016**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #50**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**84°F and sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☒ Other Stormwater Management Improvements
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Staff: Steve Willingham (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4145

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

4. Other Interviews *(Optional):* ☐ Report Attached _____

III. ONSITE DOCUMENTS & RECORDS VERIFIED ***(Click all that apply)***

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for Central Shops Burning Rubble Pits Operable Units 631-1G and 631-3G*, ER-IDS-019-031.

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Water elevation records only.

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From: (Date)	To: (Date)	(Total Cost)	
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons:

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: OU-specific perimeter fencing is not required by the remedial action.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdowns

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Candice Freeman (Name) IACD Project Manager (Title) 12/08/2016 (Date) 803-952-7085 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks: Inspections conducted from 2012 through 2016 identified overgrown grass growing on survey benchmarks, minor signage damage, evidence of hog rooting, and active ant mounds. All issues were resolved soon after discovery.

VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☐ Grass ☒ Cover properly established ☒ No signs of stress

Areal extent Depth

Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
C. Letdown Channels ☐ Applicable ☒ N/A (Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
D. Cover Penetrations ☒ Applicable ☐ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A Remarks:
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A Remarks:
3. Monitoring Wells: ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A Remarks:
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☒ N/A Remarks:
E. Gas Collection and Treatment ☐ Applicable ☒ N/A
F. Cover Drainage Layer ☐ Applicable ☒ N/A
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
H. Retaining Walls ☐ Applicable ☒ N/A

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Stormwater Management Improvements ☒ Applicable ☐ N/A

Stormwater management improvements included routing surface water flow away from the CSBRPs. The stormwater management improvements are performing as designed.

Attachment C-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is institutional controls (LUCs) in conjunction with improved stormwater management. The remedy is effective and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Implementation of the Institutional Controls alternative requires both short- and long- term actions, which are protective of human health and the environment. For the short-term, signs were posted at the OU, which indicated that this area was used for the disposal of waste material. In addition, existing SRS access controls are used to maintain this site for industrial use only.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

D-AREA BURNING/RUBBLE PITS (431-D AND 431-1D) OPERABLE UNIT

I. Introduction

This report is the fifth five-year review for the D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit (OU). The review was conducted from August 2016 through November 2016. Contaminants have been left in place at the DBRP OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the DBRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table D-1 lists the chronology of site events for the DBRP OU.

III. Background

The DBRP OU is a Resource Conservation Recovery Act (RCRA) / Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with this OU are soil and groundwater. However, groundwater monitoring was terminated in 2004.

Physical Characteristics

The DBRP OU is located in the western part of the SRS in Barnwell County, approximately 900 m (3,000 ft) east of the Savannah River in D Area (Figure D-1). The topography of the unit is flat with a surface elevation of 39 m (130 ft) above mean sea level (msl) and 13.5 m (45 ft) above the Savannah River. The water table is approximately 3 m (10 ft) below ground surface in the area of the unit. Surface drainage is to the west-southwest toward a nearby ephemeral tributary of the Savannah River. Figure D-2 depicts the layout of the DBRP OU.

The OU consists of two contiguous waste pits designated as 431-D and 431-1D, which covers a total area of 0.22 hectares (0.54 acre). The two pits are separated by a 45-m (150-

ft) wide berm of undisturbed soil. The pits have been backfilled with soil, and vegetation has been established on the resulting surface. The pit cover is raised above the surrounding terrain to enhance drainage.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the DBRP OU as being within an industrial area. The future land use for the DBRP OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

Between 1951 and 1973, burning pits were used at SRS to burn various hazardous and non-hazardous wastes. The chemical composition and volumes of the disposed wastes are unknown. Combustible materials (paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents) were burned monthly and no known or suspected radioactive materials were allowed in the burning pits. In October 1973, burning of the waste at the DBRP was discontinued. A layer of soil was placed over the residue in the pits and afterwards the pits were used as rubble pits. Figures D-3 and D-4 present photographs of the DBRP OU before remediation and in the current condition.

Initial Response

In 1983, a 0.3- to 0.9-m (1- to 3-ft) layer of clayey soil was placed over the DBRP contents, and the surface was compacted and mounded above the surrounding terrain. The cover material was placed at a time preceding the preparation of the formal CERCLA investigation and documentation. Vegetation was established to reduce erosion. Five monitoring wells were installed in 1983, 1984, and 1993.

Basis for Taking Action

Soils and groundwater were investigated in two phases of sampling between 1989 and 1993. A RCRA Facility Investigation (RFI) / Remedial Investigation (RI) Report (WSRC 1995b) and Baseline Risk Assessment (BRA) (WSRC 1995a) were completed in 1995. The soils analytical data indicate that little or no contamination of soil has occurred outside of the OU. The analytical data from the 1993 soil samples identified the following constituents of concern (COCs): arsenic, benzo(a)pyrene, chromium, manganese, octachlorodibenzo-p-dioxin, Aroclor-1260 (polychlorinated biphenyl [PCB]), and total alpha-emitting radium. Aroclor-1260 is the primary risk driver, contributing to a carcinogenic risk of 1.0E-05 to a future resident for ingestion of soil. The maximum concentration of 3.39 mg/kg is also greater than the toxic substance control value of 1 mg/kg established for PCBs in high occupancy areas. The RFI/RI (WSRC 199b) and BRA (WSRC 1995a) indicated the DBRP OU posed minimal risk to the environment. The risk to future on-unit workers is 1.0E-6. Ingestion of soil in the top two-foot layer by future residents poses a risk of 1.0E-5, primarily from Aroclor-1260.

The groundwater monitoring data indicated that no significant release of hazardous substances to groundwater from the DBRP OU has occurred. Comparison of constituent concentrations from 1984 through 1992 in the four downgradient monitoring wells (identified as DBP wells) indicated little or no constituent concentration increase in groundwater after flowing beneath the DBRP. Arsenic was only detected twice in the DBP monitoring network; the higher value in the December 1993 sample was reported as 0.044 mg/L. The following quarter when the well was re-sampled, arsenic was reported below the detection limit of 0.002 mg/L (WSRC 1997).

Per the Record of Decision (ROD) (WSRC 1997) the risk and hazards associated with the DBRP are summarized below and are the basis for taking action at the DBRP OU:

- Current Land Use – The human health risks are associated with ingestion or inhalation of soils inside the DBRP and ingestion of sediments resulting in a carcinogenic risk.

- Future Land Use – Arsenic and manganese are identified as posing a non-carcinogenic hazard to future resident adults and children and future on-unit workers through groundwater ingestion and inhalation pathways. Arsenic is identified as posing a carcinogenic risk to future on-unit workers and future on-unit residents through the groundwater ingestion pathway. In addition, polyaromatic hydrocarbons and 1,2-dichloroethane are identified as posing a carcinogenic risk to the future on-unit worker through the groundwater ingestion pathway. It should be noted that the arsenic risk was based on a single measured arsenic value in the groundwater that was less than the maximum contaminant levels (MCL) for drinking water.

- No ecological risks were identified for the DBRP OU.

None of the risks associated with the soil in the DBRP was found to be greater than 1.0E-04. Aroclor-1260 from the 0-0.6 m (0-2 ft) soil interval in Pit 431-D was the predominant risk driver for future residents contributing 79% of the 1.0E-05 risk. The Hazard Index for this exposure scenario was 0.7. The to-be-considered guidance for PCBs is a recommended soil action level of 1.0 mg/kg for residential use and 10-25 mg/kg for industrial use. The Aroclor 1260 concentration in Pit 431-D is well below the range for industrial land use (WSRC 1997).

The Final Remediation Report (FRR) (WSRC 1998) required full evaluation of all groundwater monitoring data in the five-year remedy review reports. The approved addendum to the FRR (WSRC 2006) terminated groundwater monitoring, but continued land use controls (LUCs) and five-year reviews for the DBRP OU.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 1997), the remedial action objective (RAOs) for the DBRP OU is as follows:

- Prevent hypothetical future industrial workers from exposure to PCBs in surface and subsurface soils at concentrations that exceed target risk levels. In Pit 431-D, the PCB

recommended soil action levels are 1.0 mg/kg for residential use, and 10-25 mg/kg for industrial use.

- No RAOs were identified for groundwater, but SRS was to verify that no significant groundwater contamination is originating from the DBRP OU and that no remedial action for groundwater is required.

As stated in the ROD, the selected remedial action is as follows:

- Institutional controls (i.e., LUCs) and no remedial action for the groundwater with a period of continued groundwater monitoring.

However, as stated in Section III, the approved addendum to the FRR (WSRC 2006) terminated groundwater monitoring.

Remedy Implementation

- The selected remedial action of institutional controls (i.e., LUCs) was implemented to meet the RAOs. The LUCs for the DBRP OU include the following:

- Warning signs will be posted in the near term indicating that this area was used to manage hazardous materials;

- Existing SRS access controls will be used to maintain the use of this site for industrial use only;

- Institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements; and

- In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner in compliance with Section 120(h) of CERCLA that includes notification disclosing former DBRP OU waste management and disposal activities, results from groundwater monitoring, and

remedial actions taken on the site. The deed would also include deed restrictions precluding residential use of the property.

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Annual site inspections and maintenance (repair of erosion damage, cover maintenance, and warning signs) to maintain this site for industrial use only.

The confirmatory groundwater program was discontinued in 2004 after all sampling data collected showed that none of the COCs in groundwater were detected above MCLs via approval of the Addendum to the FRR (WSRC 2006). Groundwater samples were collected annually from five monitoring wells during the second quarter of each calendar year in accordance with the FRR (WSRC 1998) from 1998 to 2003.

Table D-2 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 1997). The estimated O&M cost for FY2012 to FY2016 is $3000 for five-year remedy reviews. The actual O&M cost for FY2012 to FY2016 is $55,635 for annual site inspections and maintenance. The O&M costs during the last five years (i.e., FY2012 to FY2016) have been higher than estimated because annual costs inspections and cover system maintenance were not included in the ROD estimate.

V. Progress since Last Review

The previous protectiveness statement concluded that because the remedial actions at DBRP OU are protective, the site is protective of human health and the environment. The institutional control remedy is functioning as intended by the decision documents. Groundwater monitoring results over the five-year period between 1998 and 2003 indicated that there were no exceedances of MCLs, indicating no appreciable leaching to groundwater of these chemicals.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed documents listed in Section XII. Documents Reviewed;
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel; and documented the results on the Inspection Checklist provided in Attachment D-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Review of the annual inspection reports for the previous five-year period found grass on-unit needed mowing, active ant mounds, and the need to replace signs due to fading. There were no significant deficiencies noted.

A review of the groundwater monitoring program for the five-year period between 1998 and 2003, as summarized in Table D-3, indicated there were no exceedance of MCLs by any of the risk and hazard drivers. The data provides evidence of no appreciable leaching to groundwater of these chemicals. Based on the results of sampling over that five-year period, the U.S. Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) approved discontinuing sampling of groundwater for this OU.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and with Steve Willingham, O&M Staff Member on September 20, 2016 at the O&M organization offices. No issues were identified for the DBRP OU during these interviews.

The DBRP OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel on November 4, 2016. No issues were identified during this inspection. A site inspection was conducted by USEPA and SCDHEC personnel, accompanied by

USDOE and SRNS personnel, on February 28, 2017. No significant problems regarding this OU were identified during the inspections.

The field inspection frequency for the DBRP OU was changed from semiannual to annual in 2015. Scheduled inspections performed at the DBRP OU from FY2012 through FY2016 identified the following issues: overgrown vegetation, active ant mounds, and evidence of hog damage. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The native soil cover and institutional controls (i.e., LUCs) are effective in preventing exposure to PCBs to future industrial workers. The cover maintenance program and LUCs have been effective in maintaining the integrity of the soil cover. Based on the site inspections, there is no indication of potential remedy failure that could place protectiveness at risk.
- The confirmatory groundwater monitoring program was effective in verifying "no action" is appropriate for groundwater.

The Land Use Control Implementation Plan for the DBRP OU, located in Section 2.0 of the FRR, governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 1998). All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs still valid?

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid except for the MCL for arsenic. At the time of the ROD issuance, the MCL for arsenic was 50 µg/L. In 2001, the MCL for arsenic was changed to 10 µg/L. However, arsenic was not detected in the DBRP OU groundwater during the five-year monitoring period; and therefore, the change had no impact on the effectiveness of the

remedy. Groundwater monitoring was discontinued in 2004. There have been no changes in physical conditions at the DBRP OU that would affect the protectiveness of the remedy.

The USEPA standards and toxicity values have been updated since the last five-year remedy review as shown in Appendix B. The changes to the values for COCs at the DBRP OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Strategy?

No information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues for this OU.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for this OU.

X. Protectiveness Statement(s)

The remedy at the DBRP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated soil. All threats to contaminated soils at the DBRP OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain DBRP OU for

industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1995a. *Baseline Risk Assessment for the D-Area Burning/Rubble Pits*, Revision 1, WSRC-RP-94-708, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1995b. *RFI/RI Report for the D-Area Burning/Rubble Pits*, WSRC-RP-94-707, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997. *Record of Decision Remedial Alternative Selection for the D-Area Burning/Rubble Pits (431-D and 431-1D) (U),* WSRC-RP-96-867, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998. *Final Remediation Report for the D-Area Burning/Rubble Pits (431-D and 431-1D) (U),* WSRC-RP-97-406, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2006. *Addendum to the Final Remediation Report for the D-Area Burning/Rubble Pits (431-D and 431-1D) Operable Unit (U)*, WSRC-RP-2005-4084, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various – *Inspection Data Sheets - Field Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) Operable Unit (U)*, ER-IDS-019-003, Inspection period 2012 through 2016 (annually)

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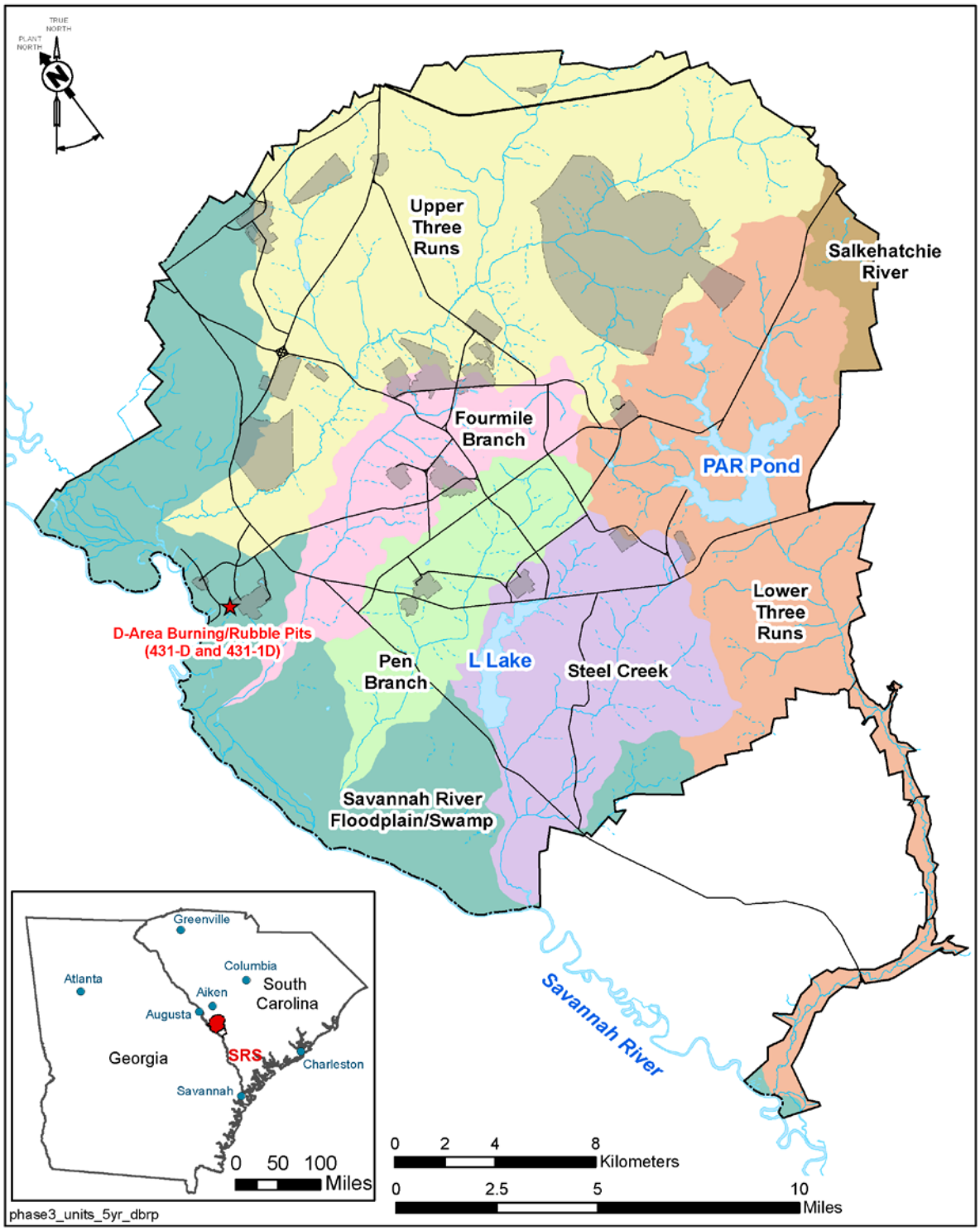

Figure D-1. Location of the DBRP OU at SRS

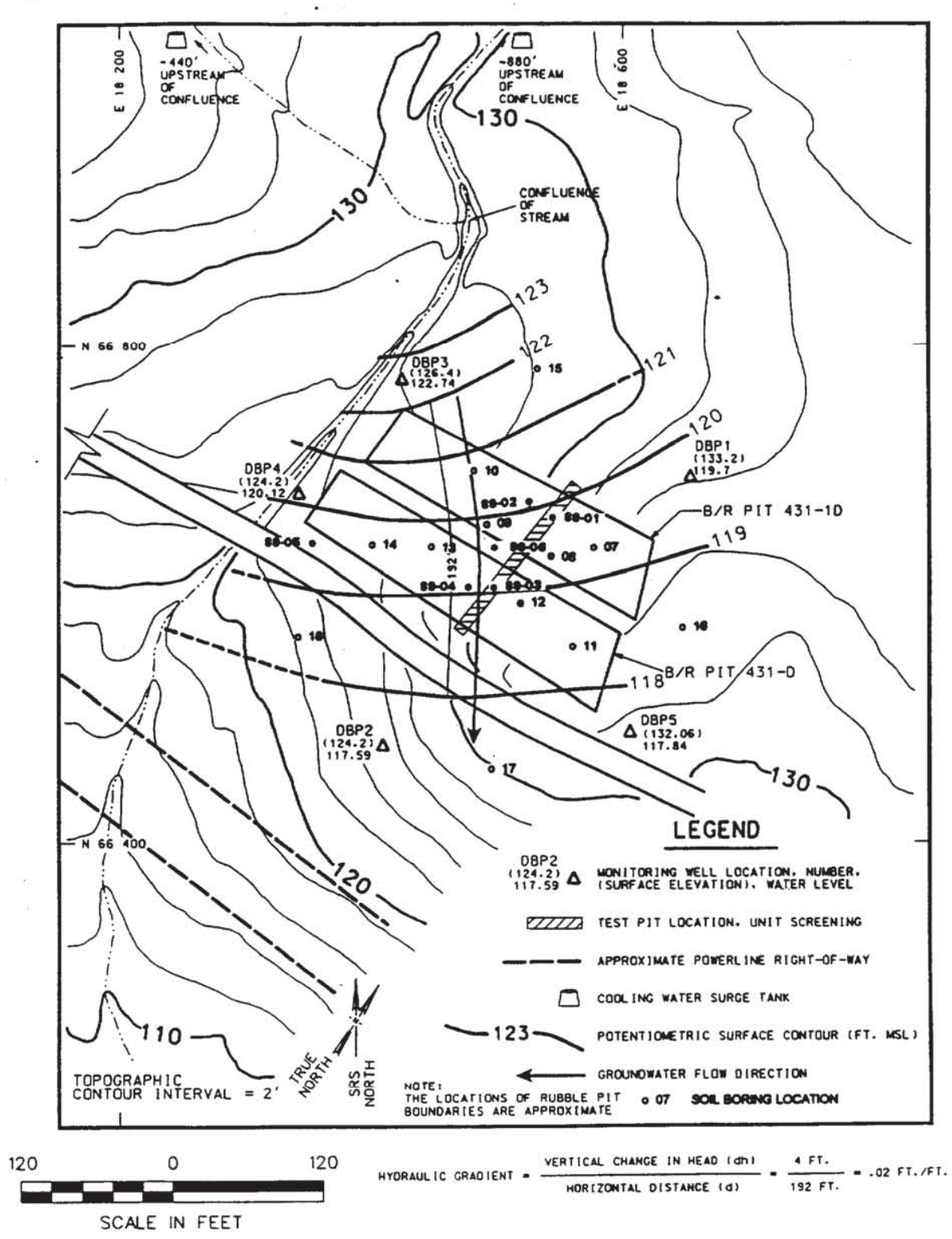

Figure D-2. Site Layout for the DBRP OU

Figure D-3. Photograph of DBRP OU During Active Operation (circa 1973)

Figure D-4. Current Photograph of DBRP OU (2016)

Table D-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	1989 / November 6, 1996
ROD Issuance	July 3, 1997
Remedial Action Start / Complete	May 12, 1998 / May 12, 1998
Previous Five-Year Reviews	June 30, 1997 / February 12, 2004 / January 29, 2009 / February 4, 2014

Table D-2. Actual versus Estimated O&M Costs

Project Cost	FY2012	FY2013	FY2014	FY2015	FY2016	5-Year Total
Total Actual O&M Costs ($)	12,324	13,304	8,713	7,938	13,356	55,635
Total ROD Estimated Direct O&M Costs* ($)	3,000	0	0	0	0	3,000

*Costs for preparation of the Fourth Five-Year Remedy Review were accounted for in FY2012. Annual O&M costs were not included in the original estimate.

Table D-3. Results of DBRP OU Groundwater Sampling (1998-2003[4])

Analyte Name	# of Samples	# of Detects	Concentration		Units	Detection Limit[1]	Sample Quantitation Limit[1]	MCL (2005)[2]	MCL (2016)
			Minimum	Maximum					
1,1,2-Trichloroethane	28	0			µg/L	0.39	5	5	5
1,2-Dichloroethane	28	0			µg/L	0.53	5	5	5
Aroclor-1260	28	0			µg/L	0.808	1.09	N/A	N/A
Arsenic	32	0			µg/L	7	70	50	10
Benzene	28	0			µg/L	0.28	5	5	5
Benzo(a)anthracene	28	0			µg/L	1.83	10.6	0.2	0.2
Benzo(a)pyrene	28	0			µg/L	2.74	10.6	0.2	0.2
Benzo(b)fluoranthene	28	0			µg/L	1.95	10.6	N/A	N/A
Benzo(k)fluoranthene	28	0			µg/L	2.28	10.6	N/A	N/A
Chromium	30	10	1.1	27.4	µg/L	3	11	100	100
Chrysene	28	0			µg/L	1.9	10.6	N/A	N/A
Dichloromethane (methylene chloride)	28	6	0.49	4.75	µg/L	4	10	5	5
Endrin	28	0			µg/L	0.0161	0.109	2	2
Manganese	29	26	3	905	µg/L	8.6	15	50[3]	50[3]
Octachlorodibenzo-p-dioxin	26	0			ng/L	4.8	10.1	N/A	N/A
Radium, total	21	14	0.649	4.3	pCi/L	1.43	3.79	5	5
Tritium	30	23	0.32	7.69	pCi/mL	0.926	2.132	20	20

1 - Maximum detection limit and sample quantitation limit reported to bound the non-detect values.
2 - The MCL (2005) column values are those reported in the Addendum to the FRR (WSRC 2006).
3- Manganese has a secondary MCL promulgated to protect the aesthetics of public water supplies and is not based on toxicity.
4- Groundwater monitoring ended in 2004.
N/A – Not applicable

Attachment D-1. Five-Year Review Site Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit

I. SITE INFORMATION			
Site Name:	**D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit**	**Date of Inspection:**	**9/8/2016**
Location and Region	**SRS, USEPA Region 4**	**USEPA ID:**	**CERCLIS #31**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 80°F**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Staff:** Steve Willingham (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord (Title) | 9/20/2016 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

Attachment D-1. Five-Year Review Site Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

4. Other Interviews *(Optional):* ☐ Report Attached _____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for D-Area Burning Rubble Pits (431-D and 431-1D)*, ER-IDS-019-003

Attachment D-1. Five-Year Review Site Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment D-1. Five-Year Review Site Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: OU-specific perimeter fencing is not required by the remedial action.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment D-1. Five-Year Review Site Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | IACD Federal Project Director (Title) | 11/4/2016 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment D-1. Five-Year Review Site Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: Inspections conducted from 2012 through 2016 identified overgrown vegetation, active ant mounds, and evidence of hog damage. These findings were resolved soon after discovery.

VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent _____ Depth _____

Remarks: _____

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths _____ Widths _____ Depths _____

Remarks: _____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent _____ Depth _____

Remarks: _____

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent _____ Depth _____

Remarks: _____

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent _____ Depth _____

Remarks: _____

Attachment D-1. Five-Year Review Site Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent _____
☐ Ponding	☐ Location shown on site map	Areal extent _____
☐ Seeps	☐ Location shown on site map	Areal extent _____
☐ Soft subgrade	☐ Location shown on site map	Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

D. Cover Penetrations ☐ Applicable ☒ N/A

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

F. Cover Drainage Layer ☐ Applicable ☒ N/A

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

H. Retaining Walls ☐ Applicable ☒ N/A

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

Attachment D-1. Five-Year Review Site Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit *(continued)*

X. OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Soil Vapor Extraction System ☐ Applicable ☒ N/A
XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is institutional controls (i.e., LUCs) with a period of groundwater monitoring (terminated in 2004). A summary report, including the data and interpretation was submitted to USDOE, SCDHEC, and USEPA following each monitoring event. During five consecutive monitoring and reporting cycles over five years, none of the constituents of concern exceeded the MCL; therefore, in 2004, USDOE, SCDHEC, and USEPA concurred with terminating the groundwater monitoring at DBRP OU.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Institutional controls (i.e., LUCs) require annual site inspections and maintenance (repair of erosion damage, cover maintenance, and warning signs). Site inspections indicated no issues therefore the long-term protectiveness of the remedy is intact. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

F-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-41G, 904-42G, AND 904-43G) OPERABLE UNIT

I. Introduction

This report is the fifth five-year review for the F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) (FHWMF) Operable Unit (OU). The review was conducted from August 2016 through November 2016. Contaminants have been left in place at the FHWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the FHWMF OU is protective of human health and the environment. This report documents the results of the review.

The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document.

II. OU Chronology

Table E-1 lists the chronology of site events for the FHWMF OU.

III. Background

The FHWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) for SRS (FFA 1993). The media associated with the FHWMF OU is soil. The groundwater associated with this unit is managed as the F-Area Groundwater OU.

Physical Characteristics

The FHWMF is located in the central portion of SRS, approximately 8 km (5 mi) from the nearest site boundary (Figure E-1). The FHWMF consists of three unlined basins,

F-1 (904-41G), F-2 (904-42G) and F-3 (904-43G) and the associated F-Area Inactive Process Sewer Line (FIPSL). Figure E-2 shows the site layout for the FHWMF. The dimensions and volumetric capacity of the basins were as follows:

- Basin F-1 – 27 m x 84 m x3.2 m (90 ft x 280 ft x 10.7 ft), 6.1 million L (1.6 million gal);
- Basin F-2 – 27 m x 159 m x3.2 m (90 ft x 530 ft x 10.7 ft), 11.7 million L (3.1 million gal); and
- Basin F-3 – 93 m x 216 m x 3.4 m (310 ft x 720 ft x 11.2 ft), 59.8 million L (15.8 million gal).

At the time of closure, the FHWMF had a combined maximum operating capacity of 77.6 million L (20.5-million gal) of wastewater.

The FIPSL that was used to convey wastewater to FHWMF is outside the scope of the FHWMF Record of Decision (ROD). The FIPSL RCRA closure action will be completed as part of the closure of the F-Area Tank Farm and Separations facility to avoid impacting underground and overhead interferences necessary to ensure safe operation of the F-Area facilities (SRNS 2009).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the FHWMF OU as being within an industrial area. The future land use for the FHWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The FHWMF operated from 1955 until November 7, 1988. During that time, the FHWMF received waste effluents from F-Area chemical separation facilities processes such as the

nitric acid recovery unit, waste storage system evaporator overheads, and general-purpose evaporator overheads.

Significant amounts of nitrate and caustic were received in the basins. Radioactive releases were greater than 99% tritium (SRNS 2009). The first soil samples at the FHWMF were collected in Basin F-3 in 1971, a year after the U.S. Environmental Protection Agency (USEPA) was formed, and five years before RCRA was enacted in 1976. A 1984 soil coring study of all three basins indicated that approximately 90% of the radionuclides, cations, and anions were concentrated within the top 0.3 m (1 ft) of basin soil.

Initial Response

Preventative actions at FHWMF were conducted pursuant to the requirements of RCRA per Settlement Agreement 87-27-SW.

Closure of the three basins began in 1989 and was completed in February 1991. The three basins were closed by dewatering; physically and chemically stabilizing the remaining sludges with a layer of granite, limestone, and blast furnace slag; and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.

The FHWMF was certified closed in July 1991 and was accepted by the South Carolina Department of Health and Environmental Control (SCDHEC) in October 1991 as being in compliance with RCRA requirements.

Basis for Taking Action

The constituents of concern (COCs) at the FHWMF are barium, cadmium, chromium, lead, mercury, copper, cyanide, nickel, zinc, gross alpha, gross beta, nitrate, radium-226, radium-228, tritium, americium-241, cesium-137, curium-243/244, curium-246, cobalt-60, strontium-90, technetium-99, uranium-233/234, uranium-238 tetrachloroethylene, and trichlorofluoromethane. No remedial goals were established in the ROD for soils (WSRC 1993).

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the FHWMF within the RCRA closure process in 1988. The FHWMF closure was begun in 1989 and completed in February 1991. Preventative activities at the FHWMF became subject to CERCLA when SRS was placed on the National Priorities List in December 1989. As documented in the ROD, the RCRA closure was selected as the final action under CERCLA. Therefore, no further action under CERCLA was necessary for the FHWMF (WSRC 1993).

The remedial action objectives (RAOs) are to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The FHWMF RCRA preventative action of stabilization and placement of all contaminated materials under a low-permeability cap satisfied both RAOs.

Remedy Implementation

Implementation of the selected final action remedy (i.e., the RCRA preventative action) included the following activities:

- Dewatering the basins to eliminate free liquids and to solidify the remaining waste and residues;
- Stabilizing the remaining waste by using 0.9 to 1.8 m (3-6 ft) of granite aggregate, 0.3 m (1 ft) of limestone and blast furnace slag to provide a load bearing capacity sufficient to support the cover system; and
- Placing a 2.7-hectare (6.8-acre) low permeability cover system consisting of a layer of backfill, a 0.6-m (2-ft) layer of low-permeability compacted kaolin clay (1.0E-07 cm/s), a 22.5-cm (9-in) drainage layer of sand, a geotextile fabric filter, topped with 0.6 m (2 ft) of topsoil to support a vegetative cover.

Figure E-3 provides current photographs of the FHWMF OU.

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Post-closure groundwater monitoring is required as a condition of the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) to verify that no unacceptable exposure to potential hazards posed by conditions at the OU occur in the future.
- Monthly site inspections for a minimum of 30 years to verify the integrity of the cover system, OU-specific perimeter fencing, signs, etc. Any necessary repairs will be made as part of the maintenance program.
- Institutional controls (i.e., land use controls [LUCs]) are being enforced to preclude unauthorized access or intrusive activities through the SRS Site Use/Site Clearance program and SRS site security.

Costs associated with the selected remedy for FHWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls (i.e., LUCs). The actual O&M cost during FY2012 to FY2016 is $128,317. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost data comparison is not provided in this remedy review.

V. Progress since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at FHWMF are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls in place while USDOE controls the OU.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment E-1with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls;
- Ensured that all actions required under the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) were implemented (i.e., monthly inspections and maintenance to the soil covers and groundwater monitoring); and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

A review of the monthly site inspection reports was conducted for the period FY2012 through FY2016. The monthly site inspections, site maintenance (i.e., repair of erosion damage, mowing, and warning signs), and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU) continue to maintain the effectiveness of response actions. The most prevalent findings in the inspection reports were active ant mounds and sediment buildup blocking drainage ditch outlets, thinning grass spots, small erosion areas, flag replacements, and vegetation growing on the fence. These findings were resolved soon after discovery. Review of the annual subsidence monitoring reports for the period FY2012 through FY2016 indicate the monument elevations are within the allowable tolerance. Inspection and maintenance data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk.

Interviews were conducted with Richard Feagin, O&M staff member, and with Steve Willingham, O&M staff member, on September 20, 2016 at the O&M organization offices. No issued were identified for the FHWMF OU during these interviews.

The FHWMF OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel on November 17, 2016. No issues were identified for the FHWMF OU during this inspection. The FHWMF OU was inspected by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on February 22, 2017. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD. The stabilization and placement of a multi-layer low permeability cover system has achieved the RAOs to prevent physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater. The effective implementation of institutional controls has prevented exposure to and ingestion of contaminated groundwater.

O&M of the cover system, overall, has been effective based on the review of inspection reports as documented in Section VI.

There were no opportunities for optimization observed during this review.

The institutional controls (i.e., LUCs) that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions); OU-specific perimeter fencing, and warning signs; and use restrictions via the SRS Site Use/Site Clearance Program. No activities were observed that would have violated the institutional controls (i.e., LUCs).

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). Therefore, a Land Use Control Implementation Plan is not required for this OU.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of final remedy selection are still valid. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. As the remedial work has been completed, the applicable standards set forth in the ROD (WSRC 1993) and the RCRA closure plan (WSRC 1991), associated with soils and basin sediments, have been met. Groundwater will be discussed in the five-year remedy reviews for the F-Area Groundwater OU.

There have been no changes in exposure pathways, land use or contaminant characteristics that would affect the protectiveness of the remedy. While no chemical specific soil remedial goals were set forth in the ROD (WSRC 1993), the remedy has eliminated the exposure pathway associated with soils.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues for the FHWMF OU.

IX. Recommendations and Follow-up Actions

In the 2000 RCRA Permit Renewal Application (SRNS 2016), SRS proposed to reduce the RCRA cap inspection frequency from monthly to quarterly, consistent with other RCRA cap inspection frequencies, and after major storms.

There are no recommendations or follow-up actions for the FHWMF OU under CERCLA.

X. Protectiveness Statement(s)

The remedy at the FHWMF OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled. All threats to contaminated soil at the FHWMF OU have been addressed through stabilization and placement of all contaminated materials under a low-permeability cap and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the FHWMF OU for industrial use only, OU-specific perimeter fencing and warning signs, and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SCDHEC, 2014. *South Carolina Hazardous and Mixed Waste Permit, Permit Number SC1 890 008 989, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, Module III – Postclosure Care and Module IV - Groundwater Requirements, Section B, F-Area Hazardous Waste Management Facility*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC

SRNS, 2009. *2000 RCRA Part B Permit Application for the F-Area Hazardous Waste Management Facility (F-Area HWMF) Postclosure*, WSRC-IM-98-30, Volume IV, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2016. *2000 RCRA Part B Permit Application for the F-Area Hazardous Waste Management Facility (F-Area HWMF) Postclosure*, WSRC-IM-98-30, Volume IV, Revision 2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1991. *Closure Plan for F Area Hazardous Waste Management Facility*, Volume IV, Revision 10, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1993. *Final Record of Decision Remedial Alternative Selection for F-Area Hazardous Waste Management Facility (U),* WSRC-RP-93-1042, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

Various – F-Area Seepage Basins Post Closure Inspections, ER-SOP-008, Inspection period 2012 through 2013 (monthly)

Various - Post-Closure Inspection F-Area Hazardous Waste Management Facilities 904-41G, 904-42G, 904-43G, ER-IDS-019-019, Inspection period 2014 through 2016 (monthly)

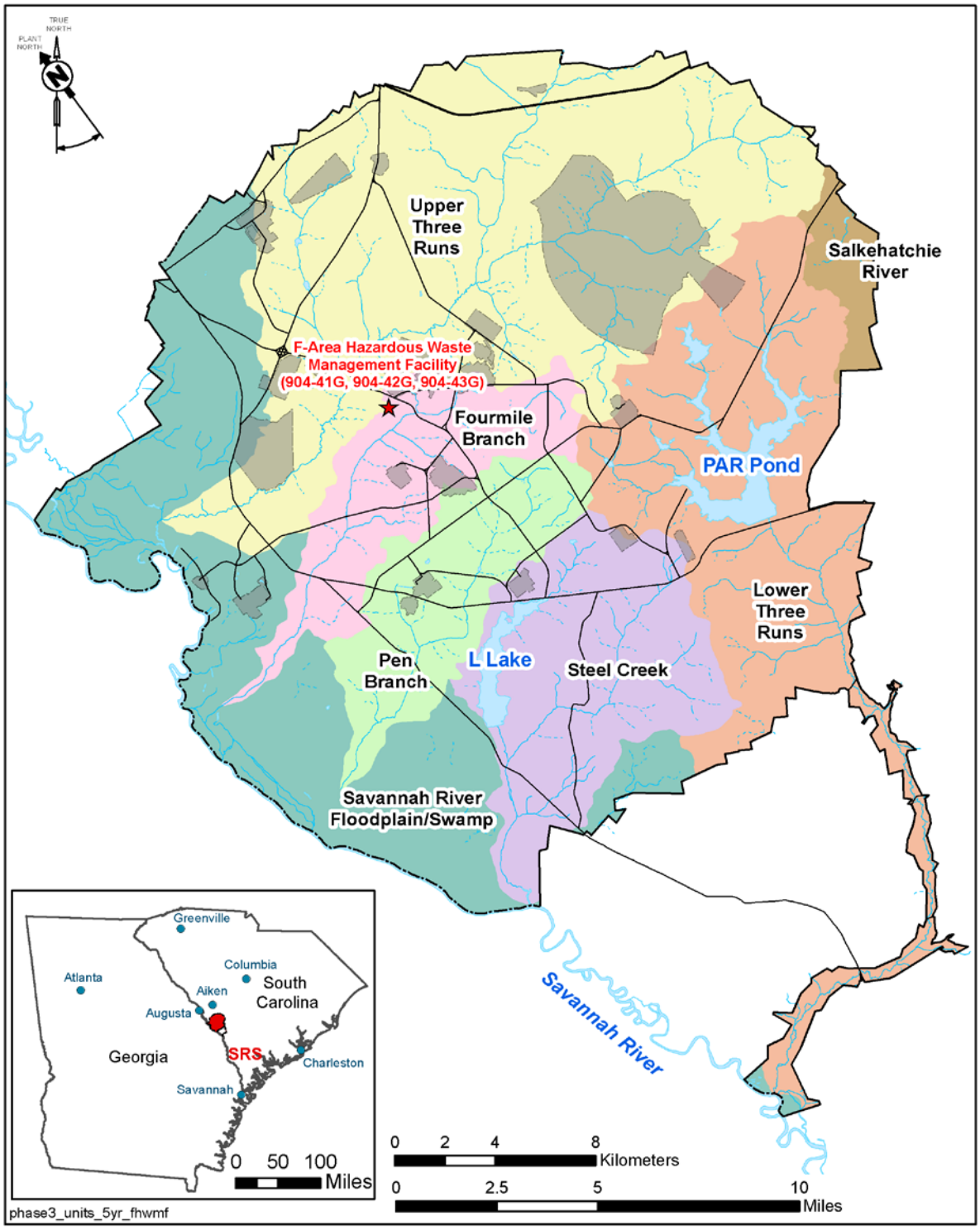

Figure E-1. Location of the FHWMF OU at SRS

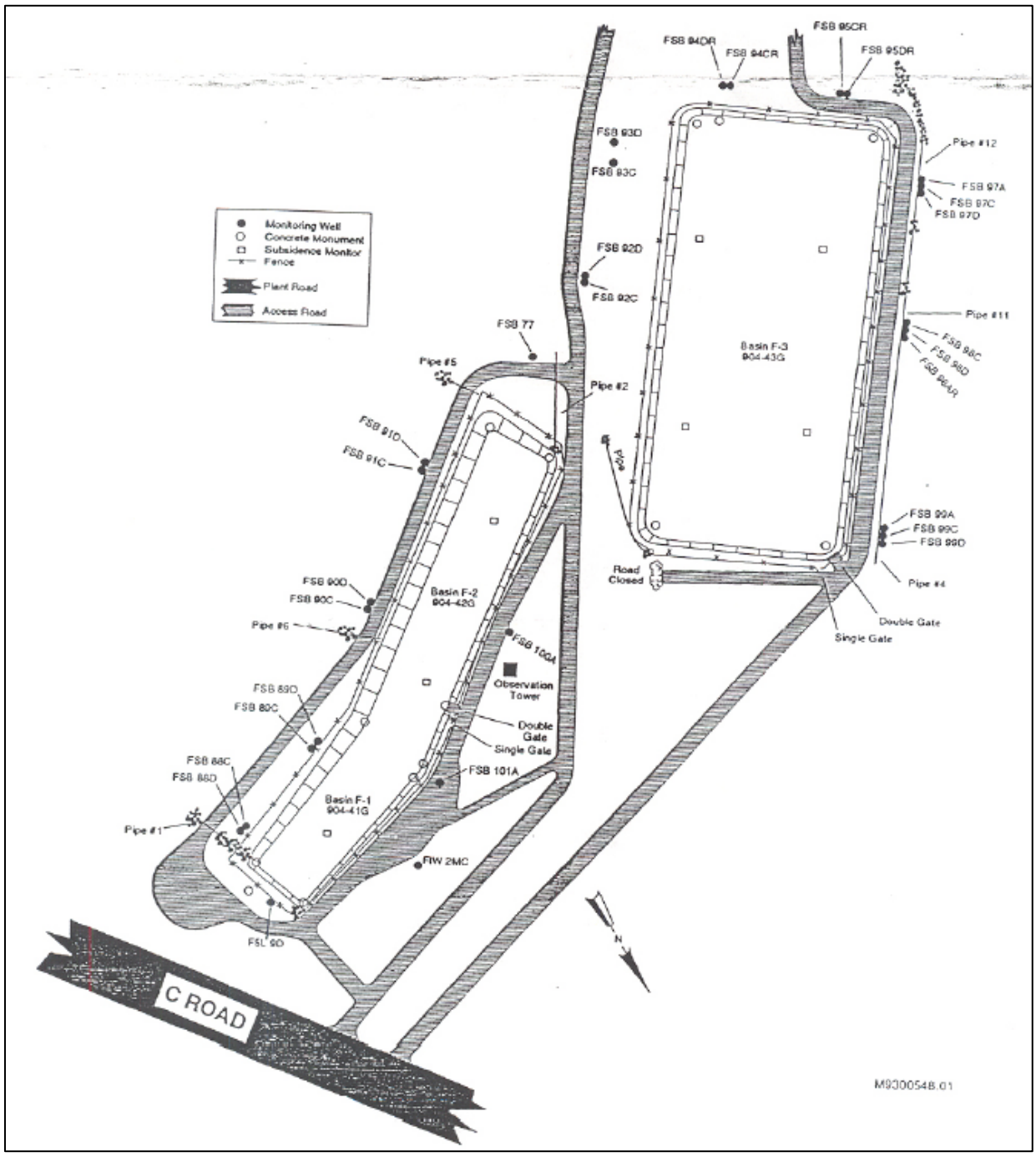

Figure E-2. Site Layout for FHWMF OU

Figure E-3. Current On-Unit Photographs of the Cover System of the FHWMF OU (2016)

Table E-1. Chronology of OU Events

Event	Date
RCRA Closure Plan Approved	June 1989
Corrective Action start	1989
RCRA Closure Certified	February 1991
Final ROD Issuance	October 1, 1993
Previous Five-Year Reviews Issuance	August 27, 1997 / February 12, 2004 / January 29, 2009 / February 4, 2014

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU

I. SITE INFORMATION			
Site Name:	**F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU**	**Date of Inspection:**	**08/31/2016**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #6**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 88°F**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☒ Other Stabilization
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Staff: Steve Willingham (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

4. Other Interviews *(Optional):* ☐ Report Attached _____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *F-Area Seepage Basins Post Closure Inspections*, ER-SOP-008 (2012 through 2013); *Post Closure Inspection F-Area Hazardous Waste Management Facilities 904-41G, 904-42G, 904-43G (U)*, ER-IDS-019-019 (2014 through 2016)

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Other Permits	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: RCRA Hazardous and Mixed Waste Permit Renewal

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is discussed in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: OU-specific perimeter fencing is required by the remedial action. Perimeter fencing is in good condition.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) IACD Program Manager (Title) 11/17/2016 (Date) 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks: Inspections conducted from 2012 through 2016 identified active ant mounds, sediment buildup blocking drainage ditch outlets, thinning grass spots, small erosion areas, flag replacements, and vegetation growing on the fence. These finding were resolved soon after discovery.

VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent _____ Depth _____

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths _____ Widths _____ Depths _____

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent _____ Depth _____

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent _____ Depth _____

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent _____ Depth _____

Remarks: Vegetation is mowed routinely.

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*			
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:			
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent ____ Depth ____ Remarks:			
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident			
☐ Wet areas	☐ Location shown on site map	Areal extent ____	
☐ Ponding	☐ Location shown on site map	Areal extent ____	
☐ Seeps	☐ Location shown on site map	Areal extent ____	
☐ Soft subgrade	☐ Location shown on site map	Areal extent ____	
Remarks:			
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent ____ Remarks:			
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)			
C. Letdown Channels ☐ Applicable ☒ N/A (Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)			
D. Cover Penetrations	☐ Applicable	☒ N/A	
E. Gas Collection and Treatment	☐ Applicable	☒ N/A	
F. Cover Drainage Layer	☐ Applicable	☒ N/A	
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A	
H. Retaining Walls	☐ Applicable	☒ N/A	

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Stabilization ☒ Applicable ☐ N/A
Stabilization was performed at FHWMF. The remedy is performing as designed.

Attachment E-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) OU *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

Closure of the three basins (904-41G, 904-42G, and 904-43G) by dewatering, physically and chemically stabilizing the remaining sludge, and placement of a protective multi-layer cover system has met the remedial objectives of preventing physical exposure to contaminants and mitigating further migration of contaminants to the groundwater. Selected remedies for the FHWMF OU are functioning as intended. There are no issues requiring corrective actions.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of site inspections and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, and the condition of the warning signs is good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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FORD BUILDING SEEPAGE BASIN (904-91G) OPERABLE UNIT

I. Introduction

This is the third five-year remedy review for the Ford Building Seepage Basin (904-91G) (FBSB) Operable Unit (OU). This review was conducted from August 2016 through November 2016. Contaminants have been left in place at the FBSB OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the FBSB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table F-1 lists the chronology of site events for the FBSB OU.

III. Background

The FBSB OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the FBSB OU include soil and groundwater beneath the OU. However, the results of the groundwater investigation contained in the RCRA Facility Investigation (RFI) / Remedial Investigation (RI) with Baseline Risk Assessment (BRA) for the FBSB OU (WSRC 2000), which included a collection of groundwater samples and analyses, revealed that the groundwater associated with FBSB OU is not contaminated.

Physical Characteristics

The FBSB OU is located approximately in the middle of SRS within the Pen Branch Watershed (Figure F-1). The water table is approximately 15 m (50 ft) below land surface and flows southwest. The FBSB and its associated components were constructed in 1964. The FBSB OU includes the following components:

- Unlined Seepage Basin – 36 by 24 m (120 by 80 ft) at ground level, 18 by 7.5 m (60 by 25 ft) at the bottom of the basin, 3 m (10 ft) deep, 567,800-L (150,000-gal) capacity;
- Underground Retention Tank – 22,700-L (6,000-gal) capacity;
- Underground Process Sewer Line between Ford Building and Retention Tank – 5-cm (2-in), 18 m (60 ft) long;
- Underground Piping Process Sewer Line between Retention Tank and Seepage Basin – 5-cm (2-in), 32.4 m (108 ft) long;
- Pumping Station;
- A delisted National Pollutant Discharge Elimination System (NPDES) Outfall CS-008 and associated riprap-lined earthen drainage ditch;
- Underground abandoned fire hydrant 20-cm (8-in) line; and
- Groundwater associated with the unit.

Figure F-2 depicts the layout of the FBSB OU.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates FBSB OU as being within the site industrial support area. The future land use for FBSB OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

From 1964 until 1984, the FBSB received approximately 1.44 million L (380,400 gal) of wastewater generated in the Ford Building during the reconfiguration, repair, and scrapping of reactor heat exchangers and other process equipment. The dominant radionuclide received was tritium (470 curies) along with smaller amounts of cobalt-60, strontium-90, cesium-137, and unidentified alpha emitters. Trace amounts of nonradioactive surfactants,

and organic and inorganic constituents may have been released into the basin. There is no record of the basin overflowing.

Initial Response

A removal action taken in 1998 removed the retention tank, pumping station, and underground piping process sewer lines to an off-unit disposal area. Approximately 2.1 m^3 (2.8 yd^3) of radiologically contaminated soil was containerized and stored at the FBSB OU until final disposition per the remedial decision in the Record of Decision (ROD) (WSRC 2001). Figures F-3 and F-4 present photographs of the FBSB OU before remediation and in the current condition.

Basis for Taking Action

The field investigations and the operational records identified four potential primary sources of contamination: FBSB, Tank/Process Sewer Line, NPDES Ditch, and the fire hydrant line. The RFI/RI/BRA report concluded that cesium-137, cobalt-60, and europium-154 present in the surface soil in the Seepage Basin Area pose human exposure health risks (greater than 1.0E-06) to future industrial workers. Aroclor-1254 represents an ecological risk to insectivorous mammals in the Seepage Basin Area. Arsenic, cesium-137, cobalt-60, and europium-154 are present in the subsurface soil beneath the Seepage Basin Area and present human health risks (greater than 1.0E-06) to future industrial workers exposed to subsurface soil. Cesium-137 and cobalt-60 are also present in surface and subsurface soils at the Tank/Process Sewer at levels that pose human exposure health risks (greater than 1.0E-06) to future industrial worker. Results of the RFI/RI/BRA concluded that there were no refined contaminants of concern (RCOCs) for the FBSB OU vadose zone, fire hydrant line, NPDES Ditch, and groundwater. There are no contaminant migration RCOCs and no principal threat source material (PTSM) at the FBSB OU.

The soil that required remedial action is located in the Seepage Basin Area (surface and subsurface) and Tank/Process Sewer Line Area (fully contained within a 1.2-m [4-ft] depth). Table F-2 provides the RCOCs and corresponding remedial goals (RGs) identified for the FBSB soils and Tank/Process Sewer Line soils.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 2001), the following are the remedial action objectives (RAOs) for the FBSB OU:

Seepage Basin Area Subunit

- Protect future industrial workers at the Seepage Basin Area from exposure to three RCOCs (cesium-137, cobalt-60, and europium-154) that exceed RGs in surface soils 0 to 0.3 m (0 to 1 ft) and four RCOCs (arsenic, cesium-137, cobalt-60, and europium-154) that exceed RGs in subsurface soils 0.3 to 1.2 m (1 to 4 ft deep) (Table F-2).
- Protect current terrestrial ecological receptors (insectivorous mammals) at the Seepage Basin Area from exposure to Aroclor 1254 at levels above the RG (0.0219 mg/kg) in surface soil.

Tank/Process Sewer Line Area Subunit

- Protect future industrial workers at the Tank/Process Line Area from exposure to cesium-137 and cobalt-60 that exceed RGs in surface and subsurface soils (Table F-2).

As stated in the ROD (WSRC 2001), the selected remedy for the FBSB OU was:

- Excavate all contaminated soil exceeding 1.0E-06 risk (for industrial worker) from the Tank/Process Sewer Line Area and disposition the soil into the seepage basin along with the vegetation existing in the basin;
- Remove the containerized soil (contaminated surface soil from the retention tank area) from two B-12 boxes and a 55-gallon drum and disposition the waste into the seepage basin;
- Backfill the remaining volume of the seepage basin and the excavated area of the Tank/Process Sewer Line Area with clean soil from an SRS borrow pit;
- Grade the clean soil to match the surrounding topography and cover the backfilled areas with vegetative cover to minimize erosion;
- Implement institutional controls (i.e., land use controls [LUCs]).

Remedy Implementation

Implementation of the FBSB OU remedial action included the following activities:

- Consolidated approximately 183.6 m^3 (240 yd^3), 505.5 m^3 (1685 yd^3) and 2.14 m^3 (2.8 yd^3) of contaminated soil by excavating to a depth of 1.2 m (4 ft) in the Tank/Process Sewer Line Area and to a width of 0.6 m (2 ft) and a depth of 0.3 m (1 ft) at the bank of the basin, and removed containerized soil (one 55-gallon drum and two B-12 boxes) and transported the soil with the existing vegetation to the basin bottom, respectively;
- Installed soil covers over the seepage basin (0.09 hectare [0.22 acre]) and the excavated areas of the Tank/Process Sewer Area (0.09 hectare [0.21 acre]) consisting of a minimum of 1.2-m (4-ft) thick common fill layer covered by a 15-cm (6-in) thick vegetative layer for the seepage basin and a 15-cm (6-in) thick crusher run for the tank/process sewer area. The common fill and vegetative layers consisted of clean soil from an approved SRS borrow pit;
- Seeded the seepage basin soil cover for vegetation;
- Established institutional controls for 0.11 hectares (0.28 acres) of the FBSB OU, which include site inspections of the seepage basin cover and the installation of warning signs around the seepage basin. Site inspections of the tank/process sewer area cover are not required because all soils exceeding 1.0E-06 risk (industrial) were removed.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Site inspections (semiannual through 2014; frequency reduced to annual thereafter [USDOE 2014]) and site maintenance (repair of erosion damage, cover maintenance, and warning signs) of the seepage basin cover; and
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit).

Table F-3 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 2001). The estimated O&M cost for FY2012 to FY2016 was $50,000 for site inspections, maintenance of the cover, and institutional controls (LUCs). . The actual O&M cost for FY2012 to FY2016 is $30,397. The actual O&M costs (Table F-3) are as expected.

V. Progress since Last Review

The previous protectiveness statement concluded that the remedial actions at FBSB OU are expected to be protective. The final remedial actions of excavation, consolidation, and backfilling of excavated areas along with institutional controls (i.e., LUCs) have been functioning properly.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment F-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and Steve Willingham, O&M staff member, on September 20, 2016, at the O&M organization offices. The only issues evident during walk-down inspections were active ant mounds. These issues have been resolved.

The FBSB OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel on December 8, 2016. No issues were identified during this inspection. A site inspection was conducted by U.S. Environmental Protection Agency (USEPA) and

South Carolina Department of Health and Environmental Control (SCDHEC) personnel, accompanied by USDOE and SRNS personnel, on February 23, 2017. No significant problems regarding this OU were identified during the inspections.

On August 20, 2014, the USDOE submitted a letter (USDOE 2014) to USEPA and SCDHEC to reduce inspection frequencies from semiannual to annual for FBSB OU. USEPA and SCDHEC approved the request on October 2, 2014 and September 17, 2014, respectively. Annual inspections for FBSB OU began in 2015.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Documents?

The remedy is functioning as intended as demonstrated below:

- The selected remedy of a compacted common fill cover over the FBSB is effective in preventing human and ecological receptors exposure to RCOCs.
- Site inspections (semiannually through 2014; annually thereafter [USDOE 2014]) are being performed and indicate the integrity of the common fill cover is intact and no problems have occurred.
- The selected remedy of a removal action at the Tank/Process Sewer Line Area Subunit was effective to protect future industrial workers from exposure to cesium-137 and cobalt-60 that exceeded RGs in the soil. This was accomplished by removing (1.2-m [4-ft]) deep contaminated soils that exceed RGs and land use restrictions for the Tank/Process Sewer Line Area are no longer needed.

The Land Use Control Implementation Plan for the FBSB OU, located in Appendix A of the Post-Construction Report/Corrective Measures Implementation Report/Final Remediation Report, governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2003). All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in physical conditions at the FBSB OU that would affect the protectiveness of the remedy.

The USEPA standards and toxicity values have been updated since the last five-year remedy review as shown in Appendix B. The changes to the values for COCs at the FBSB OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site operations, conditions, or activities that prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for this OU.

X. Protectiveness Statement(s)

The remedy at the FBSB OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by the FBSB soil cover and institutional controls (i.e., LUCs). All threats to contaminated soil at the FBSB OU have been addressed through implementation of physical access controls to

prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); administrative controls that maintain the OU for industrial use only; and warning signs and use restrictions via the SRS Site Use/Site Clearance Program. Long-term protectiveness is ensured by continued compliance with effective land use controls.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 2014. Letter, B. T. Hennessey (USDOE) to S. B. Fulmer (SCDHEC) and R. H. Pope (USEPA), *Request to Change the Inspection Frequency for Central Shops Burning/Rubble Pits (631-1G and 631-3G) and Ford Building Seepage Basin (904-19G) Operable Units*, CERCLIS Numbers: 50 and 58, IACD-14-186, dated August 20, 2014, Department of Energy, Savannah River Operations Office, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2000. *RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment for the Ford Building Seepage Basin (904-91G) Operable Unit (U),* WSRC-RP-98-4096, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001. *Record of Decision Remedial Alternative Selection for the Ford Building Seepage Basin Operable Unit (904-91G) (U)*, WSRC-RP-2000-4156, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Post-Construction Report (PCR)/Corrective Measures Implementation Report (CMIR)/Final Remediation Report (FRR) for the Ford Building Seepage Basin (904-91G) Operable Unit (U),* WSRC-RP-2003-4038, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, Ford Building Seepage Basin (904-91G) (U),* ER-IDS-019-024, Inspection period 2012 through 2016 (semiannually through 2014; annually thereafter)

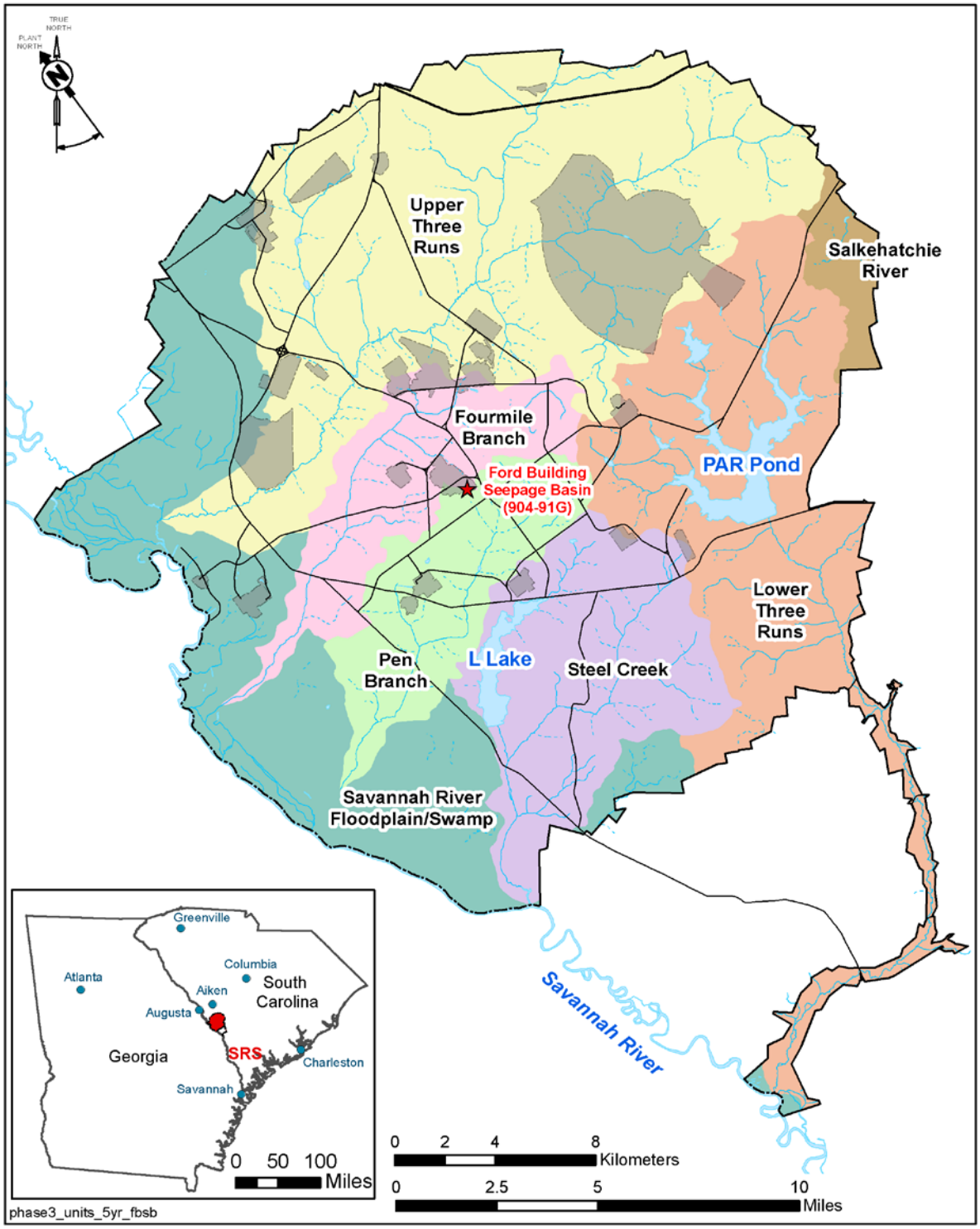

Figure F-1. Location of the FBSB OU at SRS

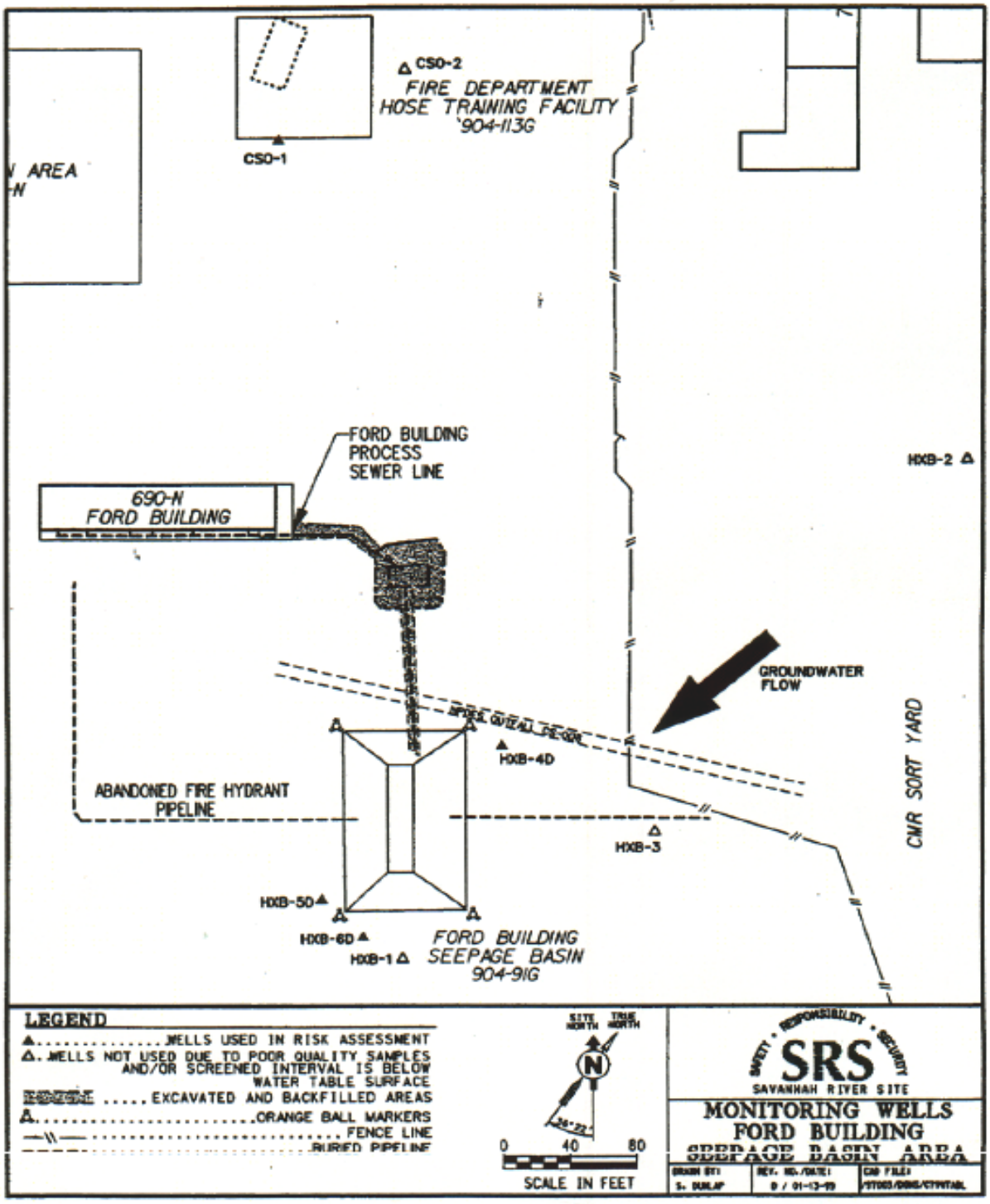

Figure F-2. Layout of the FBSB OU with Limits

Figure F-3. Oblique Aerial Photograph of the FBSB OU (1996)

Figure F-4. Current Photograph of the FBSB OU (2016)

Table F-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	October 20, 1997 / April 18, 2000
Removal Action Start / Complete	January 1, 1998 / December 31, 1998
ROD issuance	April 5, 2002
Remedial Action start/complete	January 27, 2003 / April 22, 2003
Previous Five-Year Reviews Issuance	January 29, 2009 / February 4, 2014

Table F-2. RCOCs and RGs Associated with Contaminated Media at FBSB OU

Subunit	Media	RCOC	Type of RCOC	RGs
FBSB Basin	Surface Soil	Aroclor 1254	ECO	0.0219 mg/kg
	Surface/Subsurface Soil	Cesium-137	HH	0.105 ρCi/g
	Surface/Subsurface Soil	Cobalt-60	HH	0.0224 ρCi/g
	Surface/Subsurface Soil	Europium-154	HH	0.0473 ρCi/g
	Subsurface Soil	Arsenic	HH	3.53 mg/kg
Tank/Process Sewer	Surface/Subsurface Soil	Cesium-137	HH	0.105 ρCi/g
	Surface/Subsurface Soil	Cobalt-60	HH	0.0224 ρCi/g

ECO Ecological COC
HH Human health industrial worker
PCB Polychlorinated biphenyl

Table F-3. Actual versus Estimated O&M Costs

	FY2012	FY2013	FY2014	FY2015	FY2016	5-Year Total
Total Actual O&M Costs ($)	7,763	9,054	3,701	2,701	7,178	30,397
Total ROD Estimated Direct O&M Costs* ($)	30,000	5,000	5,000	5,000	5,000	50,000

*Cost for preparation of the Fourth Five-Year Remedy Review were accounted for in FY2012.

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Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU

I. SITE INFORMATION			
Site Name:	**Ford Building Seepage Basin (904-91G) OU**	**Date of Inspection:**	**7/27/2016**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #58**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 86°F**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Excavation and consolidation

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Staff:** Steve Willingham (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145

Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: Site inspections (semiannual through 2014; annual thereafter [USDOE 2014]) are performed per SRS procedure ER-SOP-019, *Waste Unit Inspection and Maintenance*, and ER-IDS-019-024, *Field Inspection Checklist for the FBSB OU*

Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routing O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: OU-specific perimeter fencing is not required by the remedial action.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Candice Freeman (Name) | IACD Project Manager (Title) | 12/08/2016 (Date) | 803-952-7085 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey monuments were located and in good condition.

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks: Vegetation is mowed routinely. Site inspections identified active ant mounds. This issue was resolved soon after discovery.
VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent _____ Depth _____ Remarks:
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent _____ Depth _____ Remarks:
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent _____ Depth _____ Remarks:
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress Areal extent 1 acre Depth _____ Remarks: One acre of grass is maintained over and around the perimeter of the cover system, which extends beyond the 0.113 hectare (0.28 acre) LUC area.

Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
C. Letdown Channels ☐ Applicable ☒N/A (Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)
D. Cover Penetrations ☐ Applicable ☒ N/A
E. Gas Collection and Treatment ☐ Applicable ☒ N/A
F. Cover Drainage Layer ☐ Applicable ☒ N/A
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
H. Retaining Walls ☐ Applicable ☒ N/A

Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Excavation and Consolidation ☒ Applicable ☐ N/A
Excavation and consolidation were performed at FBSB OU. The remedy is performing as designed.

Attachment F-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The selected remedy for the FBSB OU was excavation, consolidation, backfilling, vegetative cover, and institutional controls (i.e., LUCs) to protect future industrial workers and terrestrial ecological receptors from exposure. Selected remedies for the FBSB OU are functioning as intended. There are no issues requiring corrective actions.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of semiannual/annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the seepage basin soil cover and the condition of the grass and vegetative cover and warning signs is good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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H-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-44G, 904-45G, 904-46G, AND 904-56G) OPERABLE UNIT

I. Introduction

This report is the fifth five-year review for the H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) (HHWMF) Operable Unit (OU). This review was conducted from August 2016 through November 2016. Contaminants have been left in place at the HHWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the HHWMF OU is protective of human health and the environment. The report documents the results of the review.

The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document.

II. OU Chronology

Table G-1 lists the chronology of site events for the HHWMF.

III. Background

The HHWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) for SRS (FFA 1993). The media associated with the HHWMF OU is soil.

The groundwater is being addressed by the H-Area Groundwater OU.

Physical Characteristics

The HHWMF is located in the central portion of SRS, approximately 9.6 km (6 mi) from the nearest site boundary (Figure G-1). The HHWMF consists of four unlined basins,

H-1 (904-44G), H-2 (904-45G), H-3 (904-46G) and H-4 (904-56G) and the associated H-Area Inactive Process Sewer Line (HIPSL) (Figure G-2).

The dimensions and volumetric capacity of the basins were as follows:

- Basin H-1 – 27 m x 72 m x 2.7 m (90 ft x 240 ft x 9 ft), 4.2 million L (1.1 million gal);
- Basin H-2 – 33 m x 138 m x 2.7 m (110 ft x 460 ft x 9 ft), 10.6 million L (2.8 million gal);
- Basin H-3 – 105 m x 144 m x 5.1 m (350 ft x 480 ft x 17 ft), 35.6 million L (9.4 million gal); and
- Basin H-4 – 39-129 m x 720 m x 2.4 m (130-430 ft x 2400 ft x 8 ft), 85.6 million L (22.6 million gal).

At the time of closure, the HHWMF (904-44G, 904-45G, and 904-56G) had a combined maximum operating capacity of 100.3 million L (26.5-million gal) of wastewater. Figure G-3 shows the basins prior to the start of closure.

The HIPSL that was used to convey wastewater to the HHWMF is outside the scope of the HHWMF Record of Decision (ROD). The HIPSL RCRA closure action was completed in conjunction with the General Separations Area Consolidated Unit OU remedial action.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the HHWMF OU as being within an industrial area. The future land use for the HHWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The HHWMF operated from 1955 until November 1988. In 1962, Basin H-4 replaced Basin H-3. During that time, the HHWMF received waste effluents from H-Area chemical separation facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general-purpose evaporator overheads.

Significant amounts of nitrate and caustic were received in the basins. Radioactive releases were greater than 99 percent tritium. A 1984 soil coring study showed that approximately 90 percent of the radionuclides and metals were concentrated within the top 0.3 m (1 ft) of basin soil (WSRC 2001).

Initial Response

Preventative actions at HHWMF OU were conducted pursuant to the requirements of RCRA per Settlement Agreement 87-27-SW.

Closure of the four basins began in 1989 and was completed in May 1991. The four basins were closed by dewatering; physically and chemically stabilizing the remaining sludge with a layer of granite, limestone, and blast furnace slag; and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.

The HHWMF was certified closed in July 1991 and was accepted by the South Carolina Department of Health and Environmental Control (SCDHEC) in October 1991 as being in compliance with RCRA requirements (SRNS 2016).

Basis for Taking Action

The constituents of concern at the HHWMF are arsenic, barium, cadmium, copper, lead, mercury, nickel, vanadium, zinc, tetrachloroethylene, gross alpha, gross beta, tritium, nitrate, carbon-14, cobalt-60, iodine-129, radium-226, radium-227, strontium-90, technetium-99, and uranium-233/234. No remedial goals were established in the ROD for soils (WSRC 1993).

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the HHWMF within the RCRA closure process in 1988. Closure of the HHWMF began in 1989 and was completed in July 1991. Preventative activities at the HHWMF became subject to CERCLA when SRS was placed on the National Priorities List in December 1989. As documented in the ROD, the RCRA closure was selected as the final action under CERCLA. Therefore, no further action under CERCLA was necessary for the HHWMF (WSRC 1993).

The remedial action objectives (RAOs) for the HHWMF OU were to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The HHWMF RCRA preventative action of stabilization and placement of all contaminated materials under a low-permeability cap satisfied both RAOs.

Remedy Implementation

Implementation of the selected final action remedy (i.e., the RCRA preventative action) included the following activities:

- Dewatering the basins to eliminate free liquids and to solidify the remaining waste and residues;
- Stabilizing the remaining waste using 0.9-1.8 m (3-6 ft) of granite aggregate, 0.3 m (1 ft) of limestone and blast furnace slag to provide a load bearing capacity sufficient to support the cover system; and
- Placing a 9-hectare (22.1-acre) low permeability cover system consisting of a layer of backfill, a 0.6-m (2-ft) layer of low-permeability compacted kaolin clay, a 22.5-cm (9-in) drainage layer of sand, a geotextile fabric filter, topped with 0.6 m (2 ft) of topsoil to support a vegetative cover.

In 2011, enhancements to the cover system over the basins were completed. Specifically, the drainage system, consisting of concrete lined swales, was re-graded and new concrete

installed. In addition, modifications to tie the drainage layer from the cap to the swales were completed. Figure G-4 provides current photographs of the HHWMF.

Systems Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Post-closure groundwater monitoring is required as a condition of the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) to verify that no unacceptable exposure to potential hazards posed by conditions at the OU occur in the future.
- Monthly site inspections will occur for a minimum of 30 years to verify the integrity of the cover system, OU-specific fencing, signs, etc. Any necessary repairs will be made as part of the maintenance program. Annual elevation surveys are conducted to monitor the long-term settlement of the cap.
- Institutional controls (i.e., land use controls [LUCS]) are being enforced to preclude unauthorized access or intrusive activities through the SRS Site Use/Site Clearance program and SRS site security.

Costs associated with the selected remedy for HHWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls (i.e., LUCs). The actual O&M cost during FY2012 to FY2016 is $273,130. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost data comparison is not provided in this remedy review.

V. Progress since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at HHWMF are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls in place while USDOE controls the OU.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment G-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Ensured that all actions required under the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) were implemented (i.e., monthly inspections, maintenance to the soil covers, groundwater monitoring).

Summary of Inspections and Interviews

A review of the monthly site inspection reports was conducted for the period FY2012 through FY2016. The monthly site inspections, site maintenance (i.e., repair of erosion damage, mowing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) currently implemented continue to maintain the effectiveness of response actions. The most prevalent findings were active ant mounds and blocked drainage grates and outlets. The findings were addressed upon discovery. Additionally, a crack in the drainage head wall associated with Basin H-4 (904-56G) was identified during the August 2011 inspection. The design for the drainage head wall replacement is complete. Construction was completed in November of 2016. Review of the annual subsidence monitoring reports for the period FY2012 through FY2016 indicate the monument elevations are within the allowable tolerance. Inspection and maintenance data do not indicate a history of remedy problems or potential remedy failure.

Interviews were conducted with Richard Feagin, O&M staff member, and with Steve Willingham, O&M staff member, on September 20, 2016 at the O&M organization offices. No issued were identified for the HHWMF during these interviews.

The HHWMF OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel on November 17, 2016. No issues were identified for the HHWMF OU during this inspection. The HHWMF OU was inspected by U.S. Environmental Protection Agency (USEPA) and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on February 22, 2017. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, applicable or relevant and appropriate requirements, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD. The stabilization and placement of a multi-layer low permeability cover system has achieved the RAOs to prevent physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater. The effective implementation of institutional controls has prevented exposure to, and ingestion of, contaminated groundwater.

O&M of the cover system has, on the whole, been effective based on the review of inspection reports as documented in Section VI.

There were no opportunities for optimization observed during this review.

The institutional controls (i.e., LUCs) that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions); OU-specific perimeter fencing and warning signs; and use restrictions via the SRS Site Use/Site Clearance Program. No activities were observed that would have violated the institutional controls (i.e., LUCs).

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). Therefore, a Land Use Control Implementation Plan is not required for this OU.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of final remedy selection are still valid. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

As the remedial work has been completed, the applicable standards set forth in the ROD (WSRC 1993) and RCRA closure plan (WSRC 2000) associated with soils and basin sediments have been met. Groundwater will be discussed in the five-year remedy reviews for the H-Area Groundwater OU.

There have been no changes in exposure pathways, land use or contaminant characteristics that would affect the protectiveness of the remedy. While no chemical specific soil remedial goals were set forth in the ROD (WSRC 1993), the remedy has eliminated the exposure pathway associated with soils.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

In the 2000 RCRA Permit Renewal Application (SRNS 2016), SRS proposed to reduce the RCRA cap inspection frequency from monthly to quarterly, consistent with other RCRA cap inspection frequencies, and after major storms.

There are no recommendations for follow-up actions for the HHWMF OU under CERCLA.

X. Protectiveness Statement(s)

The remedy at the HHWMF OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled. All threats to contaminated soil at the HHWMF OU have been addressed through stabilization and placement of all contaminated materials under a low-permeability cap and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the HHWMF OU for industrial use only, OU-specific perimeter fencing and warning signs, and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SCDHEC, 2014. *South Carolina Hazardous and Mixed Waste Permit, Permit Number SC1 890 008 989, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, Module III – Postclosure Care and Module IV - Groundwater Requirements, Section C, H-Area Hazardous Waste Management Facility*, South Carolina

Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC

SRNS, 2016. *2000 RCRA Part B Permit Renewal Application - H-Area Hazardous Waste Management Facility (H-Area HWMF) Postclosure*, WSRC-IM-98-30, Volume V, Revision 2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1993. *Final Record of Decision Remedial Alternative Selection for H-Area Hazardous Waste Management Facility (U)*, WSRC-RP-93-1043, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2000. *H-Area HWMF Closure Plan (U)*, WSRC-RP-98-4024, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001. *H-Area Corrective Action Phase 1 Evaluation*, WSRC-RP-2001-4015, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *H-Area Seepage Basins Post Closure Inspection*, ER-SOP-009, Inspection period 2012 through 2013 (monthly)

Various - *Post-Closure Inspection H-Area Hazardous Waste Management Facilities 904-45G, 904-46G, 904-56G*, ER-IDS-019-021, Inspection period 2014 through 2016 (monthly)

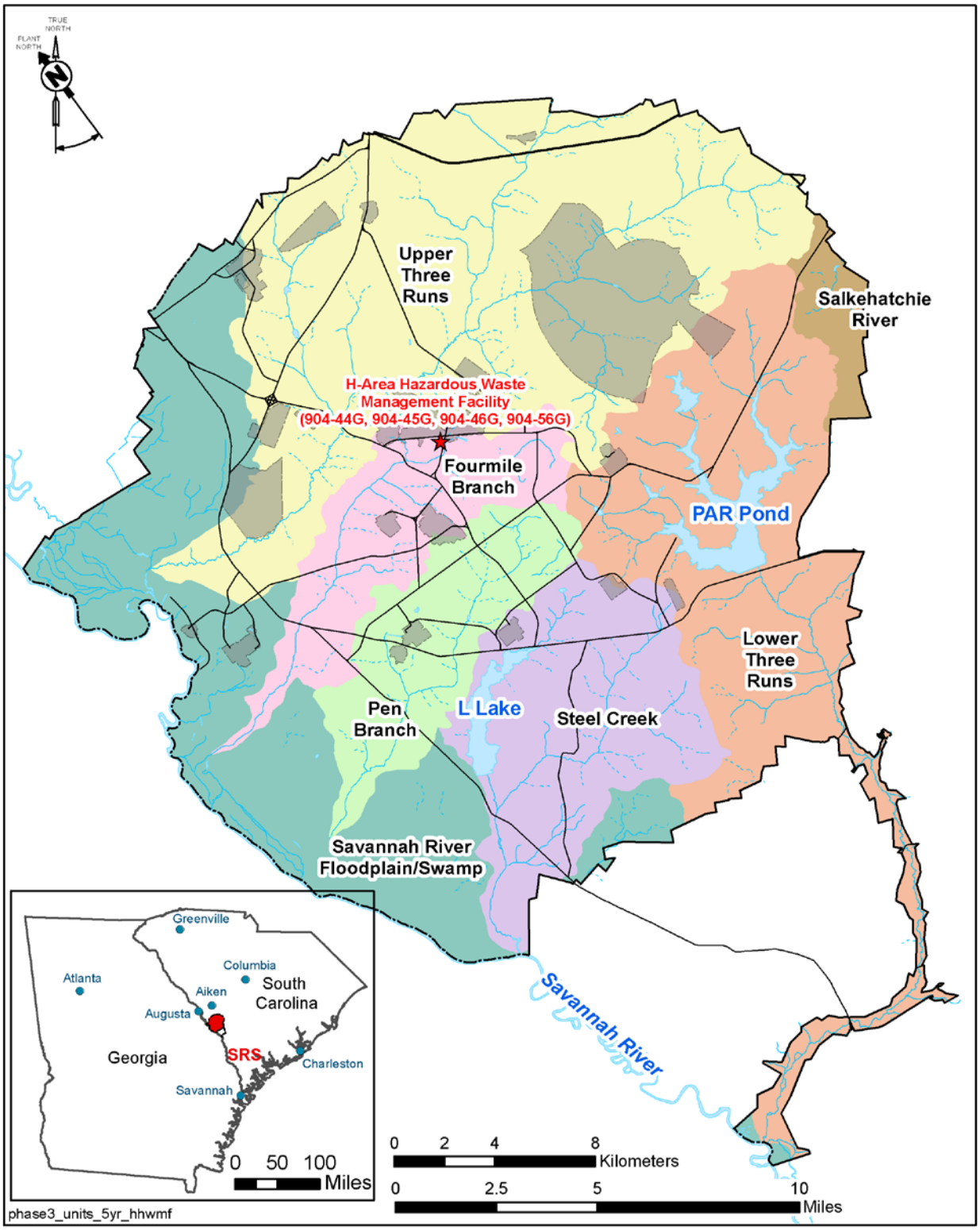

Figure G-1. Location of the HHWMF OU at SRS

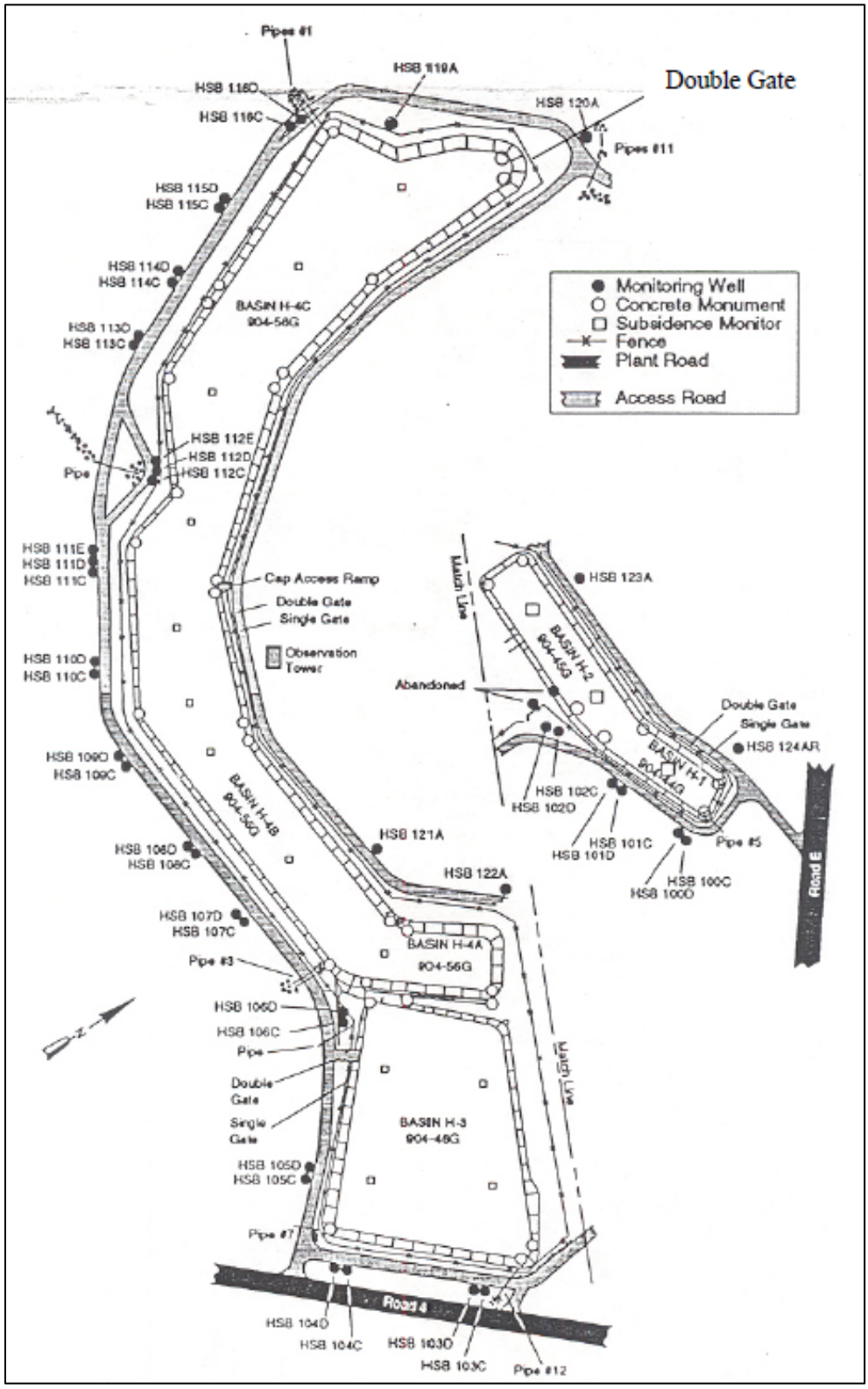

Figure G-2. Site Layout for HHWMF OU

Figure G-3. HHWMF OU Basins Prior to Closure (1989)

Figure G-4. Current On-Unit Photographs of the Cover System of the HHWMF OU (2016)

Table G-1. Chronology of OU Events

Event	Date
RCRA Closure Plan Approved	1989
Corrective Action Start	1989
RCRA Closure Certified	October 1, 1991
Final ROD Issuance	September 10, 1993
Previous Five-Year Reviews Issuance	August 27, 1997 / February 12, 2004 / January 29, 2009 / February 4, 2014

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Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU

1. SITE INFORMATION			
Site Name:	**H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU**	**Date of Inspection:**	**9/06/2016**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #7**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**91°F, sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Stabilization

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

2. INTERVIEWS *(Click all that apply)*

1. **O&M Staff:** Steve Willingham (Name); EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title); 9/20/2016 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name); EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title); 9/20/2016 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

3. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *H-Area Seepage Basins Post Closure Inspection*, ER-SOP-009 (2012 through 2013); Post-Closure Inspection H-Area Hazardous Waste Management Facilities 904-45G, 904-46G, 904-56G ER-IDS-019-021 (2014 through 2016)

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Other Permits	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: RCRA Hazardous and Mixed Waste Permit Renewal

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

IV. O&M COSTS

1 O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2 O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is discussed in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3 Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. Access and Institutional Controls ☒ Applicable ☐ N/A

A Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: Fencing is in good condition.

B Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | IACD Program Manager (Title) | 11/17/2016 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks: The most prevalent findings were active ant mounds and blocked drainage grates and outlets. The findings were addressed upon discovery. Additionally, a crack in the drainage head wall associated with Basin H-4 (904-56G) was identified during the August 2011 inspection. The design for the drainage head wall replacement is complete. Construction was completed in November of 2016.

VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent _____ Depth _____

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths _____ Widths _____ Depths _____

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent _____ Depth _____

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent _____ Depth _____

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent _____ Depth _____

Remarks:

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent _____
☐ Ponding	☐ Location shown on site map	Areal extent _____
☐ Seeps	☐ Location shown on site map	Areal extent _____
☐ Soft subgrade	☐ Location shown on site map	Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mates, riprap, grout bags, or gabions that descends down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*	
D. Cover Penetrations	☒ Applicable ☐ N/A
1. Gas Vents:	☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A Remarks:
2. Gas Monitoring Probes:	☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A Remarks:
3. Monitoring Wells:	☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A Remarks:
4. Leachate Extraction Wells:	☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A Remarks:
5. Settlement Monuments:	☒ Located ☒ Routinely Surveyed ☐ N/A Remarks:
E. Gas Collection and Treatment	☐ Applicable ☒ N/A
F. Cover Drainage Layer	☒ Applicable ☐ N/A
1. Outlet Pipes Inspected:	☐ Functioning ☒ N/A Remarks:
2. Outlet Rock Inspected:	☒ Functioning ☐ N/A Remarks:

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*		
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A
H. Retaining Walls	☐ Applicable	☒ N/A
I. Perimeter Ditches/Offsite Discharge	☒ Applicable	☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident

Areal extent_____ Depth_____

Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☒ N/A

☐ Vegetation does not impede flow

Areal extent_____ Type_____

Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent_____ Depth_____

Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A

Remarks: The drainage ditches at basin H4 (904-56G) have been relined with concrete. A culvert has a crack which is being analyzed for repair to ensure effective transport of surface water runoff away from the contaminant source.

VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Stabilization ☒ Applicable ☐ N/A

Stabilization was performed at HHWMF. The remedy is performing as designed.

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

XI. OVERALL OBSERVATIONS
1. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Closure of the three basins (904-44G, 904-45G, and 904-46G) by dewatering, physically and chemically stabilizing the remaining waste, and placement of a low permeability cap has met the remedial objectives of preventing physical exposure to contaminants and mitigating further migration of contaminants to the groundwater.
2. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Operating and Maintenance programs are well established and functioning to ensure that remedial systems remain effective service. When inspections identify any necessary maintenance repairs, repairs will be performed accordingly to maintain current and long-term protectiveness
3. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
4. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

K-AREA BURNING/RUBBLE PIT (131-K) AND K-AREA RUBBLE PILE (631-20G) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the K-Area Burning/Rubble Pit (131-K) (KBRP) / K-Area Rubble Pile (631-20G) (KRP) Operable Unit (OU). The review was conducted from August 2016 through November 2016. Contaminants and waste have been left in place at the KBRP/KRP OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the KBRP/KRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table H-1 lists the chronology of site events for the KBRP/KRP OU.

III. Background

The KBRP/KRP OU is a Resource Conservation Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The KBRP/KRP OU consists of two soil waste units and groundwater beneath the OU.

Physical Characteristics

The KBRP/KRP OU is located approximately 9.4 km (5.9 mi) east of the nearest site boundary and 0.6 km (0.4 mi) east of the K-Reactor Area (Figure H-1). Figure H-2 shows the site layout of the KBRP/KRP OU. The KBRP was constructed in 1955 to 1956 as a shallow, unlined excavation measuring approximately 9 m (30 ft) wide, 72 m (240 ft) long, and approximately 2.4 m (8 ft) deep for waste burning and burial.

The KRP, constructed sometime between 1956 and 1961, consists of a general disposal area, semicircular in shape, measuring approximately 90 m (300 ft) long and 15 to 40.5 m (50 to 135 ft) wide. Individual rubble piles within the area were 1.2 to 1.8 m (4 to 6 ft) high. Total estimated waste volume is 2,142 m^3 (2,800 yd^3).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a) designates KBRP/KRP OU as being within an industrial area. The future land use for KBRP/KRP OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

KBRP was constructed for the disposal of combustible wastes. During operation, organic liquids of unknown use and origin, waste oils, paper, plastics, and rubber were disposed of in the pit and burned periodically. Disposal records, including composition, origin, and use of materials disposed, were not kept for this unit during its period of operation. The use of the KBRP for disposal of combustible wastes was discontinued in 1973. Only inert rubble was placed in the pit until it was backfilled with soil to grade level in 1981. The primary contaminants detected in soil were polyaromatic hydrocarbons (PAHs) formed by incomplete burning of organic materials.

The KRP was constructed as a general disposal area. KRP is composed primarily of soil matter, with some broken asphalt, broken concrete pieces, and gravel-sized coal. The coal and asphalt exist in a wide range of particle sizes and are dispersed in a highly heterogeneous manner throughout the individual rubble piles. Disposal records were not kept for this unit during its period of operation. The primary contaminants detected in soil at the KRP were PAHs and metals.

A volatile organic carbon (VOC) groundwater plume originated beneath the KBRP/KRP and has migrated southwestwardly from the KBRP/KRP OU. Tetrachloroethylene (PCE) and trichloroethylene (TCE) exceed maximum contaminant levels (MCLs); however, the VOC plume is not located near a surface water discharge. No source material is present in the KBRP/KRP soils. There are no contaminant migration constituents of concern (CMCOCs) for the KBRP/KRP soils that pose a risk to groundwater.

Figures H-3 and H-4 present photographs of KBRP/KRP OU before remediation and in the current condition.

Initial Response

The KBRP was backfilled with soil to grade level in 1981 when the disposal capacity was reached.

Basis for Taking Action

The potential exposure to or ingestion of contaminated soil and groundwater poses a potential increased risk of cancer to human receptors and is the basis for taking action at the KBRP/KRP OU.

The RCRA Facility Investigation (RFI) / Remedial Investigation (RI) collected soil samples within the KBRP and from soil within the KRP individual rubble piles and native soils beneath the piles (WSRC 1998). During unit screening, ground penetrating radar surveys were performed to define the pit and pile boundaries to locate any buried objects in order to avoid drilling into buried material. No restriction to drilling was encountered.

Final human-health constituents of concern (COCs) were identified for the KBRP/KRP OU based on the results of the baseline risk assessment. PAHs are the predominant COCs in both KBRP and KRP soil. Arsenic was also identified as a COC for the KRP.

Groundwater immediately downgradient of KBRP was found to have PCE and TCE concentrations above MCLs. Groundwater and soil data indicate that the KBRP is no longer a source for groundwater contamination. This is based on the historical trends of

analytical data in the adjacent monitoring wells and the results of the soil investigation. No CMCOCs were identified for the surface units. The soil and groundwater COCs are listed in Table H-2.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD), the remedial action objectives (RAOs) for the unit are as follows:

- Protect future industrial workers from unacceptable exposures to PAHs in soil at the KBRP/KRP and arsenic in soil at the KRP;
- Protect future industrial workers from unacceptable exposures to PCE and TCE in groundwater; and
- Prevent further degradation of groundwater and return it to levels below MCL to allow beneficial uses.

As stated in the ROD, the selected remedial actions for the unit are as follows:

- Soil cover over the KBRP/KRP;
- Institutional controls (i.e., land use controls [LUCs]); and
- Monitored natural attenuation (MNA) for the water table aquifer groundwater.

Because the source of groundwater contamination is depleted and no CMCOCs were identified, no source control actions were required for the unit.

Remedy Implementation

The implementation of the selected remedy included the following activities:

- Consolidated 7,650 m^3 (10,000 yd^3) of contaminated soil (KRP soil from individual rubble piles), which was outside the planned cover area, into the KBRP. The soil removal area was expanded to include other rubble piles composed of gravel-size coal,

rocks, and dirt that were discovered near the soil removal area. Confirmatory sampling verified no COCs remained in the soil removal area (WSRC 2002).

- Installed a 0.6 m (2-ft) thick minimum common fill soil cover over KBRP/KRP per South Carolina Regulation 61-107, 11, Part IV, Subtitle G using conventional and commercially available earth-moving equipment. The soil cover system covers 0.3 hectares (0.8 acres) per the Post Construction Report (PCR) (WSRC 2002).
- Implemented LUCs for 0.47 hectares (1.15 acres) and posted warning signs at the perimeter of KBRP/KRP.
- Installed groundwater monitoring wells and established a long-term groundwater monitoring program for MNA to ensure maximum groundwater mixing zone (GMZ) concentration limits are not exceeded per the groundwater mixing zone application (GMZA) (WSRC 1999). The following changes listed below have been made to the monitoring network and sampling since the development of the GMZA. Changes have been documented within the various annual groundwater reports.
- Additional cone penetrometer technology data collected in 2002 indicated that the compliance boundary well KRP 7 would likely exceed the MCLs for PCE and TCE and was not suitable as a compliance boundary well. The KRP cluster (KRP 14D and KRP 14C) was proposed and accepted as new compliance boundary wells installed further downgradient of KRP 7.
- Later in 2002, PCE and TCE exceeded MCLs in one well (KRP 14D), a compliance boundary well. Since the number of exceedances was small; the USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) directed SRS to do a moderate corrective action plan. The plan included continued quarterly sampling in the GMZ network and the installation of the KRP 15 well cluster (WSRC 2003).
- In 2004, it was again reported that well KRP 14D exceeded the MCL for TCE. The USDOE, USEPA, and SCDHEC agreed that it would not be feasible to pursue the contamination beyond KRP 14 because the plume was migrating toward the congested

subsurface of the K-Reactor facility and could merge with the additional uncharacterized plumes associated with K Area. Per USEPA, SCDHEC and USDOE agreement, the KRP 14 cluster (KRP 14D and KRP 14C) was removed from the monitoring network. It was further agreed that the GMZA would not be modified, no additional modeling was needed, and no additional monitoring wells needed to be installed. Well KRP 7 was designated as the new compliance boundary well.

- In 2006, the USEPA, SCDHEC and USDOE agreed to reduce the sampling frequency from semiannual to quarterly due to steady or declining concentration trends, and compliance boundary wells being considerably below MCLs. USEPA, SCDHEC, and USDOE also approved the reduction of the analytical list from all of the Method 8260 analytes to only PCE, TCE, and their daughter products (vinyl chloride, 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene).
- In 2012, the USEPA, SCDHEC, and USDOE agreed to reduce the sampling frequency at KBRP/KRP to annually from semiannually due to steady or declining concentration trends and compliance boundary wells being considerably below MCLs. Sampling of the four Lower Aquifer Zone wells and three Transmissive Zone wells was also suspended due to contamination remaining in one or two upper aquifer zone wells.

System Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs);
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit); and
- Sampling of the GMZA monitoring wells. The MNA monitoring program verifies the natural decrease of contaminant concentrations in the groundwater to levels below MCLs for PCE and TCE. Sampling will continue until MCLs have been attained, the

MNA has achieved its RAOs, and the remedial action is complete. The results were reported via annual effectiveness monitoring reports since 2003. Starting in 2008, the monitoring results for KBRP/KRP were combined with the L-Area Burning Rubble Pit (131-L) (LBRP) and P-Area Burning/Rubble Pit (131-P) (PBRP) monitoring reports into a single abbreviated annual groundwater data summary, with full detailed reports every five years (USDOE 2008). The first five-year detailed report was submitted in June 2012 (SRNS 2012). The next five-year detailed report is to be submitted in June 2017. The MNA remedy was expected to reduce groundwater concentrations to below MCLs by 2005 due to the processes of advection and dispersion (WSRC 1999c). However, contamination still exists above MCLs, but core concentrations continue to decline and a GMZ is still reasonable for monitoring.

Table H-3 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 2000). The estimated O&M cost for FY2012 to FY2016 was $27,812 for inspections, maintenance, GMZA monitoring, and institutional controls (i.e., LUCs). The actual O&M cost for FY2012 until FY2016 is $90,770. The actual O&M costs are higher than expected because groundwater monitoring and reporting have continued longer than expected.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedy of a soil cover over the KBRP/ KRP with institutional controls (i.e., LUCs) and MNA for the groundwater at the KBRP/KRP is protective of human health and the environment.

An agreement with the USEPA, SCDHEC, and USDOE was reached in 2008 to combine the reports for KBRP/KRP, LBRP, and PBRP into an annual groundwater monitoring data summary letter with a detailed groundwater report every fifth year beginning June 30, 2012 (USDOE 2008).

In the previous five-year review in 2014, it was recommended that 1,4-dioxane be analyzed at the KBRP/KRP OU. All wells sampled under the optimized sampling were analyzed

for 1,4-dioxane during 4Q2013 and reported in the 2013 Annual Groundwater Data Summary Letter Report which was submitted in June 2014 (USDOE 2014). All results were non-detect for 1,4-dioxane; therefore, it was agreed by USEPA, SCDHEC, and USDOE that continued analysis for 1,4-dioxane analysis was not needed.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Reviewed the groundwater monitoring data (Table H-4);
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment H-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Annual groundwater reports or data summaries have been submitted for the KBRP/KRP OU since 2003 and were thoroughly reviewed for this Five-Year Remedy Review. The 2012 detailed report includes time-series plots of PCE and TCE at each station, a plume map, and a comprehensive review of the monitoring activities and monitoring results (SRNS 2012). Steady or declining concentration trends and compliance boundary wells below MCLs were discussed in the 2012 report.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and Steve Willingham, O&M staff member, on September 20, 2016 at the O&M organization offices. No issues were identified for the KBRP/KRP OU during these interviews.

The field inspection frequency for the KBRP/KRP OU was changed from semiannual to annual in 2015. Scheduled inspections conducted from FY2012 through FY2016 identified the following issues: active ant mounds and hog damage on soil covers. These findings were documented on the field inspection checklists and resolved soon after discovery.

The KBRP/KRP OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel on November 21, 2016. No issues were identified for the KBRP/KRP OU during this inspection. The KBRP/KRP OU was inspected by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on February 23, 2017. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The soil cover continues to protect present and future industrial workers from unacceptable exposures to PAHs in soil at the KBRP/KRP, and arsenic in soil at the KRP;
- LUCs (including institutional controls) are continuing to prevent human exposure to contaminated soils and groundwater; and
- The MNA program and monitoring well network provides sufficient data to assess the progress of natural attenuation within the groundwater. MNA is preventing further degradation of groundwater and is returning it to levels below MCLs. Core plume contaminant levels, as seen in well KRP 9, have been decreasing over the past four years (Figure H-5). Groundwater contamination has persisted longer than originally expected due to reductions in dispersion and groundwater recharge, as well as possible increases in the sorption of contaminants. The VOC plume has not increased in areal size or migrated below the uppermost aquifer zone. Based on the annual monitoring reporting, the requirements of the GMZ are being satisfied. All groundwater

monitoring results are well below mixing zone contaminant levels (MZCLs) as shown in Table H-4.

The above remedial activities are meeting the RAOs established for the KBRP/KRP OU as discussed in Section IV, by eliminating or controlling all routes of exposure to possible industrial workers. The Land Use Control Implementation Plan for KBRP/KRP OU is located in Appendix D of the PCR and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2002). All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. The MCLs for PCE and TCE have remained the same since the remedies were implemented (Appendix B). There have been no changes in the physical conditions of the KBRP/KRP OU that would affect the protectiveness of the remedy. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Due to the presence of chlorinated solvents at the site, 1,4-dioxane was identified during the last five-year review to potentially exist at the KBRP/KRP OU since it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. SRS analyzed all samples that were collected in 4Q2013 for 1,4-dioxane and all results were non-detect. The 1,4-dioxane results were reported and discussed in the subsequent annual Groundwater Monitoring Data Summary that was submitted in June 2014 (USDOE 2014). Based on the results, the USEPA, SCDHEC and USDOE decided that 1,4-dioxane does not need to be monitored at the KBRP/KRP OU.

In addition to 1,4-dioxane, fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. No other listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No new information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to the KBRP/KRP OU.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the KBRP/KRP OU.

X. Protectiveness Statement(s)

The remedy at KBRP/KRP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to contaminated soil at the KBRP/KRP OU have been addressed through implementation of the soil cover, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the KBRP/KRP OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2012. *K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-3L, and 131-2L) (LBRP), and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units (OUs) Detailed Combined Groundwater Monitoring Report (U)*, SRNS-RP-2012-00200, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 2008. *Submittal of the Proposal to Standardize Sampling and Reporting Requirements of Groundwater Data for P, L, and K Area Burning/Rubble Pit Operable Units, CERCLIS Numbers 59, 56, 40*, ACP-08-133, January, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 2014. *2013 K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-3L, and 131-2L) (LBRP), and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units Combined Groundwater Monitoring Report (Sampling Summary), CERCLIS Numbers: 40, 56, and 59*, ACP-14-156, June, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken SC

WSRC, 1998. *RCRA Facility Investigation/Remedial Investigation Report with the Baseline Risk Assessment for the K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-97-442, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 1999a. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1999c. *Groundwater Flow and Solute Transport Modeling Report for the K-Area Burning/Rubble Pit and Rubble Pile*, WSRC-RP-98-5052, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000. *Record of Decision Remedial Alternative Selection for the K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-97-862, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2002. *Post-Construction Report (PCR) for the K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-2002-4095, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Comparison of Groundwater Monitoring Data with Modeling Predictions for the K-Area Burning/Rubble Pit and Rubble Pile Groundwater Contamination and Plan for Corrective Action (U)*, WSRC-RP-2002-4185, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist K-Area Burning Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) (U)*, ER-IDS-019-015, Inspection period 2012 through 2016 (annually)

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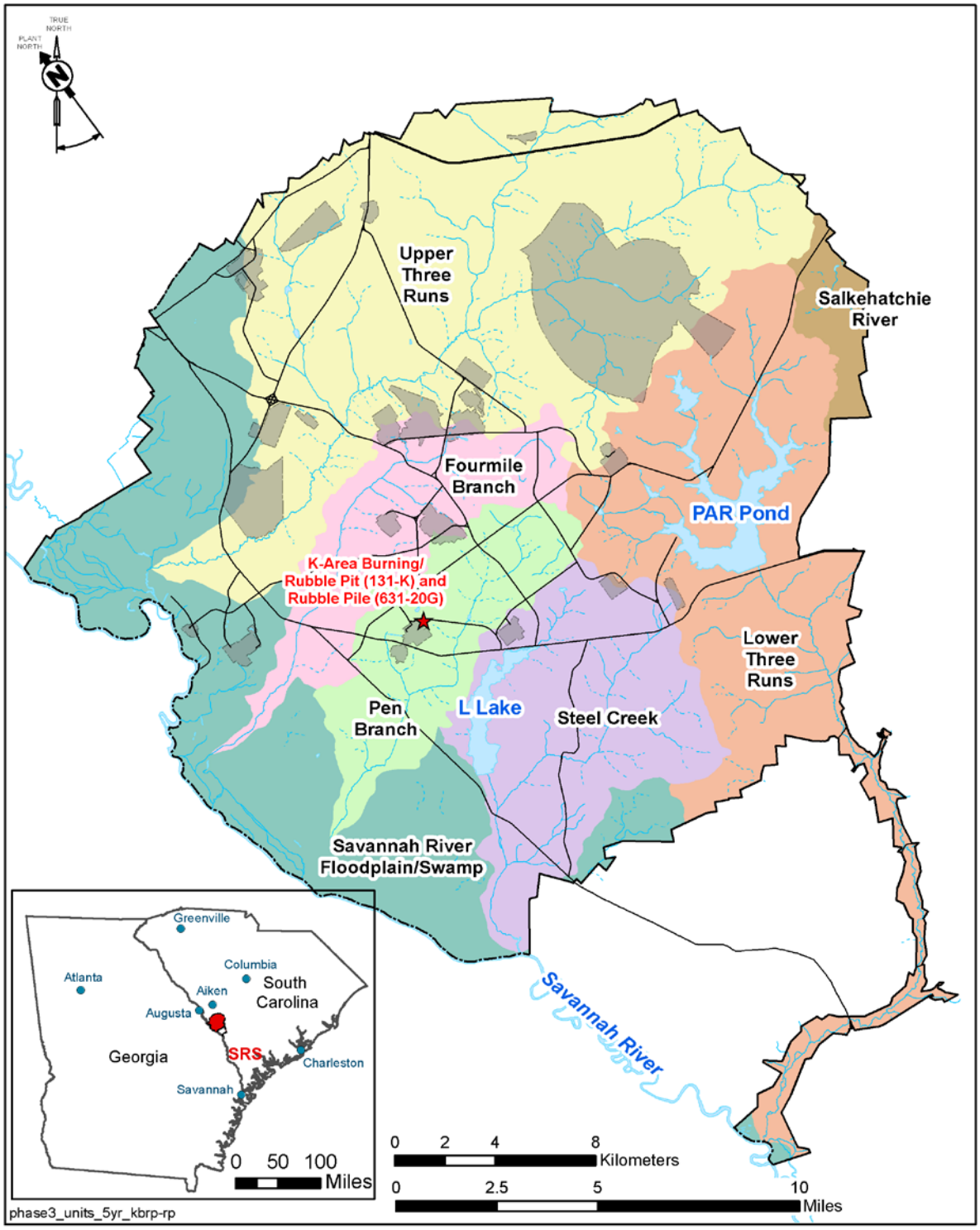

Figure H-1. Location of the KBRP/KRP OU at SRS

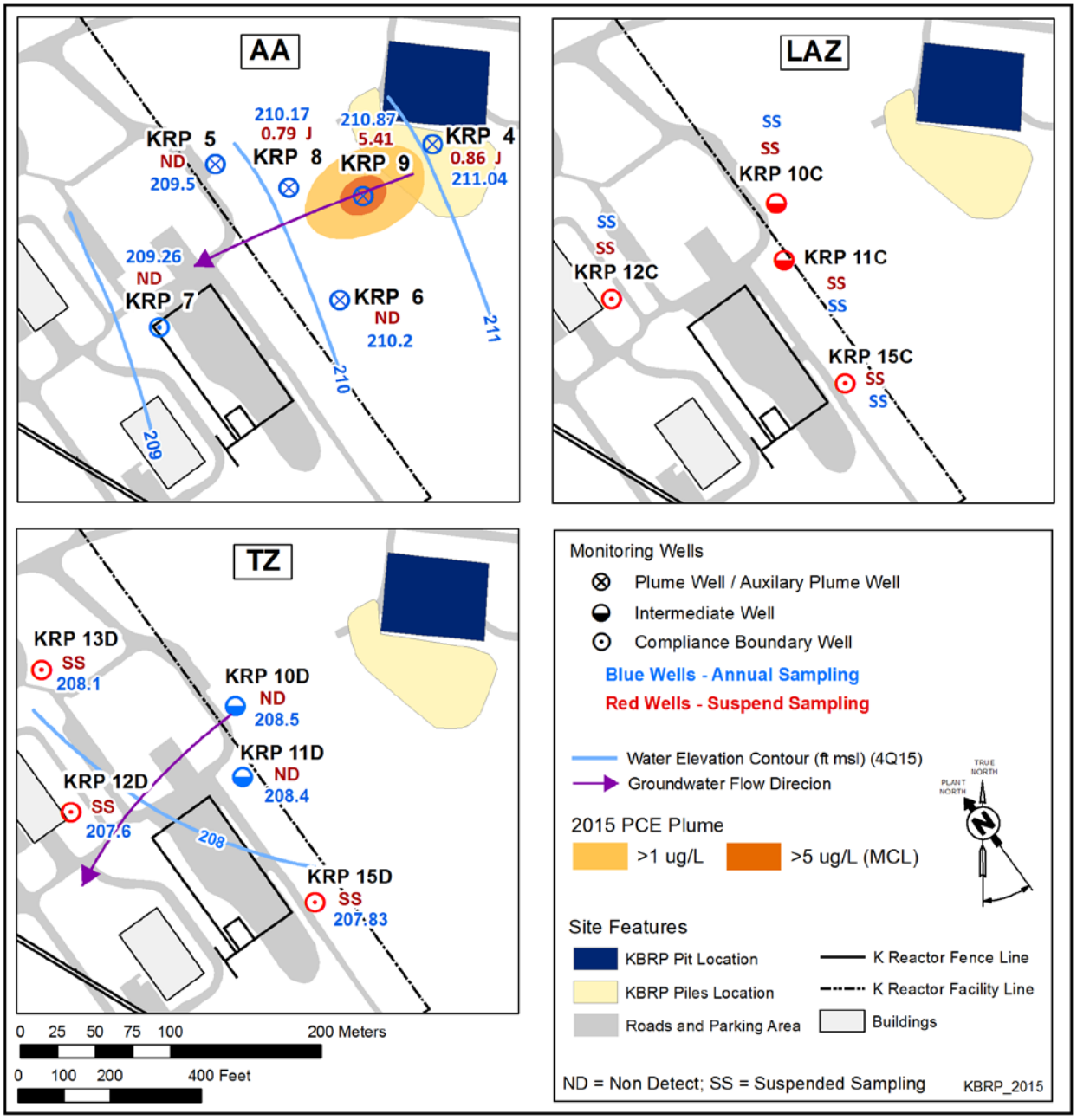

Figure H-2. Site Layout of KBRP/KRP and Well Locations

Figure H-3. Photo of KBRP/KRP OU Before Remediation Activities (1974)

Figure H-4. Current Photo of the KBRP/KRP OU (2016)

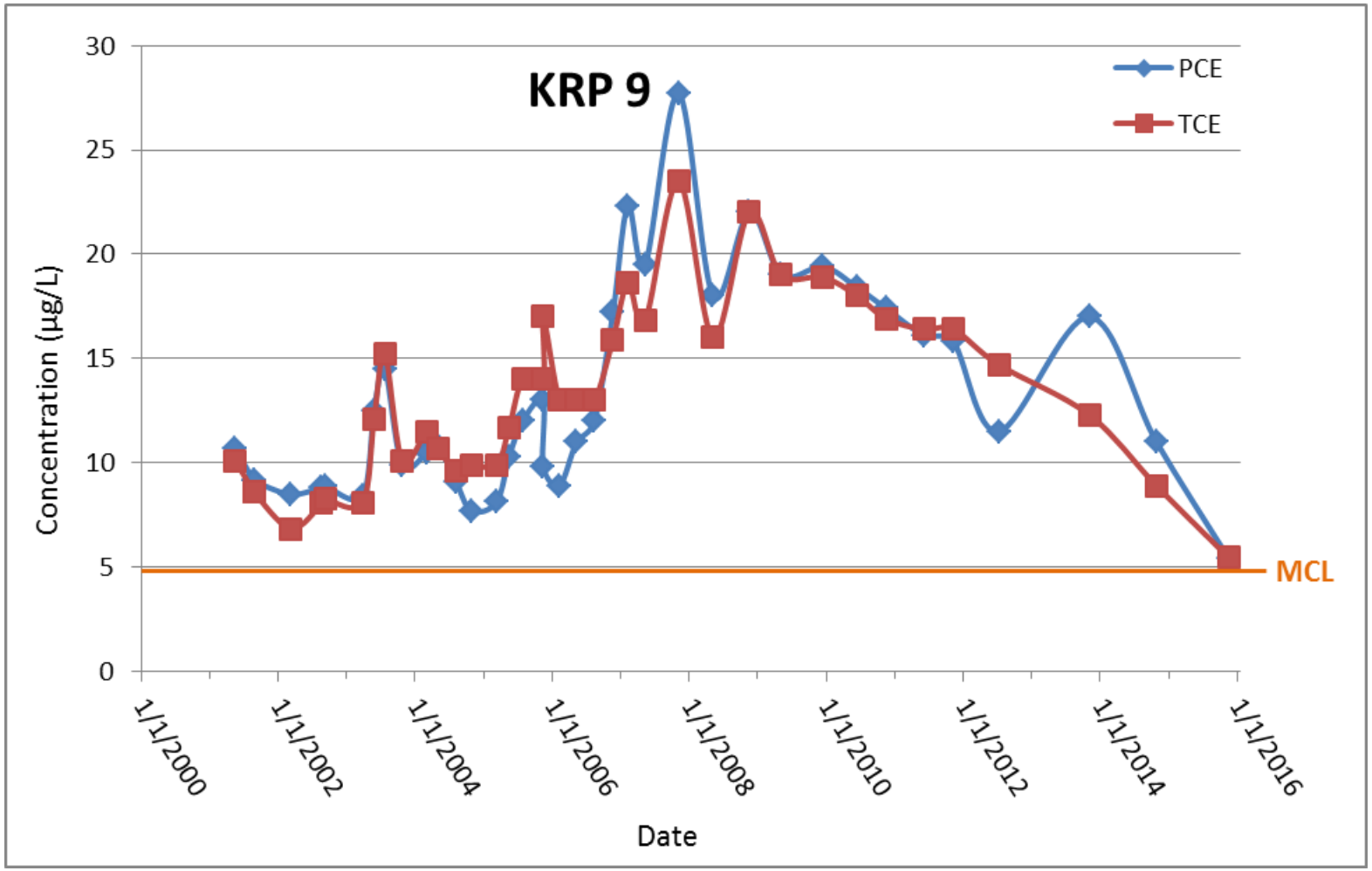

Figure H-5. PCE and TCE Time-Trend Plot at Well KRP 9

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Table H-1. Chronology of Events

Event	Date
RFI/RI start/complete	1996 / December 1998
ROD issuance	August 20, 2001
Remedial Action start/complete	October 8, 2001 / March 27, 2002
Previous Five-Year Reviews Issuance	February 12, 2004 / January 29, 2009 / February 4, 2014

Table H-2. Constituents of Concern, Risks to Future Industrial Workers, and Remedial Goals for KBRP and KRP OU

Medium	COCs	Basis/Receptor	Baseline Risk	Remedial Goals (for 10^{-6} or HQ=0.1)
KBRP Soil	Benzo[a]anthracene	Future Industrial Worker	3.70E-05*	6.24 mg/kg[a]
	Benzo[a]pyrene		3.70E-04*	0.624 mg/kg[a]
	Benzo[b]fluoranthene		5.00E-05*	6.24 mg/kg[a]
	Benzo[k]fluoranthene		2.50E-06*	62.4 mg/kg[a]
	Dibenzo[a,h]anthracene		5.40E-05*	0.624 mg/kg[a]
	Indeno[1,2,3-c,d]pyrene		2.14E-05*	6.24 mg/kg[a]
KRP Soil	Benzo[a]anthracene	Future Industrial Worker	1.81E-05*	6.24 mg/kg[a]
	Benzo[a]pyrene		1.45E-04*	0.624 mg/kg[a]
	Benzo[b]fluoranthene		2.30E-05*	6.24 mg/kg[a]
	Indeno[1,2,3-c,d]pyrene		8.70E-06*	6.24 mg/kg[a]
	Arsenic		3.35E-05*	7.96 mg/kg[c]
KBRP and KRP OU Water Table Aquifer	Tetrachloroethylene (PCE)	Future Industrial Worker and Exceedance of MCL	1.6E-06**	5.0 µg/L[b]
	Trichloroethylene (TCE)		1.10E-07**	5.0 µg/L[b]

Chrysene, fluoranthene, and pyrene are residential COCs that exist at the KBRP/KRP OU at concentrations less than future industrial worker exposure concentrations.

* Combines ingestion, inhalation, and dermal contact based on potential exposure to soil in the 0- to 1-foot interval.

** Risk based on potential exposure (ingestion) of groundwater.

a The remedial goal is based on the 1.0E-06 target cancer risk to the hypothetical, future, industrial worker.

b The remedial goal is based on the Water Quality Protection of Human Health as established by South Carolina Regulation 61-68 of the Pollution Control Act.

c The remedial goal is based on two times the mean concentration of arsenic in background soil at the KBRP and KRP.

HQ = hazard quotient

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

Table H-3. Actual versus Estimated O&M Costs

	FY2012	FY2013	FY2014	FY2015	FY2016	5-Year Total
Total Actual O&M Costs ($)	33,984	24,976	7,692	7,844	16,274	90,770
Total ROD Estimated Direct O&M Costs * ($)	16,212	2,900	2,900	2,900	2,900	27,812

*Costs for preparation of the Fourth Five-Year Remedy Review were accounted for in FY2012.

Table H-4. Groundwater Monitoring Results Compared to MZCLs and MCLs

STATION ID	PCE		TCE	
	2015 Result	MZCL*/MCL	2015 Result	MZCL*/MCL
KRP 4	0.86 J	43*/5	ND	61*/5
KRP 5	ND	43*/5	ND	61*/5
KRP 6	ND	43*/5	ND	61*/5
KRP 7	ND	5	ND	5
KRP 8	0.79 J	43*/5	ND	61*/5
KRP 9	5.41	43*/5	5.45	61*/5
KRP 10C	SS	5	SS	5
KRP 10D	ND	5	ND	5
KRP 11C	SS	5	SS	5
KRP 11D	ND	5	ND	5
KRP 12C	SS	5	SS	5
KRP 12D	SS	5	SS	5
KRP 13D	SS	5	SS	5
KRP 15C	SS	5	SS	5
KRP 15D	SS	5	SS	5

MZCL*=Mixing Zone Contaminant Level; MCL= Maximum Contaminant Level; ND= Non-detect; J= Estimated Value
SS= Sampling of well suspended under optimized sampling network

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit

I. SITE INFORMATION			
Site Name:	**K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit**	**Date of Inspection:**	**8/31/2016**
Location and Region	**SRS, USEPA Region 4**	**CERCLIS #:**	**#40**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Clear 93°F**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other MNA

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Staff: Steve Willingham (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

II. INTERVIEWS ***(Click all that apply)(Continued)***

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for K-Area Burning Rubble Pit (131-K) and Rubble Piles (631-20G)*, ER-IDS-019-015.

_____

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: OU-specific perimeter fencing is not required by the remedial action.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs and monuments are in good condition.

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Brian Hennessey (Name) FFA Program Manager (Title) 11/21/2016 (Date) 803-952-8365 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks: Inspections for KBRP/KRP OU performed between FY2012 and FY2016 identified active ant mounds and hog damage on soil covers. These findings were resolved soon after discovery.

VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks: Vegetation is mowed routinely.

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

- ☐ Wet areas ☐ Location shown on site map Areal extent _____
- ☐ Ponding ☐ Location shown on site map Areal extent _____
- ☐ Seeps ☐ Location shown on site map Areal extent _____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*				
D. Cover Penetrations	☒ Applicable	☐ N/A		
1. Gas Vents:	☐ Active	☐ Passive		
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration	☐ Needs maintenance	☒ N/A		
Remarks:				
2. Gas Monitoring Probes:				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration	☐ Needs maintenance	☒ N/A		
Remarks:				
3. Monitoring Wells:				
☒ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration	☐ Needs maintenance	☐ N/A		
Remarks:				
4. Leachate Extraction Wells:				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration	☐ Needs maintenance	☒ N/A		
Remarks:				
5. Settlement Monuments:	☐ Located	☐ Routinely Surveyed	☒ N/A	
Remarks:				
E. Gas Collection and Treatment	☐ Applicable	☒ N/A		
F. Cover Drainage Layer	☐ Applicable	☒ N/A		
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A		
H. Retaining Walls	☐ Applicable	☒ N/A		
I. Perimeter Ditches/Offsite Discharge	☐ Applicable	☒ N/A		
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A		

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: _____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks: _____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

C. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

D. Monitored Natural Attenuation ☒ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Monitored Natural Attenuation ☒ Applicable ☐ N/A

The MNA program and monitoring well network provides sufficient data to assess the progress of natural attenuation within the groundwater. The remedy is performing as designed.

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is installation of a soil cover over KBRP and KRP with institutional controls (i.e., LUCs) and Monitored Natural Attenuation for the water table aquifer groundwater. The remedy is fully established and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Institutional controls (i.e., LUCs) will maintain future industrial use through implementation of a Land Use Control Implementation Plan and include: (1) physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); (2) administration controls that maintain this site for industrial use only (SRS is a secured government facility with land use restrictions); and (3) warning signs and land use controls (SRS Site Use/Site Clearance Program).
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

M-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-51G AND 904-112G) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the M-Area Hazardous Waste Management Facility (904-51G and 904-112G) (MHWMF) Operable Unit (OU). The review was conducted from August 2016 through November 2016. Contaminants have been left in place at the MHWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the MHWMF OU is protective of human health and the environment. This report documents the results of the review.

The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document.

II. OU Chronology

Table I-1 lists the chronology of site events for the MHWMF OU.

III. Background

MHWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the MHWMF OU is soil. Groundwater is not addressed under this OU. Per the Interim Action Record of Decision (IROD) (WSRC 1992), the MHWMF groundwater is being addressed under the A/M Area Groundwater OU.

Physical Characteristics

The MHWMF is located in M Area near the northwest edge of SRS (Figure I-1). The nearest site boundary is approximately 1,740 m (5,800 ft) northwest of this OU. The MHWMF has been designated as a source-specific OU within the A/M Area Fundamental Study Area. The MHWMF consists of an unlined surface impoundment known as the M-Area Settling Basin (904-51G) (MASB), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina Bay known as the Lost Lake (904-112G) (Figure I-2).

The MASB dimensions were approximately 99 m (325 ft) by 84 m (276 ft) (surface dimensions) by 5.1 m (17 ft) deep with a volumetric capacity of approximately 30.3 million liters (8 million gal). Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the MHWMF OU as being within an industrial area. The future land use for the MHWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The MASB was constructed in 1958 to settle out metals (primarily uranium, nickel, lead, and aluminum) discharged from M-Area manufacturing facilities for nuclear fuel components and research facilities. The manufacturing processes consisted of aluminum-forming and metal-finishing processes used to produce fuel and targets for the SRS reactors. Waste effluents were discharged from three production buildings and two support laboratories to the MASB through an underground process sewer line. Cracks in the sewer line allowed some of the effluent to leak into the ground, contaminating underlying soils. The pipeline was slip-lined in 1983 after the cracks were discovered. In July 1985, a

permitted wastewater treatment facility was placed in operation and discharges to the MASB were discontinued.

The volume of waste within the MASB was estimated to be 28,920 m^3 (37,800 yd^3). The volume of contaminated soils and dried sludge in the overflow ditch, seepage area, process sewer line, and Lost Lake was estimated to be 30,370 m^3 (39,700 yd^3).

Initial Response

Contamination was detected in groundwater, surface water, soil, sediments, and air and evaluated in a 1985 risk analysis, which was used to develop closure alternatives. Closure of the MHWMF OU was initiated in 1988. The MHWMF OU was closed by removal and treatment of any standing water remaining in the basin; discharge of effluent to the National Pollutant Discharge Elimination System permitted M-004 Outfall; excavation, dewatering, and stabilization of the basin sludge with Portland cement; placement, consolidation, and compaction of stabilized sludge in the basin; excavation of a portion of the process sewer line and the contaminated soils associated with the sewer line, drainage ditch, seepage area, and Lost Lake; placement and compaction of contaminated materials in the basin; construction of a low permeability cap over the MASB and restoration of the area. The drainage ditch soils were excavated and stabilized with cement in the basin during closure activities.

The MHWMF was certified closed in 1990 and was accepted by the South Carolina Department of Health and Environmental Control (SCDHEC) in 1991 as being in compliance with RCRA requirements.

Basis for Taking Action

The MHWMF was subject to closure under South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79-265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (SRNS 2000). Per the approved 2014 RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014), post-closure care is regulated under SCHWMR R.61-79-264. In addition, an ongoing

program of corrective action and groundwater monitoring at the MHWMF is administered through the 2014 RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014).

Characterization efforts prior to the IROD (WSRC 1992) indicated contamination was present in basin surface water, basin soil, basin sludge, overflow ditch soils/sediments, seepage area soils/sediments, and Lost Lake soils/sediments. The major contaminants identified were nitrate as nitrogen, phosphate, sulfate, chloride, sodium, aluminum, nickel, uranium, lead, trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane (SRNS 2000).

IV. Remedial Actions

Remedy Selection

As stated in the IROD (WSRC 1992), the remedial action objective (RAO) is to prevent the physical exposure to contaminants and mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

As stated in the IROD, the selected interim action remedy is the previous MHWMF RCRA preventative action of stabilization and placement of all contaminated materials under a low-permeability cap. Since the preventative action is protective to human health and the environment and satisfies CERCLA requirements, no further action under CERCLA is necessary for this source control OU.

Remedy Implementation

Implementation of the selected RCRA preventative action remedy (i.e., the RCRA preventative action) included the following activities:

- Dewatering of the basin;
- Treating and discharging the basin liquid to a permitted outfall;
- Stabilizing 28,820 m^3 (37,800 yd^3) of the dewatered basin sludge with Portland cement;

- Consolidating 30,370 m^3 (39,700 yd^3) contaminated materials by excavating a portion of the process sewer line and associated soils (842 m^3 [1,100 yd^3]) and contaminated soils from the overflow ditch (5,126 m^3 [6,700 yd^3]), the seepage area (7,497 m^3 [9,800 yd^3]) and areas of Lost Lake (16,907 m^3 [22,100 yd^3]) and transporting to the top of the stabilized sludge within the basin; and
- Installing a 0.97-hectare (2.4-acre) low permeability cover system over the MASB consisting of a layer of backfill, a 0.6-m (2-ft) layer of low permeability compacted kaolin clay with a permeability of 1E-07 cm/s or less, a 0.3-m (1-ft) drainage layer, geotextile filter fabric, topped with 0.6 m (2 ft) of vegetative cover (15-cm [6-in] of topsoil over 45-cm [18-in] of common fill), 15-cm (6-in) perforated drainage collection pipe, and stormwater conveyance system.

Current photos of the MHWMF OU are presented in Figure I-3

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Post-closure groundwater monitoring to verify that no unacceptable exposure to potential hazards posed by conditions at the OU occur in the future as required per the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014).
- Quarterly site inspections and site maintenance for a minimum of 30 years to maintain the integrity of the cover system, OU-specific perimeter fencing, signs, etc. Any necessary repairs will be made as part of the maintenance program.
- Institutional controls (i.e., land use controls [LUCs]) to restrict access to authorized personnel with appropriate training on applicable requirements and to preclude unauthorized access or intrusive activities through the SRS Site Use/Site Clearance program and SRS site security.

Costs associated with the selected remedy for MHWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls (i.e., LUCs). The actual O&M cost

during FY2012 to FY2016 is $54,815. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost comparison is not provided in this remedy review.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at MHWMF are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls (i.e., LUCs).

Under the RCRA Hazardous and Mixed Waste Permit Renewal, additional corrective action was taken adjacent to and beneath the MASB. Dynamic Underground Stripping (DUS) injected steam into a 1.2-hectare (3-acre) footprint with target depths of 13.5 to 49.5 m (45 to 165 ft) and an estimated 339,802 m^3 (12 million ft^3) of soil to remediate. Heated solvent vapors were removed by soil vapor extraction. During operation between 2005 and 2012, the DUS system removed 207,485 kg (457,426 lbs of volatile organic compounds (VOC) contamination in the target area. In July 2013, post remediation soil samples were collected and the VOC soil results indicated that > 99% of the solvent mass (including dense non-aqueous phase liquids) was removed from the target zone. Elevated VOC concentrations are persistent in the vadose zone and groundwater outside of the target zone near the MASB, which will require additional corrective action to be taken under the direction of the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014).

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Confirmed implementation of the remedial action;

- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment I-1; and
- Ensured that all actions required under the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) were implemented (i.e., quarterly inspections and maintenance to the soil covers and groundwater monitoring).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and Steve Willingham, O&M staff member, on September 20, 2016 at the O&M organization offices. No issues were identified for the MHWMF during these interviews.

The MHWMF OU was inspected by Savannah River Site Nuclear Solutions, LLC (SRNS) and USDOE personnel on November 2, 2016. No issues were identified for the MHWMF OU during this inspection. The MHWMF OU was inspected by U.S. Environmental Protection Agency (USEPA) and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on February 28, 2017. No significant problems regarding this OU were identified during the inspection.

Quarterly site inspections conducted from FY2012 to FY2016 identified overgrown vegetation, active ant mounds, and hog damage on the soil cover. These issues were resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, applicable or relevant and appropriate requirements (ARARs), the results of the site inspection, and subsidence monitor surveys indicates that the remedy is functioning as intended by the IROD (WSRC 1992). The stabilization and placement of all contaminated materials (process sewer line and associated soils, contaminated soils from the seepage area and areas of Lost Lake) under the low permeability cover has achieved the purpose of the interim action, as stated in the IROD, to minimize migration

of contaminants to the groundwater (WSRC 1992). The effective implementation of institutional controls (i.e. LUCs) has prevented exposure to, or ingestion of, contaminated soils, sediments, groundwater, and surface waters.

O&M of the cover system has, on the whole, been effective based on the review of inspection reports as documented in Section VI.

There were no opportunities for optimization observed during this review.

The institutional controls (i.e., LUCs) that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions); OU-specific perimeter fencing and warning signs; and LUCs (SRS Site Use/Site Clearance Program). No activities were observed that would have violated the institutional controls (i.e., LUCs).

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). Therefore, a Land Use Control Implementation Plan is not required for this OU.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Groundwater will be discussed in the five-year remedy reviews for the A/M Groundwater.

There have been no changes in exposure pathways, land use or contaminant characteristics. While no chemical specific soil remedial goals were set forth in the IROD (WSRC 1992), the remedy has eliminated the exposure pathway associated with soils.

The ARARs discussed in the IROD (WSRC 1992) for this limited action focus on the design and construction of the remedial action which was completed in 1990. Based on

the review of this OU, the requirements of the ARAR that sets forth the performance standards for the cover system (i.e., long-term minimization of migration of contaminants, function with minimum maintenance) continue to be met.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the MHWMF OU under CERCLA.

X. Protectiveness Statement(s)

The remedy at the MHWMF OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by maintenance of the low-permeability clay cover system with institutional controls (i.e., LUCs), environmental monitoring, and site inspections to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. LUCs include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the MHWMF OU for

industrial use only, OU-specific perimeter fencing and warning signs, and use restrictions via the SRS Site Use/Site Clearance Program. No activities were observed that would have violated the LUCs.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SCDHEC, 2014. *South Carolina Department of Health and Environmental Control Hazardous and Mixed Waste Permit, Permit Number SC1 898 008 989, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, Module III - Postclosure Care and Module IV – Groundwater Requirements, Section A, M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC

SRNS, 2000. *2000 RCRA Part B Permit Renewal Application (U), Volume III, M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities (M-Area and Met Lab HWMFs) Postclosure*, WSRC-IM-98-30, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1992b. *Interim Action Record of Decision Remedial Alternative Selection M-Area Hazardous Waste Management Facility Operable Unit*, WSRC-RP-92-743, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – M-Area Settling Basin Post Closure Inspection (U),* ER-SOP-012, Inspection period 2012 through 2013 (quarterly)

Various - *Inspection Data Sheets – Field Inspection Checklist, M-Area HWMF Post Closure Inspection (U),* ER-IDS-019-022, Inspection period 2014 through 2016 (quarterly)

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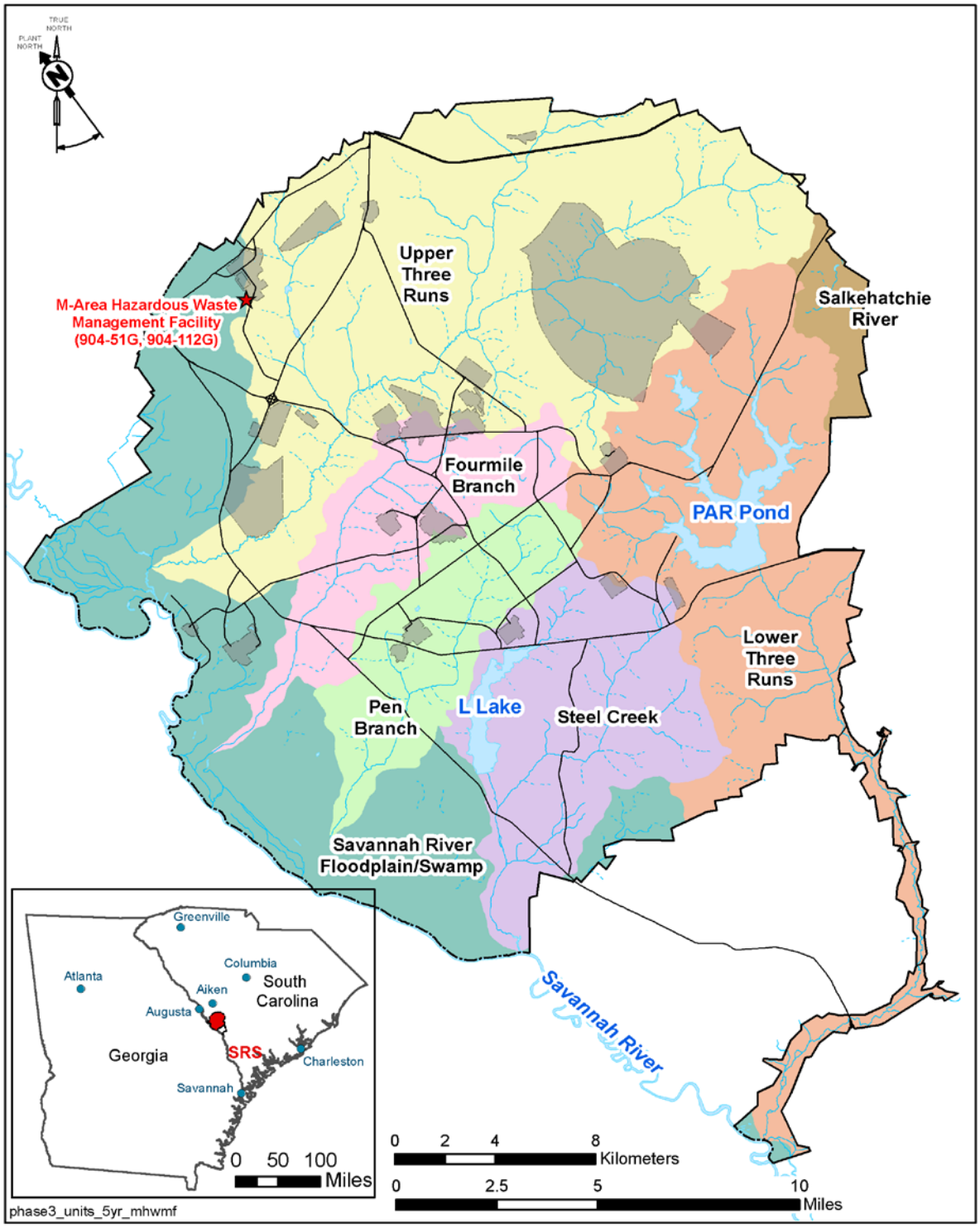

Figure I-1. Location of M-Area HWMF at SRS

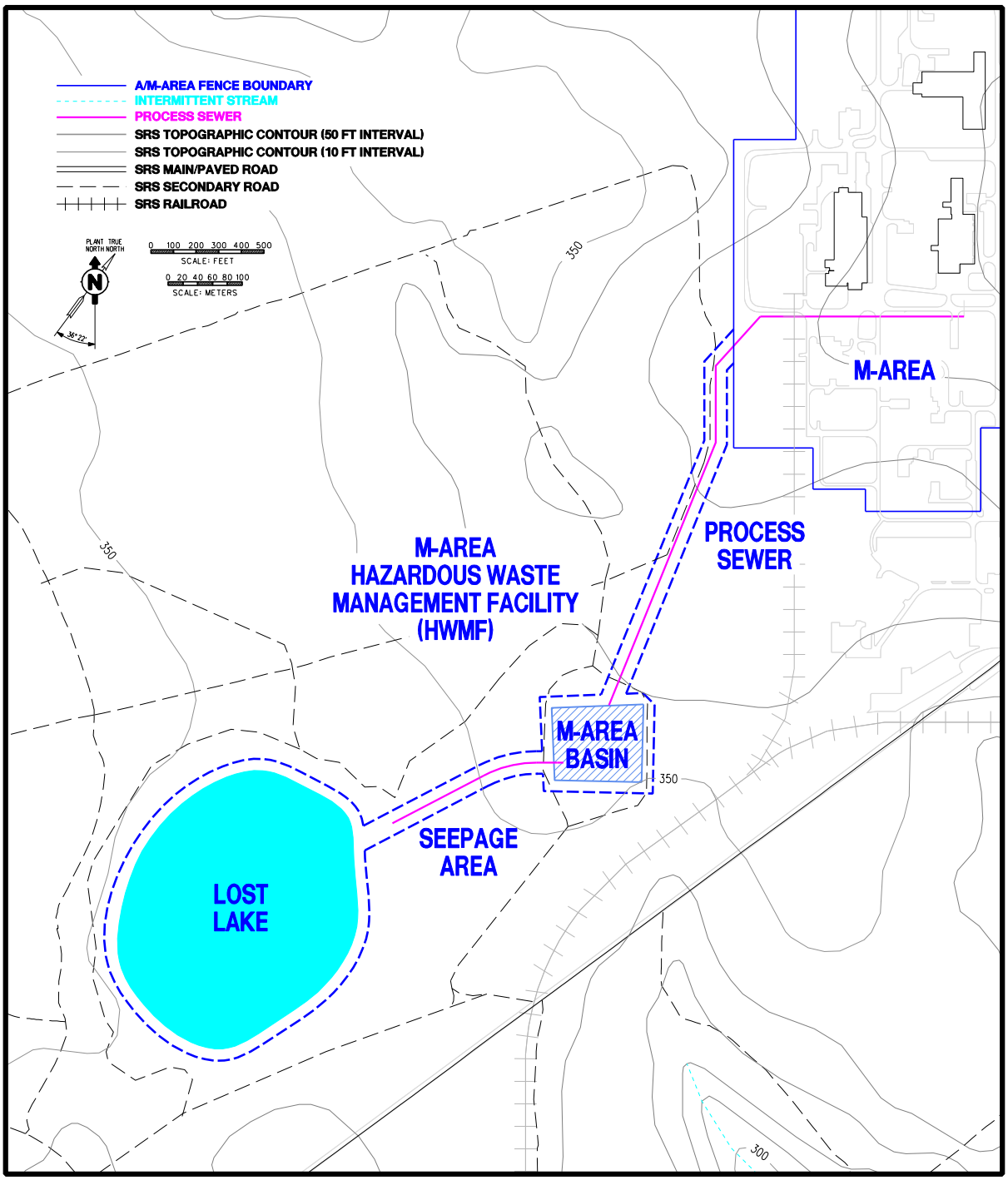

Figure I-2. Site Layout for M-Area HWMF

Figure I-3. Photographs of the M-Area HWMF at the SRS (2016)

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Table I-1. Chronology of OU Events

Event	Date
RCRA Closure Plan Approved	1987
Corrective Action Start	1988
RCRA Closure Completed	1990
IROD Issuance	September 6, 1992
Previous Five-Year Reviews Issuance	June 30, 1997 / * / January 29, 2009 / February 4, 2014

*No review was conducted in 2004 due to an oversight.

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Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU

I. SITE INFORMATION			
Site Name:	**M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU**	**Date of Inspection:**	**9/01/2016**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #1**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Partly Cloudy 90°F**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Consolidation, Waste Stabilization, Excavation, Disposal

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Staff: Steve Willingham (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

4. Other Interviews *(Optional):* ☐ Report Attached _____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *M-Area Settling Basin Post Closure Inspection*, ER-SOP-012 (FY2012 through FY2013), *Field Inspection Checklist for M-Area Hazardous Waste Management Facility, 904-51G*, ER-IDS-019-022 (FY2014 through FY2016)

Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Other Permits	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: RCRA Hazardous and Mixed Waste Permit Renewal

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is discussed in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From: (Date)	To: (Date)	(Total Cost)	
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: ____________

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: OU-specific perimeter fencing is required by the remedial action. The perimeter fence is in good condition.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Jasmin Selby (Name) | IACD Project Manager (Title) | 11/02/2016 (Date) | 803-952-7680 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks: Site inspections conducted during FY2012 through FY2016 identified overgrown vegetation, active ant mounds, and hog damage on the soil cover. These issues were resolved soon after discovery.
VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent _____ Depth _____ Remarks:
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent _____ Depth _____ Remarks:
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent _____ Depth _____ Remarks:
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress Areal extent _____ Depth _____ Remarks: Vegetation is mowed routinely.

Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
C. Letdown Channels ☐ Applicable ☒ N/A (Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)
D. Cover Penetrations ☐ Applicable ☒ N/A
E. Gas Collection and Treatment ☐ Applicable ☒ N/A

Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
F. Cover Drainage Layer ☒ Applicable ☐ N/A
1. Outlet Pipes Inspected: ☒ Functioning ☐ N/A Remarks:
2. Outlet Rock Inspected: ☐ Functioning ☒ N/A Remarks:
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
H. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A
1. Siltation: ☐ Location shown on site map ☒ Siltation not evident Areal extent _____ Depth _____ Remarks:
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☒ Vegetation does not impede flow Areal extent _____ Type _____ Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent _____ Depth _____ Remarks:
4. Discharge Structure: ☐ Location shown on site map ☒ N/A Remarks:
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
X. OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Consolidation, Stabilization, Excavation, Disposal ☒ Applicable ☐ N/A Consolidation, stabilization, excavation, and disposal were performed at MHWMF. The remedy is performing as designed.

Attachment I-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility (904-51G and 904-112G) OU *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The remedy of stabilizing the basin contents, consolidating contaminated materials in the basin, and installing and maintaining a low permeability cap was designed and implemented to prevent physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater. The cover system is intact, long term grasses have been fully established. Soil cover system remedy is functioning as designed. Drainage channels are functioning adequately.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of quarterly site inspections and site maintenance (repair of erosion damage, cover system, fencing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs and fencing is good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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METALLURGICAL LABORATORY HAZARDOUS WASTE MANAGEMENT FACILITY (904-110G) OPERABLE UNIT

I. Introduction

This report is the fifth five-year review for the Metallurgical Laboratory Hazardous Waste Management Facility (904-110G) (Met Lab HWMF) Operable Unit (OU). The review was conducted from August 2016 through November 2016. Contaminants have been left in place at the Met Lab HWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the Met Lab HWMF OU is protective of human health and the environment. This report documents the results of the review.

The remedy for the Met Lab is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document.

II. OU Chronology

Table J-1 lists the chronology of site events for the Met Lab HWMF OU.

III. Background

The Met Lab HWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) for SRS (FFA 1993). The media associated with the Met Lab HWMF OU is soil. Groundwater is not addressed under this OU. Per the Interim Action Record of Decision (IROD) (WSRC 1992), the Met Lab HWMF groundwater is being addressed under the A/M Area Groundwater OU.

Physical Characteristics

The Met Lab HWMF OU is located in M Area of the SRS near the northwest edge of SRS (Figure J-1). The nearest site boundary is located approximately 1.2 km (0.75 mi) northwest of this OU. The Met Lab HWMF has been designated as a source-specific OU within the Upper Three Runs Watershed.

The Met Lab HWMF OU is located in the eastern portion of the A/M-Area Central Sector (Figure J-2). The OU includes the unlined Met Lab Basin, the abandoned portion of the influent process sewer line, an associated Carolina Bay, and the A-008 drainage outfall to the bay (Figure J-3). The Met Lab Basin dimensions are approximately 27 m (90 ft) by 36 m (120 ft) by 1.5 m (5 ft) deep. The Carolina Bay is a marshy, oval-shaped natural depression that covers approximately 2.4 hectares (6 acres).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the Met Lab HWMF OU as being within an industrial area. The future land use for the Met Lab HWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The Met Lab Basin began receiving effluent from the Savannah River Laboratory Equipment Engineering Division Metallurgical Laboratory in 1956. The effluent consisted primarily of noncontact cooling water (water that did not contact process operations) and small quantities of laboratory rinse water containing hazardous substances. The historic wastewater discharge rate to the Met Lab Basin was estimated to be 3.8 m^3/day (5 yd^3/day). Discharges to the basin during the period from 1983 to November 8, 1985, consisted of nonhazardous effluent. All flow to the Met Lab Basin was terminated on November 8, 1985, when the process sewer line was plugged.

The Carolina Bay received wastes from three sources: (1) wastewater and surface water runoff overflow from the Met Lab Basin A-008 Outfall, (2) surface water runoff and cooling water from the A-Area coal-fired power plant and (3) A/M Area stormwater through the A-009 Outfall.

Initial Response

Contamination was detected in groundwater, basin surface water, soil, and basin sediments and evaluated in a risk assessment in 1985. The Met Lab HWMF OU was closed by removal and treatment of any standing water remaining in the basin, discharge of the effluent to the National Pollutant Discharge Elimination System (NPDES) permitted outfall, excavation, dewatering, placement, consolidation and compaction of stabilized sludge in the basin, and excavation of a portion of the process sewer line and contaminated soils associated with the sewer line. The Met Lab HWMF closure plan was submitted and approved by SCDHEC in June 1991. The Met Lab Basin closure was certified on July 17, 1992.

Characterization of the Met Lab Carolina Bay for human health risks was completed in 1991 and for ecological risks in 1993. Surface sediments and soil to a depth of 0.6 m (2 ft) were contaminated with metals and organics. Risks were found to be acceptable and no further remedial action was required.

The Met Lab HWMF underlying groundwater is being addressed under the A/M Area Groundwater OU and is not included in this review.

Basis for Taking Action

On September 24, 1985, the Natural Resources Defense Council and others filed a complaint against USDOE concerning the Met Lab Basin and neighboring Carolina Bay. The associated lawsuit resulted in a Consent Decree in June 1988 which mandated that the Met Lab HWMF and associated Carolina Bay were subject to RCRA (WSRC 1992). The Met Lab HWMF OU was subject to closure under South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.265. Closure of the basin was conducted as a landfill without excavation of soil from the basin (WSRC 1991).

At the time of the IROD, no contaminants of concern (COCs) were identified, though previous characterization efforts indicated contamination was present in groundwater, basin surface water, soil, and basin sediments. Detected contaminants in the basin and/or process sewer line sediments included sulfate, nitrate, cyanide, and metals (though all were substantially below the U.S. Environmental Protection Agency [USEPA] Toxicity concentration criteria). Chlorinated solvents, specifically trichloroethylene (TCE) and tetrachloroethylene (PCE), were detected in both upgradient and downgradient wells (WSRC 1992)

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the Met Lab HWMF within the RCRA closure process. Preventative activities at the Met Lab HWMF became subject to CERCLA when SRS was placed on the National Priorities List in December 1989.

The remedial action objectives (RAOs), as documented in the IROD (WSRC 1992), are to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The selected interim action remedy is the previous Met Lab HWMF RCRA preventative action of no waste removal, excavation of the process sewer line and associated contaminated sediments, placement of all contaminated materials under a low-permeability cap and no action for the Carolina Bay. Since the preventative action is protective to human health and the environment and satisfies CERCLA requirements, no further action under CERCLA is necessary for this source control OU (WSRC 1992).

Remedy Implementation

Implementation of the selected interim action remedy (i.e., the RCRA preventative action) included the following activities:

- Sampling the accumulated rainwater in the basin;

- Treating and discharging excess water to a NPDES permitted outfall;
- Consolidating 344 m^3 (450 yd^3) of contaminated materials by excavating the process sewer line and associated soils and transporting to the top of the contaminated sediments in the basin; and
- Installing a 0.08-hectare (0.2-acre) low permeability cover system over the settling basin consisting of a layer of backfill, a 0.6-m (2-ft) layer of low-permeability compacted kaolin clay with a permeability of 1.0E-07 cm/s or less, a 0.3-m (1-ft) drainage layer, geotextile filter fabric, topped with 0.6 m (2 ft) of vegetative cover (15 cm [6 in] of topsoil over 45 cm [18 in] of common fill), and stormwater conveyance system.

A recent photograph of the unit is presented in Figure J-4.

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Post-closure groundwater monitoring to verify that no unacceptable exposure to potential hazards posed by conditions at the OU occur in the future as required per the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014).
- Quarterly site inspections for a minimum of 30 years to verify the integrity of the cover system, OU-specific perimeter fencing, signs, etc. Any necessary repairs will be made as part of the maintenance program.
- Institutional controls (i.e., land use controls [LUCs]) to restrict access to authorized personnel with appropriate training on applicable requirements and to preclude unauthorized access or intrusive activities through the SRS Site Use/Site Clearance program and SRS site security.

Costs associated with the selected remedy for Met Lab HWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls (i.e., LUCs). The

actual O&M cost during FY2012 to FY2016 is $46,905. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost comparison cannot be provided in this remedy review.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at Met Lab HWMF are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls (i.e., LUCs).

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment J-1; and
- Ensured that all actions required under the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) were implemented (i.e., quarterly inspections, annual subsidence survey reports and maintenance to the soil covers).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and Steve Willingham, O&M staff member, on September 20, 2016 at the O&M organization offices. No issues were identified for the Met Lab OU during these interviews.

The Met Lab HWMF OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel on November 2, 2016. No issues were identified for the Met Lab HWMF OU during this inspection. The Met Lab HWMF OU was inspected by

USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on February 28, 2017. No significant problems regarding this OU were identified during the inspection.

Quarterly field inspections conducted from FY2012 to FY2016 have identified active ant mounds on the soil cover, overgrown grass, trees blocking roads and drainage ditches, overgrown vines, and vegetation growing in drainage routes. All issues were resolved soon after discovery. The annual subsidence monitoring logs indicate the cap is performing within design tolerances.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, applicable or relevant and appropriate requirements (ARARs), the results of the site inspection, and subsidence monitor surveys indicates that the remedy is functioning as intended by the IROD. The consolidation of process sewer lines within the basin and under the low permeability cover has achieved the purpose of the interim action to minimize migration of contaminants to the groundwater from the basin sediments and sediments associated with the process sewer line (WSRC 1992). The effective implementation of institutional controls (i.e., LUCs) has prevented exposure to, or ingestion of, contaminated soils, sediments, groundwater, and surface waters.

O&M of the cover system has, on the whole, been effective based on the review of the inspection reports as documented in Section VI.

There were no opportunities for optimization observed during this review.

The institutional controls (i.e., LUCs) that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions); OU-specific perimeter fencing and warning signs; and use restrictions (SRS Site Use/Site Clearance Program). No activities were observed that would have violated the institutional controls (i.e., LUCs).

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). Therefore, a Land Use Control Implementation Plan is not required for this OU.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Two ARARs were identified in the IROD (WSRC 1992). The first, a NPDES permit modification for discharge of basin rainwater to an outfall to surface water, has been met as the construction of the cover system is completed. The second ARAR includes SCHWMR R.61-79.265 for RCRA equivalent performance standards for the cap design. The cap was designed to meet the ARAR. Based on the review of this OU, the requirements of the ARAR (i.e. long-term minimization of migration of contaminants, function with minimum maintenance) continue to be met. There have been no changes in standards or to-be-considered guidance identified in the IROD that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues that prevent the remedy for the Met Lab HWMF OU from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the Met Lab HWMF OU under CERCLA.

X. Protectiveness Statement(s)

The remedy at the Met Lab HWMF OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by maintenance of the low-permeability clay cover system with institutional controls (i.e., LUCs), environmental monitoring, and site inspections to prevent the physical exposure to contaminants and mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. LUCs include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the Met Lab HWMF OU for industrial use only, OU-specific perimeter fencing and warning signs, and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SCDHEC, 2014. *South Carolina Department of Health and Environmental Control Hazardous and Mixed Waste Permit, Permit Number SC1 898 008 989, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, Module III - Postclosure Care and Module IV – Groundwater Requirements, Section A, M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1991. *Metallurgical Laboratory Hazardous Waste Management Facility Closure Plan* WSRC-RP-92-423, Revision 5, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1992. *Interim Action Record of Decision Remedial Alternative Selection, Metallurgical Laboratory Hazardous Waste Management Facility Operable Unit (U),* WSRC-RP-92-745, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist, Metallurgical Laboratory HWMF Post Closure Inspection (U),* ER-IDS-019-020, Inspection Period 2012 to 2016 (quarterly)

Various - *Met Lab Settling Basin 904-110G Subsidence Monitor Survey Logs* for the period May 2012 through May 2016

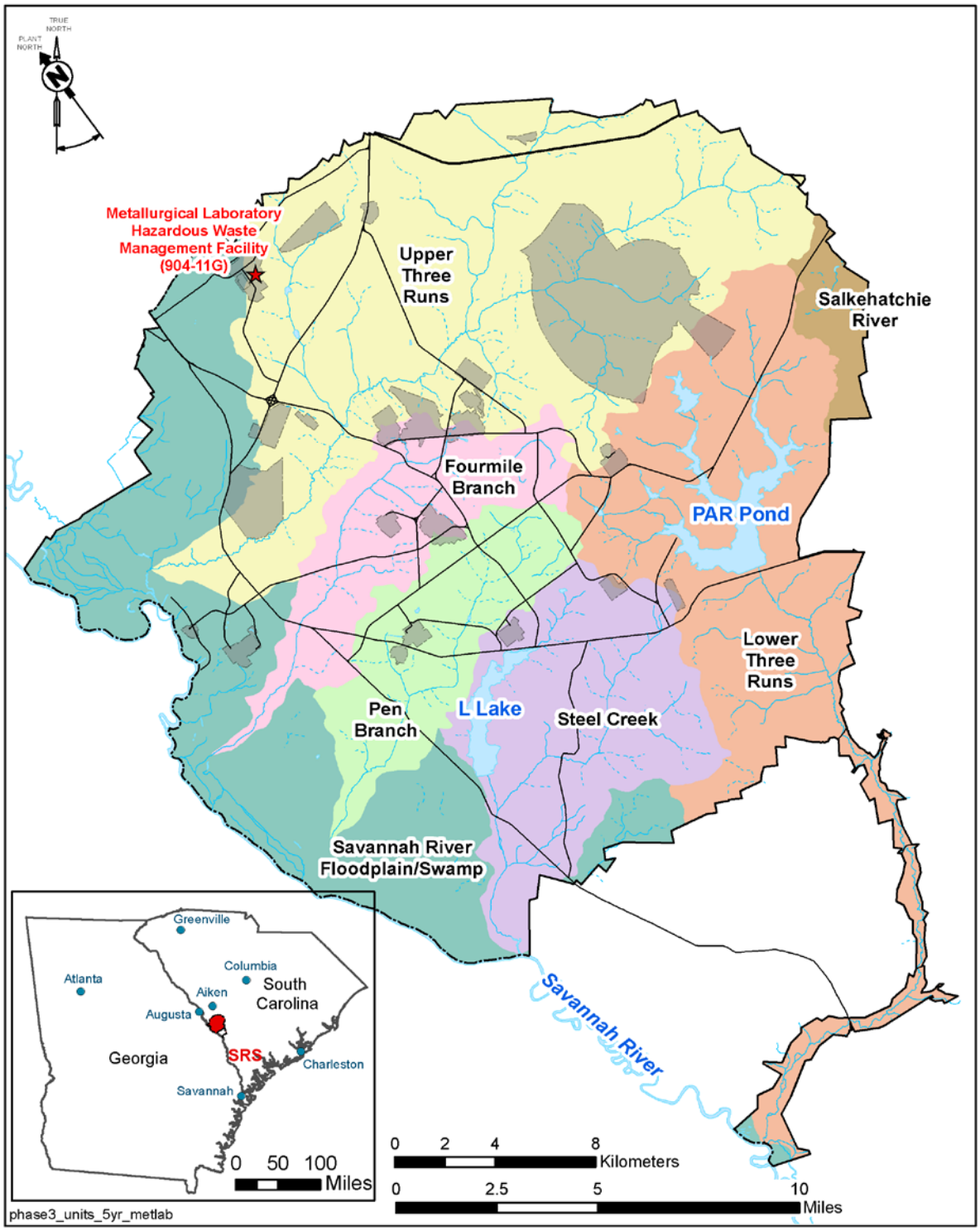

Figure J-1. Location of the Met Lab HWMF OU at SRS

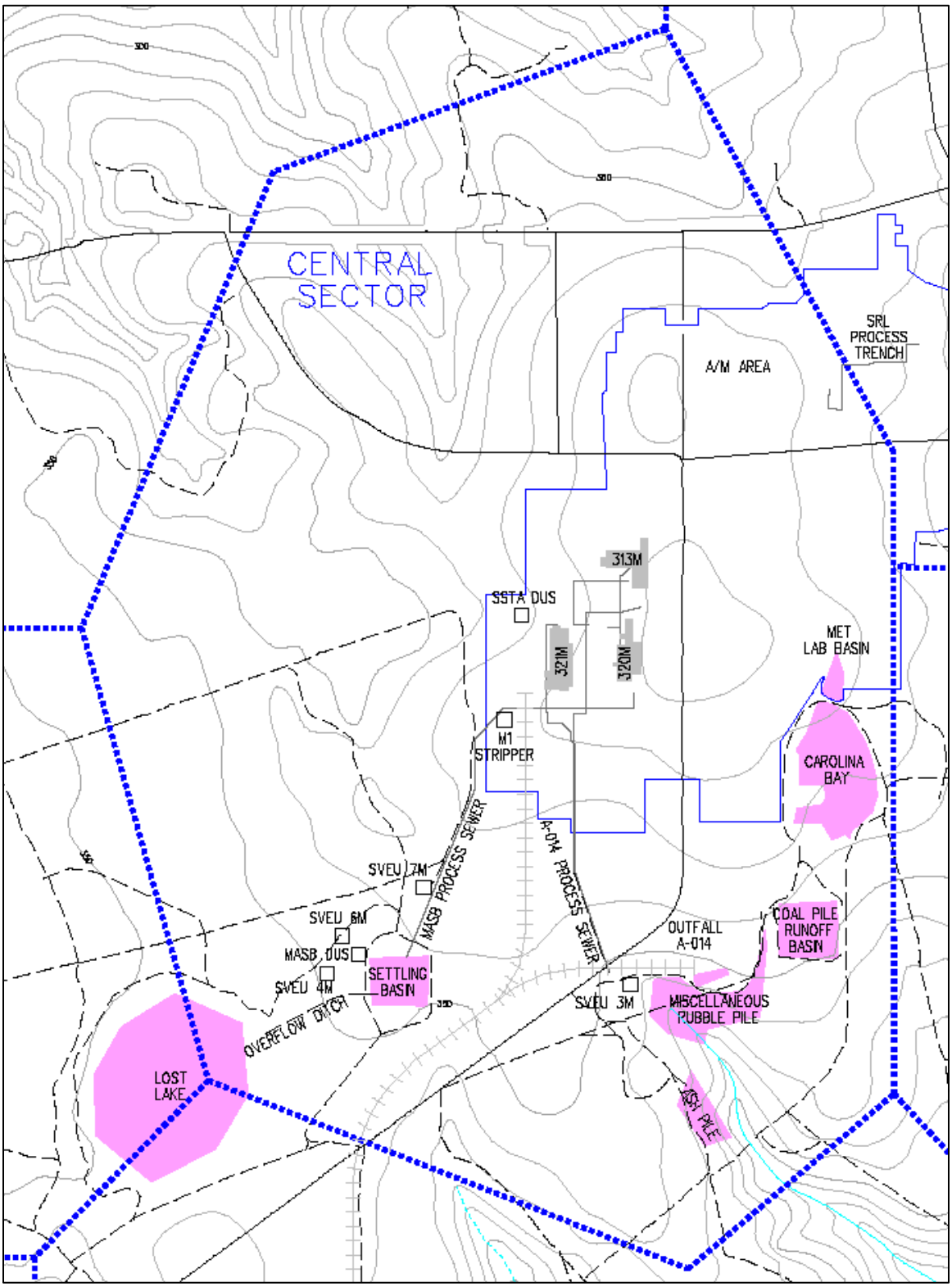

Figure J-2. Location of the Met Lab HWMF OU within the A/M Area Groundwater Central Sector at SRS

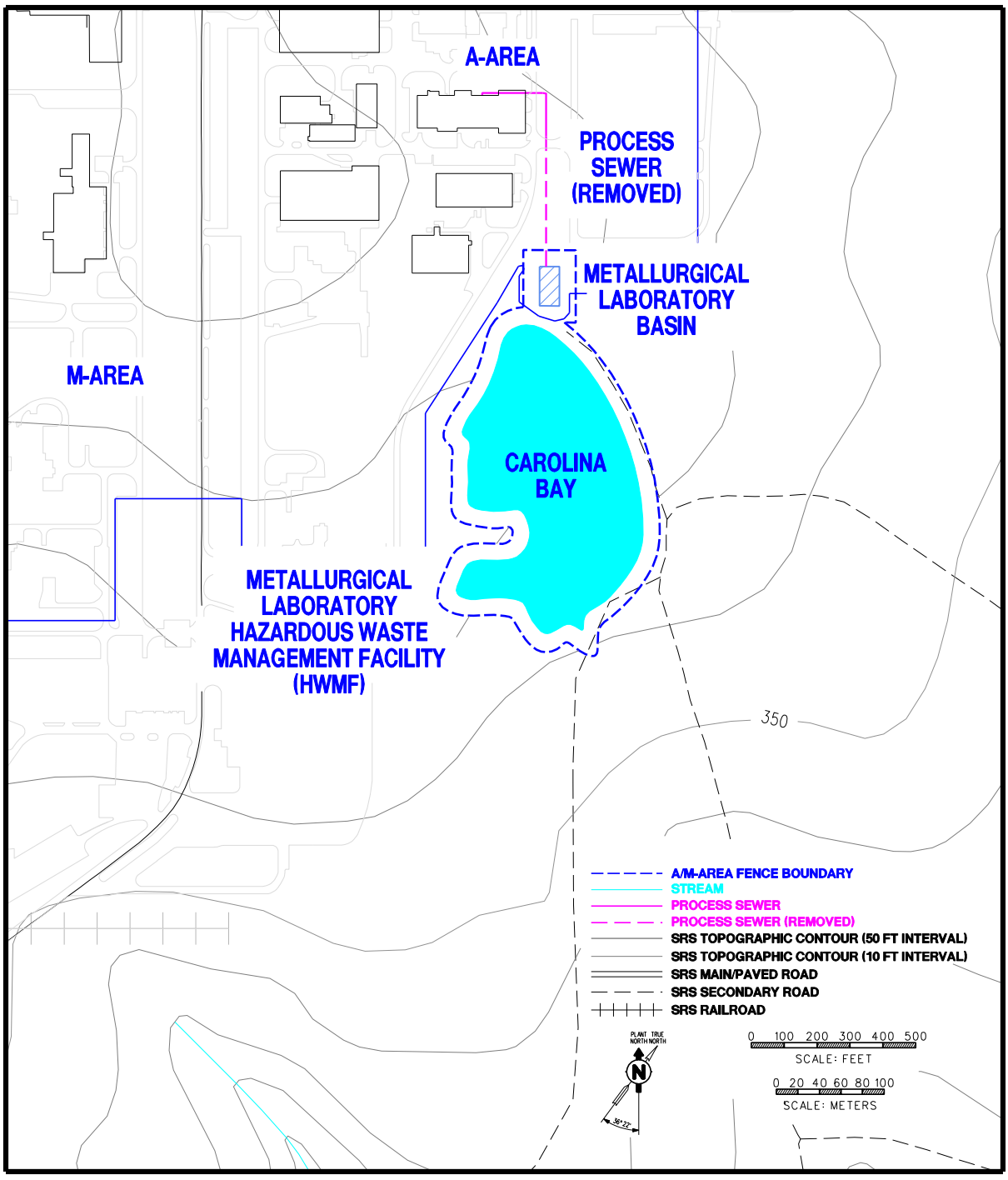

Figure J-3. Site Layout of Met Lab HWMF OU at SRS

Figure J-4. Photograph of the Met Lab HWMF OU Covered Basin (2016)

Table J-1. Chronology of OU Events

Event	Date
Corrective Action Start	1991
RCRA Closure Certified	June 1991
IROD Issuance	September 16, 1992
Previous Five-Year Reviews Issuance	August 27, 1997 / February 12, 2004 / January 29, 2009 / February 4, 2014

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Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU

I. SITE INFORMATION			
Site Name:	**Metallurgical Laboratory HWMF (904-110G) OU**	**Date of Inspection:**	**9/01/2016**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #2**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Partly Cloudy 90°F**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other **Consolidation,** Excavation, Disposal

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Staff:** Steve Willingham (Name); EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title); 9/20/2016 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name); EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title); 9/20/2016 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

4. Other Interviews *(Optional):* ☐ Report Attached _____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *Met Lab HWMF Field Inspection Checklist, ER-IDS-019-020* (quarterly)

Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201,HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is discussed in Section IV of this OU-specific review:

Total annual cost by year for review period, if available

From (Date)	To (Date)	(Total Cost)	
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: ______________________

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: OU-specific perimeter fencing is required by the remedial action. Perimeter fencing was in good condition.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Jasmin Selby (Name) | IACD Project Manager (Title) | 11/02/2016 (Date) | 803-952-7680 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey monuments were located and in good condition.

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks: Inspections conducted quarterly from FY2012 through FY2016 identified active ant mounds, overgrown grass, trees blocking roads and drainage ditches, overgrown vines, and vegetation growing in drainage ditches. These issues were resolved soon after discovery.
VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent Depth Remarks:
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths Widths Depths Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent Depth Remarks:
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent Depth Remarks:
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress Areal extent Depth Remarks: Vegetation is mowed routinely.

Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
C. Letdown Channels ☐ Applicable ☒N/A (Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)
D. Cover Penetrations ☐ Applicable ☒ N/A
E. Cover Drainage Layer ☒ Applicable ☐ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☒ N/A Remarks:_____
2. Outlet Rock Inspected: ☒ Functioning ☐ N/A Remarks:_____
F. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
G. Retaining Walls ☐ Applicable ☒ N/A

Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

H. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Consolidation, Excavation, Disposal ☒ Applicable ☐ N/A

Consolidation, Excavation, and Disposal were performed at Met Lab HWMF. The remedy is performing as designed.

Attachment J-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-110G) OU *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The remedy of stabilizing the basin contents, consolidating contaminated materials in the basin, and installing and maintaining a low permeability cap is designed to prevent physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater. The cover system is intact, long-term grasses have been fully established. The soil cover system remedy appears to be functioning as designed. Drainage channels are functioning adequately.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of quarterly site inspections and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs and fencing is good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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MIXED WASTE MANAGEMENT FACILITY (643-28E) OPERABLE UNIT

I. Introduction

This report is the fifth five-year review for the Mixed Waste Management Facility (643-28E) (MWMF) Operable Unit (OU). The review was conducted from August 2016 through November 2016. Contaminants have been left in place at the MWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the MWMF OU is protective of human health and the environment. This report documents the results of the review.

The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, no further remedial action is necessary under CERCLA.

II. OU Chronology

Table K-1 lists the chronology of site events for the MWMF OU.

III. Background

MWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) for SRS (FFA 1993). The media associated with the MWMF OU is soil.

Groundwater is regulated by the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) and is addressed in the MWMF Groundwater OU.

Physical Characteristics

The MWMF OU is located in the central portion of SRS between F- and H-Areas, approximately 8 km (5 mi) from the nearest site boundary (Figures K-1 and K-2). The MWMF is a source-specific OU within the Burial Ground Complex and within the Upper Three Runs Watershed. The MWMF consists of 118 slit trenches, one engineered low-level trench (ELLT), and a naval core barrel mound. This facility comprises approximately 23.5 hectares (58 acres).

The slit trenches are generally 6 m (20 ft) deep and 6 m (20 ft) wide with varying lengths up to 360 m (1200 ft). The trenches were spaced approximately 3 m (10 ft) apart. The trenches were backfilled with natural soil during landfilling operations to minimize the potential for fire and airborne releases. This practice was modified in 1985 with the initiation of ELLT operation, which consisted of stacking waste containerized in B-25 boxes (metal disposal containers, 1.2 m x 1.2 m x 1.8 m [4 ft x 4 ft x 6 ft] in dimension) in the trench completely before backfilling the trench. The dimensions of the ELLT are 40.2 m (134 ft) by 150 m (500 ft) by 6.6 (22 ft) deep. Approximately 9,600 B-25 boxes were placed in ELLT-1. An earthen mound was used for the disposal of naval reactor equipment.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the MWMF OU as being within an industrial area. The future land use for the MWMF OU is reasonably anticipated to remain industrial with U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The MWMF operated from 1969 until March 11, 1986. During that time, this facility received low-level radioactive waste materials produced at SRS. Some of these materials are classified under RCRA as mixed waste containing both hazardous and radioactive components. Waste from SRS was disposed of in the form of job control waste and sent to the MWMF (e.g., rags, gloves and coveralls, soil, construction debris, failed equipment, spent air filters, spent lithium-aluminum targets, irradiated scrap metal, naval reactor hardware, lead shielding, waste oil, scintillation fluids, cadmium, and silver-coated beryl saddles). The primary constituents of concern (COCs) are tritium, lead, trichloroethylene (TCE), and uranium.

Initial Response

RCRA preventive actions at the MWMF were conducted pursuant to the requirements of the RCRA per Settlement Agreement 87-27-SW.

Closure of the MWMF began in 1988, per the South Carolina Department of Health and Environmental Control (SCDHEC) approved closure plan (WSRC 1991) and was completed in December 1990. The MWMF was closed by compaction of the waste in place via dynamic compaction followed by placement of a protective low-permeability multi-layer cover system over the waste trenches to reduce rainwater contact with wastes.

The MWMF was certified closed in 1991 and was accepted by SCDHEC in April 1991 as being in compliance with RCRA requirements.

Basis for Taking Action

In 1984, SRS made an administrative decision to determine the extent of mixed waste deposited in the Low Level Radioactive Waste Disposal Facility (LLRWDF). Through researching of records and analysis of mixed wastes against RCRA regulations, SRS determined that the area within LLRWDF referred to as the MWMF contained mixed wastes.

A RCRA Closure Plan was submitted to SCDHEC in 1985 with approval in 1987. The RCRA preventive activities at the MWMF became subject to CERCLA when the entire SRS facility was placed on the National Priorities List in December 1989. A Part B Permit Application for Post-Closure Care was submitted in November 1992.

The COCs at the MWMF OU are barium, chloroform, cadmium, 1,1-dichloroethane, vinyl chloride, trans-1,2-dichloroethylene, phenol, aluminum, iron, manganese, carbon-14, lead, tritium, nickel, tetrachloroethylene, TCE, zinc, uranium-234/235, and uranium-238 (WSRC 1994). No remedial goals (RGs) were identified in the ROD for these constituents.

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the MWMF within the RCRA closure process in 1988. As documented in the MWMF OU ROD, the RCRA closure was selected as the final action under CERCLA. Therefore, no further action under CERCLA was necessary for the MWMF OU (WSRC 1994).

The closure design for the MWMF was consistent with requirements of: RCRA, 40 Code of Federal Regulation 265, South Carolina Hazardous Waste Management Regulations R.61-79.265, and USDOE Order 5820.2 Radioactive Waste Management.

The MWMF was closed according to the approved Closure Plan (WSRC 1991).

The remedial action objectives (RAOs) were to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The MWMF RCRA preventative action of placement of all contaminated materials under a low-permeability cap and institutional controls (i.e., Land Use Controls [LUCs]) satisfied both RAOs.

Remedy Implementation

Implementation of the selected final action remedy (i.e., the RCRA preventative action) included the following activities:

- Pre-compacting the waste by dynamic compaction to minimize future differential waste settlement;
- Backfilling after compaction to a level 1.5 m (5 ft) below the final cover elevations; and
- Placed a 23.5-hectare (58-acre) low permeability cover system over the waste trenches consisting of a layer of back fill, a 0.6-m (2-ft) layer of low-permeability compacted kaolin clay with a permeability of 1.0E-07cm/s or less, topped with 0.6 m (2 ft) of topsoil to support a vegetative cover, cap surface drainage and stormwater conveyance

system. Later in 1994, portions of the RCRA LLRWDF 5.3-hectare (13-acre) geosynthetic cover system was tied into the MWMF cover system.

Figure K-3 provides current photographs of the MWMF OU.

Systems Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Inspection and repair, as necessary, of the groundwater monitoring wells associated with the post-closure groundwater monitoring program for the MWMF.
- Quarterly site inspections for a minimum of 30 years to verify the integrity of the cover system, OU-specific perimeter fencing, signs, etc. Any repairs will be made as necessary to maintain the integrity and effectiveness of the initial cover including making repairs to the surface cap as necessary to correct the effects of settling, subsidence, erosion, or other events.
- Institutional controls (i.e. LUCs) to restrict access to authorized personnel with appropriate training on applicable requirements and preclude unauthorized access or intrusive activities through the SRS Site Use/Site Clearance program and SRS site security. The survey plat and records associated with deed restriction use of the MWMF have been filed with Aiken County.

Operation and maintenance (O&M) costs associated with the selected remedy for MWMF OU include costs of the soil cover inspection and maintenance, institutional controls (i.e. LUCs) and five-year remedy reviews. The actual O&M cost during FY2012 to FY2016 is $1,179,875. RCRA documentation does not require estimated project costs to be prepared. Therefore, actual cost data comparison to estimated cost data is not included in this remedy review.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at MWMF OU are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls (i.e., LUCs) in place while USDOE controls the OU.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment K-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Ensured that all actions required under the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) were implemented (i.e., quarterly inspections and maintenance to the soil covers and groundwater monitoring).

Data Review

Groundwater

Fact sheets provided on the U.S. Environmental Protection Agency (USEPA) webpage regarding emerging contaminants were reviewed for applicability to this site. Due to the presence of chlorinated solvents at the MWMF, 1,4-dioxane was identified as a potential contaminant and has been sampled dating back to 1992. As shown in Figure K-4, 1,4-dioxane has been detected in the Southwest Plume (SWP) and will be addressed as part of the MWMF Groundwater OU. It is co-mingled with the tritium plume.

The low permeability cap over the Old Radiological Waste Burial Ground (ORWBG) has reduced the tritium concentration in the SWP by approximately 40%. The groundwater is managed under the MWMF RCRA permit. It is expected that the concentration of chlorinated solvents and 1,4-dioxane will eventually be reduced due to the effects of the cap (SRNS 2012).

The current phytoremediation/spray irrigation system operating in the SWP to address the tritium appears to be curtailing expansion of the 1,4-dioxane plume. 1,4-dioxane is prone to volatilization and photo-oxidation in air (7 to 10 hour half-life, maximum lifetime of 23 hours) in a spray irrigation setting. The remedial approach for the 1,4-dioxane is described in the 2013 RCRA Permit Renewal Application for the MWMF (SRNS 2015).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and Steve Willingham, O&M staff member, on September 20, 2016, at the O&M organization offices. No issues were identified for the MWMF OU during these interviews.

The MWMF OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel on November 22, 2016. No issues were identified for the MWMF OU during this inspection and interviews. A site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on February 22, 2017. No significant problems regarding MWMF OU were identified during the inspection.

Quarterly site inspections conducted from FY2012 through FY2016 identified active ant mounds, vegetation/grass that needed cutting/mowing, plugged weep holes and small cracks/chips in concrete associated with the drainage channels. All findings were addressed shortly after discovery. As part of drainage enhancements implemented by USDOE, the previously existing one inch weep holes were replaced with a French style drainage system that feeds into a three inch pipe. This design should prevent future clogging. Additionally, USDOE is repairing and cleaning the concrete associated with the drainage channels to ensure ongoing protectiveness. This work is scheduled to be completed by 2017. There was one instance of subsidence noted on Trench Area 2 (August

2014) and it was repaired by the US Forest Service. Review of the annual survey of the MWMF subsidence monitors for the period FY2012 through FY2016 indicate all surveyed monuments are within the design/baseline tolerances, providing evidence that the cover system integrity is intact. Inspection reports, survey reports, and maintenance data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD (WSRC 1994). Placement and maintenance of a protective multi-layer cover system over the MWMF OU breaks the contaminant migration pathway to the groundwater and facilitates meeting the RAOs to prevent physical exposure to the contaminants and mitigating further migration of contaminants to the groundwater. As shown in Figure K-5, there are multiple operating and closed facilities in close proximity to the MWMF OU. Contamination emanating from the ORWBG and other Burial Ground Complex subunits has been identified to be commingled with contamination from the MWMF OU (SRNS 2013). The close proximity of these facilities and similarity of potential contaminants adds to the complexity of identification of the precise sources of groundwater contamination within this large area.

O&M of the cover system has, on the whole, been effective based on the review of the maintenance inspections reports presented in Section VI.

There are no opportunities for optimization observed during this review.

The institutional controls (i.e., LUCs) that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions); OU-specific perimeter fencing and warning signs; and use

restrictions (SRS Site Use/Site Clearance Program). No activities were observed that would have violated the institutional controls (i.e., LUCs).

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). Therefore, a Land Use Control Implementation Plan is not required for this OU.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of final remedy selection are still valid. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

As the remedial work has been completed, the applicable standards, set forth in the ROD (WSRC 1994) and RCRA closure plan (WSRC 1991), have been met. All standards and To-Be-Considered values associated with groundwater will be addressed as part of the MWMF Groundwater OU. Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. 1,4-dioxane was identified in 1992 and was added to the Groundwater Protection Standards for the SWP emanating from the MWMF (SRNS 2013). SRS has been investigating various methods of potentially treating 1,4-dioxane. The 2013 RCRA Renewal Application (SRNS 2015) describes the corrective action for 1,4-dioxane. None of the other listed emerging contaminants were identified as applicable to this OU.

There have been no changes in exposure pathways, land use or contaminant characteristics. While no chemical specific soil RGs were set forth in the ROD (WSRC 1994), the remedy has eliminated the exposure pathway associated with soils and compacted waste.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues for the MWMF OU.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the MWMF OU under CERCLA.

X. Protectiveness Statement(s)

The remedy at the MWMF is protective of human health and the environment.

Exposure pathways that could result in unacceptable risk are being controlled by the low-permeability clay cover system and institutional controls (i.e., LUCs). LUCs include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions), OU-specific perimeter fencing and warning signs, and land use restrictions via the SRS Site Use/Site Clearance Program. In addition, exposure pathways associated with the groundwater contamination are being actively monitored and/or remediated as part of the MWMF Groundwater OU.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SCDHEC, 2014. *South Carolina Department of Health and Environmental Control Hazardous and Mixed Waste Permit, Permit Number SC1 898 008 989, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, Module IV - Postclosure Care and Module IV – Groundwater Requirements, Section D, Mixed Waste Management Facility*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC

SRNS, 2012. *Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility and the Mixed Waste Management Facility (U)*, SRNS-RP-2012-00045, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *2013 RCRA Permit Renewal Application: Mixed Waste Management Facility (MWMF) Post Closure*, SRNS-IM-2012-00002, Volume VII, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2015. *2013 RCRA Permit Renewal Application: Mixed Waste Management Facility (MWMF) Post Closure*, SRNS-IM-2012-00002, Volume VII, Revision 2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2016. *Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste management Facility, and the Mixed Waste Management Facility (U)*, SRNS-RP-2016-00106, Volume I, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1991. *Mixed Waste Management Facility (MWMF) Closure Plan*, Revision 4, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1994. *Final Record of Decision Remedial Alternative Selection for Mixed Waste Management Facility (U)*, WSRC-RP-93-1511, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist, Mixed Waste Management Facility Post Closure Inspection (U)*, ER-IDS-019-018, Inspection Period 2014 to 2016 (quarterly)

Various - Inspection Data Sheets – *Mixed Waste Management Facility Post Closure Inspection (U)*, ER-SOP-006, Inspection Period 2012 to 2013 (quarterly)

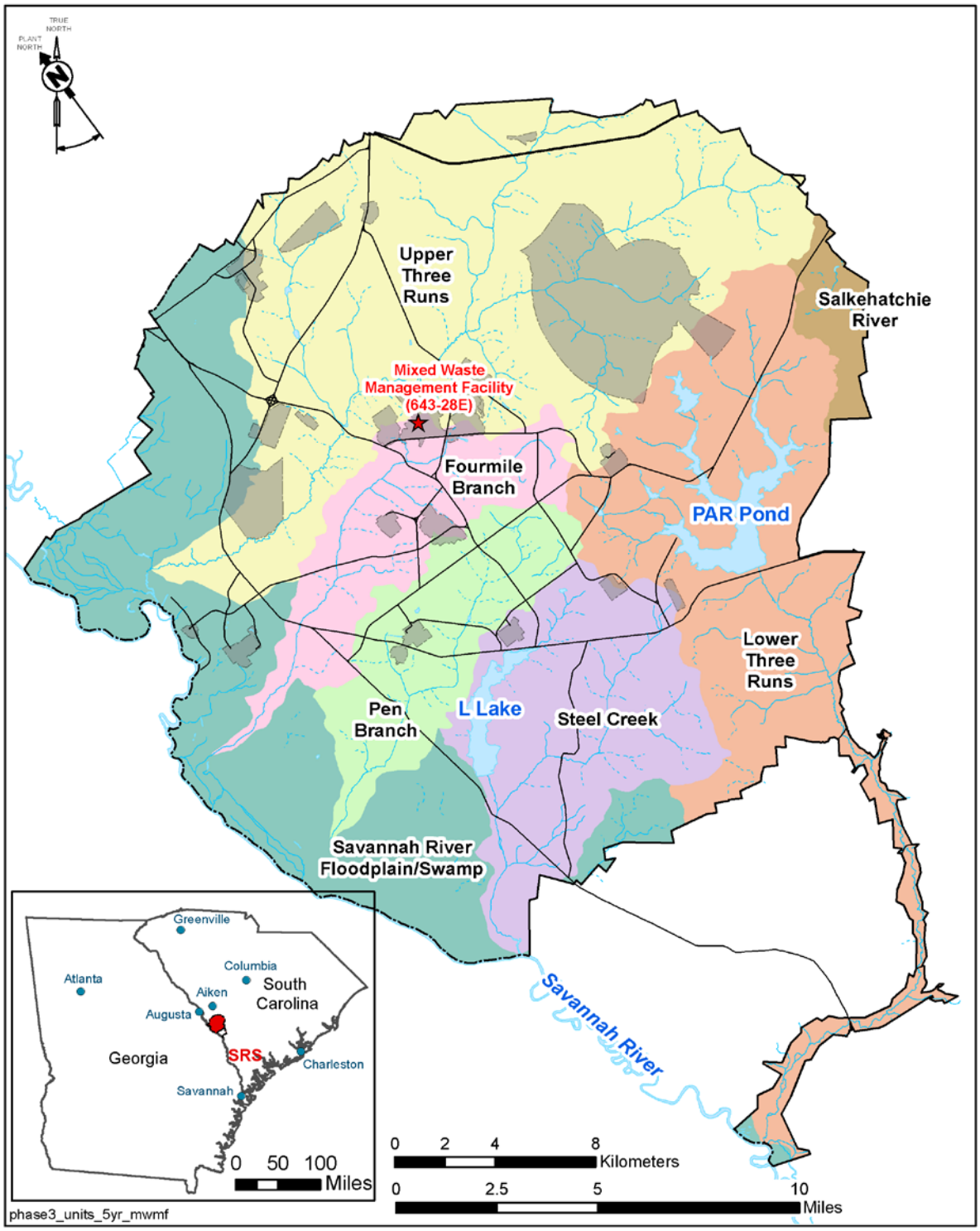

Figure K-1. MWMF OU at SRS

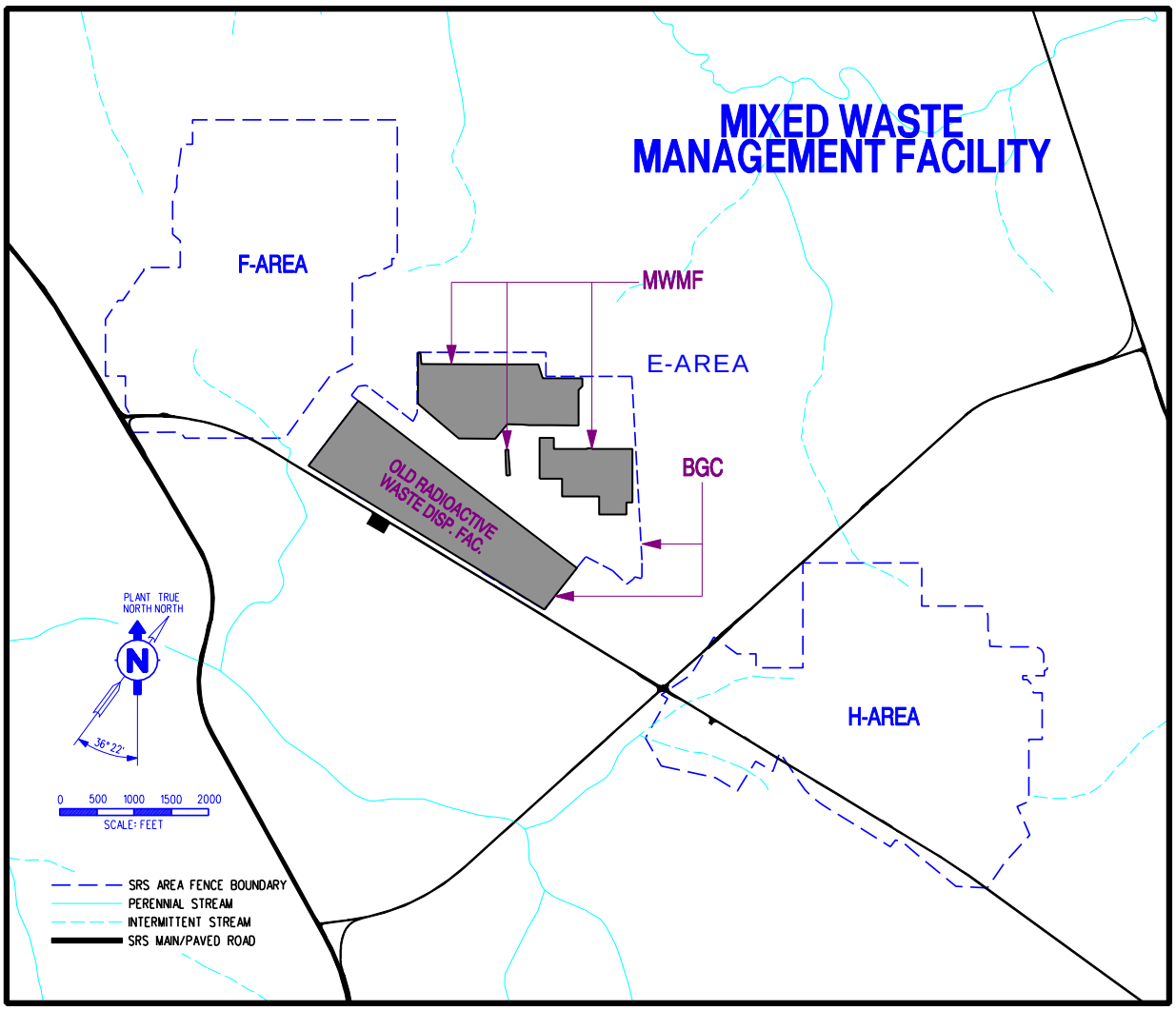

Figure K-2. Site Layout of MWMF OU

Figure K-3. Current Surface Photographs of the MWMF OU (2016)

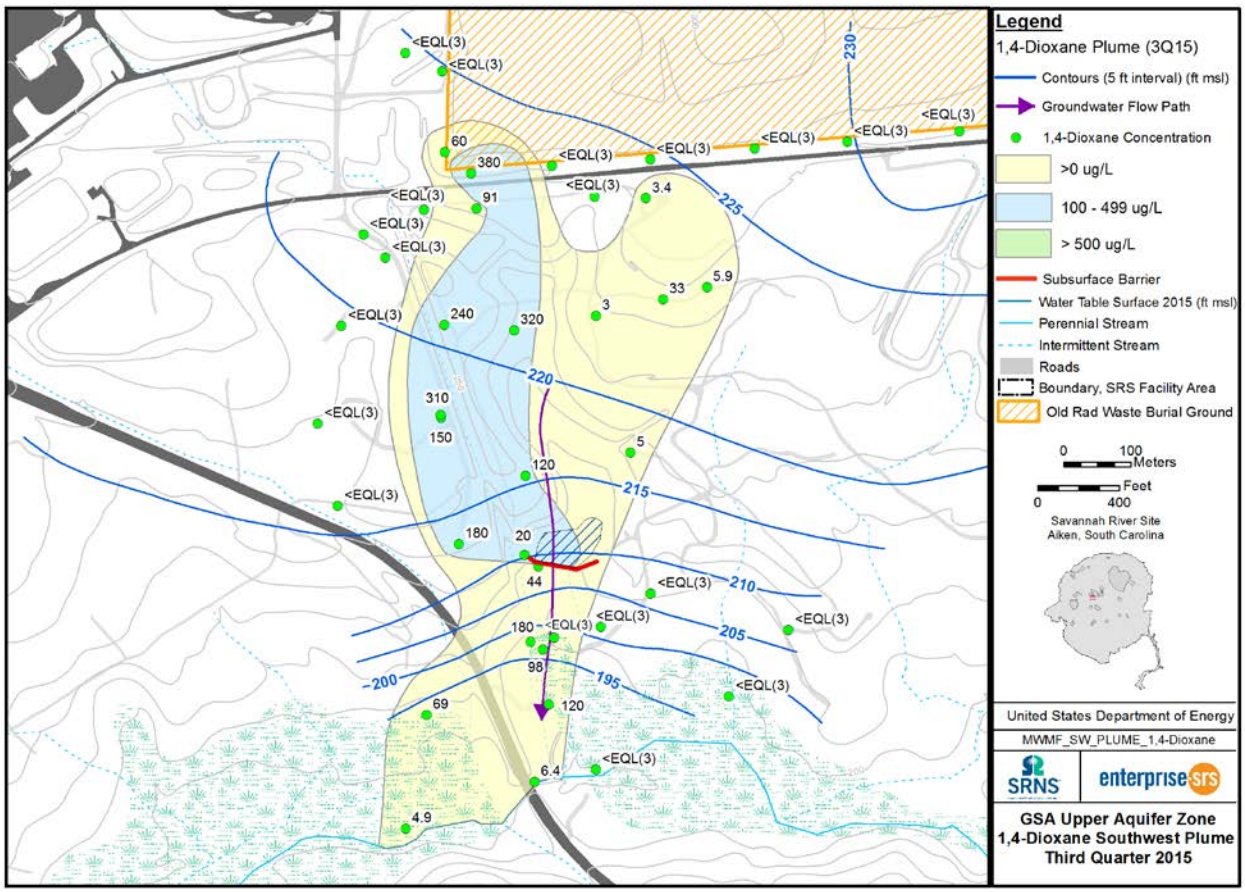

Figure K-4. MWMF Southwest Plume 1,4-dioxane Concentrations in the Upper Aquifer Zone (SRNS, 2016)

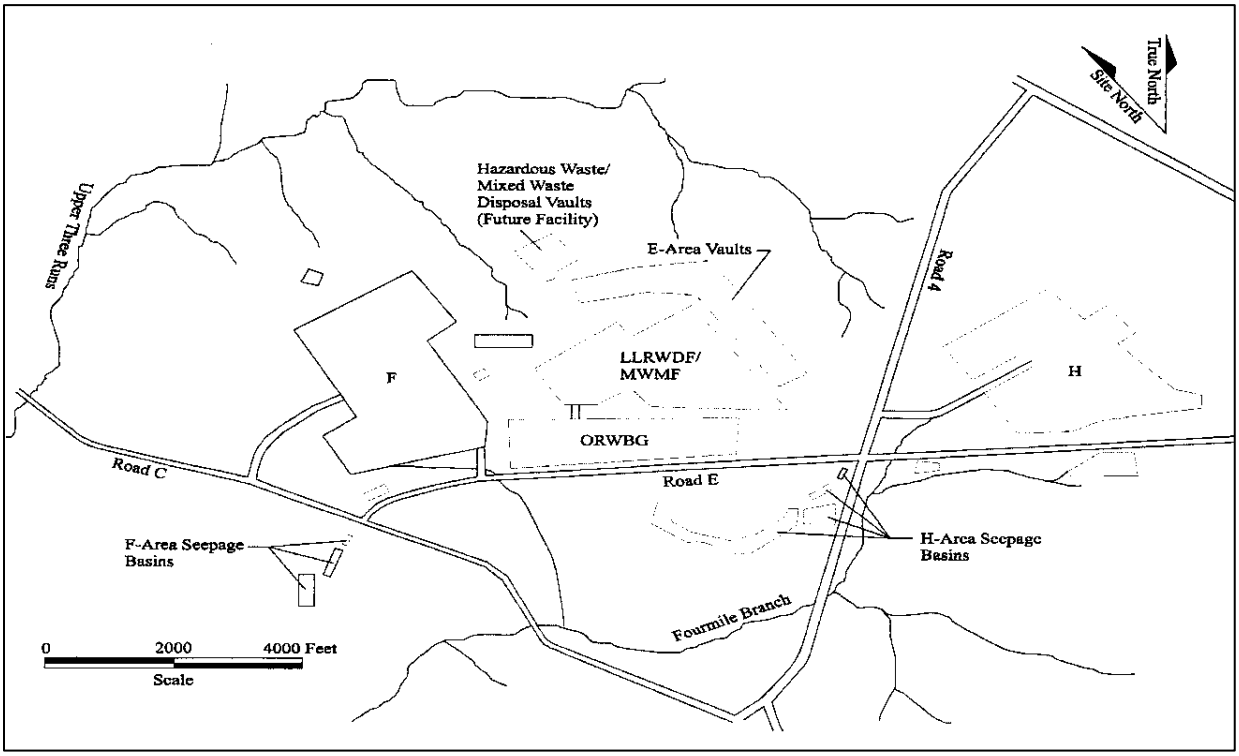

Figure K-5. Facility Layout within the Burial Ground Complex

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Table K-1. Chronology of Site Events

Event	Date
RCRA Closure Plan Approved	December 1987
Corrective Action start	1988
RCRA Closure Certified	1991
Final ROD issuance	September 23, 1994
Previous Five-Year Reviews Issuance	August 27, 1997 / February 12, 2004 / January 29, 2009 / February 4, 2014

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Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

I. SITE INFORMATION			
Site Name:	**Mixed Waste Management Facility (643-28E) (MWMF) OU**	**Date of Inspection:**	**9/08/2016**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SC1890008989**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Cloudy 85°F**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Staff:** Steve Willingham (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145

Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

II. INTERVIEWS *(Click all that apply)(Continued)*

3. **Local Regulatory Authorities and Response Agencies** (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached

_____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *Mixed Waste Management Facility (MWMF) Post Closure Inspection, ER-SOP-006.*

_____

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is discussed in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:________ (Date) To:________ (Date) ________ (Total Cost) ☐ Breakdown attached
From:________ (Date) To:________ (Date) ________ (Total Cost) ☐ Breakdown attached
From:________ (Date) To:________ (Date) ________ (Total Cost) ☐ Breakdown attached
From:________ (Date) To:________ (Date) ________ (Total Cost) ☐ Breakdown attached
From:________ (Date) To:________ (Date) ________ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: ________

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: OU-specific perimeter fencing is required by the remedial action. Perimeter fences are in good condition.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once every 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Brian Hennessey (Name) | FFA Program Manager (Title) | 11/22/2016 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks: Quarterly site inspections conducted from FY2012 through FY2016 identified active ant mounds, vegetation/grass that needed cutting/mowing, plugged weep holes and small cracks/chips in concrete associated with the drainage channels. All issues were addressed shortly after discovery.

VII. LANDFILL COVER/CONTAINEMENT ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks:

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VII. LANDFILL COVER/CONTAINEMENT *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
C. Letdown Channels ☐ Applicable ☒ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VII. LANDFILL COVER/CONTAINEMENT *(Continued)*				
D. Cover Penetrations	☒ Applicable	☐ N/A		
1. Gas Vents:	☐ Active	☐ Passive		
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A	
Remarks:				
2. Gas Monitoring Probes:				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A	
Remarks:				
3. Monitoring Wells:				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A	
Remarks:				
4. Leachate Extraction Wells:				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A	
Remarks:				
5. Settlement Monuments:	☒ Located	☒ Routinely Surveyed	☐ N/A	
Remarks:				
E. Gas Collection and Treatment	☐ Applicable	☒ N/A		
F. Cover Drainage Layer	☐ Applicable	☒ N/A		
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A		
H. Retaining Walls	☐ Applicable	☒ N/A		

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VII. LANDFILL COVER/CONTAINEMENT *(Continued)*

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident

Areal extent_____ Depth_____

Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A

☒ Vegetation does not impede flow

Areal extent_____ Type_____

Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent_____ Depth_____

Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A

Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

Attachment K-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

Remedy for this site is low-permeability soil cover system and institutional controls (i.e., LUCs) to prevent physical exposure to contaminants and mitigating further migration of contaminants to the groundwater. The cover system is intact, long-term grasses have been fully established. Soil cover system remedy is functioning as designed. USDOE is planning to implement drainage enhancements during the next 5-year remedy review cycle to ensure ongoing protectiveness.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of quarterly site inspections and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs is good.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

SRL SEEPAGE BASINS (904-53G1, 904-53G2, 904-54G, AND 904-55G) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the Savannah River Laboratory (SRL) Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) (SRLSB) Operable Unit (OU). The review was conducted from August 2016 through November 2016. Contaminants have been left in place at the SRLSB OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the SRLSB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table L-1 lists the chronology of site events for the SRLSB OU.

III. Background

SRLSB OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the SRLSB OU is soil.

Physical Characteristics

The SRLSB OU is located within the northwestern section of SRS, approximately 1,200 m (4,000 ft) from the nearest SRS boundary and 1,350 m (4,500 ft) from the nearest residence (Figure L-1). The SRLSB OU consists of four seepage basins, designated as Seepage Basins 1 through 4, and a process sewer pipeline (Figure L-2). The four basins lie within the northern portions of the A/M Area, northeast of Savannah River Ecology Laboratory and southeast of the Savannah River National Laboratory (SRNL). The settings to the north, east, and south of the basins are wooded. Tims Branch is located north of the basins

and an unnamed intermittent stream is immediately east of them. The area to the west is cleared and vegetated with low grasses. The four basins (Figure L-2) had an approximate depth of 3.6 m (12 ft) and covered a total area of approximately 0.87 hectares (2.15 acres). The total capacity of the basins was 2,605 m^3 (688,200 gal). A berm of undisturbed soil separated each of the four basins. The four basins were connected by a series of sequential overflow channels designed to receive wastewater by overflow from Basin 1 (904-52G) to Basin 2 (904-53G) to Basin 3 (904-54G) and then to Basin 4 (904-55G).

Wastewater was conveyed from Building 776-A (SRNL) to the west end of Basin 1 through a vitrified clay process sewer pipe. The line was constructed in conjunction with Basins 1 and 2 for start of operation in 1954. There is no surface water within the boundaries of the SRLSB.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a) designates SRLSB OU as being within the site industrial support area. The future land use for SRLSB OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

Basins 1 and 2 were placed into operation in 1954, and Basins 3 and 4 were added in 1958 and 1960, respectively (WSRC 1999b). The basins were used from 1954 to 1982 to dispose of low-level radioactive liquid waste generated in the SRNL laboratories (Buildings 735-A and 773-A). The laboratory-derived, low-level liquid waste was stored in Building 776-A waste tanks until the activities was confirmed to be below 100 dpm/mL alpha and/or 50 dpm/mL beta-gamma. Waste meeting this transfer criterion was then sent via the process sewer line to Basin 1. Figures L-3, L-4, and L-5 present photographs of the SRLSB OU before remediation and in the current condition.

During the 28 years of operation, the basins received 1.2 million m^3 (340 million gal) of wastewater, or about 42,960 m^3/year (12.1 million gal/year). There is no record of overflow out of the basins and no account of any local ground surface seeps. The wastewater seeped into the ground within the basins as designed.

Initial Response

Over the years, large trees had grown in and around the basins. A CERCLA removal action for removal of the vegetation at the SRLSBs was performed in 1997. The vegetation was stored and covered with geotextile material in Basins 2 and 4 until disposal at the SRS E-Area Low-Level Radioactive Waste Disposal Facility in October 1999. Disposal of this contaminated vegetation was not a part of the SRLSB OU remedial action, but was performed as a separate action under USDOE removal action authority.

Basis for Taking Action

Analytical data collected for the Remedial Facility Investigation (RFI) / Remedial Investigation (RI) / Baseline Risk Assessment (BRA) and Focused Corrective Measures Study / Feasibility Study (CMS/FS) (WSRC 1998) indicate that significant impacts to the soil media associated with the SRLSB had occurred from both radiological and inorganic contaminants. Major radionuclide contaminants detected in the soil at SRLSB OU include actinium-228, cesium-137, cobalt-60, curium-243/244, radium-228, thorium-228, and uranium-238. The primary inorganic contaminants are mercury, silver, vanadium, and chromium. Process knowledge suggests that no significant quantities of chlorinated organics were discarded into the SRLSB OU.

As determined in the RFI/RI/BRA/CMS/FS, SRLSB operations and resulting soil contamination have not significantly impacted groundwater. The fate and transport analysis does not predict future impacts to the groundwater from the contaminants within the SRLSB OU. Therefore, groundwater is not a media of concern. Additionally, there are no contaminant migration (CM) constituents of concern (COCs) as indicated by contaminant migration modeling.

The final list of human health COCs for the future industrial worker scenario includes eighteen radionuclides and two metals (Table L-2). Only one ecological COC, chromium, was determined. Remedial goals (RGs) were established for the industrial worker scenario based on a risk of 1.0E-06, or a hazard quotient of 1.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 1999b), the remedial action objectives (RAOs) for the SRLSB OU are as follows:

- Eliminate exposure of the future industrial worker to radiochemical constituents, mercury, and chromium in the soils of SRLSB OU;
- Remove all principal threat source material (PTSM) (soil above 1.0E-03 industrial worker health risk level) from Basins 1, 2, and 3; and
- Reduce risk to soil invertebrates from the ingestion of chromium in the surface soils of Basin 1.

As stated in the ROD (WSRC 1999b), the selected remedy for the SRLSB OU was to excavate soil above 1.0E-03 industrial risk (PTSM), dispose at an off-SRS site, such as Envirocare of Utah, Inc., place an earthen cover over all four basins, and use institutional controls (i.e., land use controls [LUCs]) to maintain future industrial land use only.

Remedy Implementation

Implementation of the selected remedy at SRLSB OU included the following activities:

- Removal of 4,740 m^3 (6,200 yd^3) of PTSM soil by (1) excavation of approximately 1.2 m (4 ft) from the bottom of Basins 1, 1.5 m (5 ft) from the bottom of Basin 2, and 0.6 m (2 ft) from the bottom of Basin 3, and 0.3 m (1 ft) from all of the berms in the three basins; (2) excavation of the process sewer pipeline and the soils 0.3 m (1 ft) below and 0.45 m (1.5 ft) on each side of the pipeline from Basin 1 to the first manhole; and (3) packaging all job control waste and transporting to Envirocare of Utah, Inc., a low-

level waste disposal facility. Basin 4 did not require excavation of contaminated soil, but was backfilled with clean soil.

- Performing confirmatory soil samples to verify all PTSM soil was removed.
- Backfilling the process sewer trench and all four basins (0.85 hectare [2.1 acres]) with clean soil to a depth between 2.7 m (9 ft) and 5.7 m (19 ft) and sloped to provide proper stormwater drainage. The top 15 cm (6 in) of the vegetative layer contained topsoil, fertilizer, lime, seed and mulch.
- Established LUCs for 1 hectare (2.56 acres) including physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the SRLSB OU for industrial use only, and warning signs and site use restrictions via the SRS Site Use/Site Clearance Program, for the SRLSB OU.
- Conducting maintenance and maintaining institutional controls (i.e., LUCs) of the covered basins to prevent unauthorized access.

Systems Operations/Operation and Maintenance

There are no system operational requirements. The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (i.e., soil cover maintenance, repair of erosion damage, and warning signs);
- Site controls and land use restrictions via the SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the SRLSB OU.

Table L-3 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 1999b). The estimated O&M cost for FY2012 to FY2016 was $25,000 for site inspections, maintenance, and LUCs. The actual O&M cost for FY2012 to FY2016 is $46,200. The

actual O&M costs are higher than expected because O&M costs were not included in the ROD estimate.

V. Progress Since Last Review

The previous protectiveness statement concluded that because the remedial actions at SRLSB OU are protective, the site is protective of human health and the environment. The implementation of institutional controls (i.e., LUCs), including controlled access to SRLSB OU is protective of human health and the environment. Exposure pathways that could result in unacceptable risks have been controlled through soil excavation and disposal at an off-SRS CERCLA-approved facility, backfilling the area to grade with clean soil, re-vegetation of the area and institutional controls (i.e., LUCs).

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU and documented the results on the Inspection Checklist provided in Attachment L-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and Steve Willingham, O&M staff member, on September 20, 2016 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The SRLSB OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) and USDOE personnel November 4, 2016. No issues were identified for the SRLSB OU during this inspection and interviews. A site inspection was conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control personnel, accompanied by USDOE and SRNS personnel, on February 28, 2017. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from FY2012 through FY2016 identified the following issues: overgrown vegetation, active ant mounds, hog damage, and downed trees and limbs. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The removal of contaminated soil (PTSM) and the installation of soil covers are effective in preventing human health and ecological exposure to residual contaminated basin soils.
- The cover system maintenance program and LUCs have been effective in maintaining the integrity of the cover system and preventing human and ecological exposure. The annual inspection reports indicate no visible signs of erosion, signs are legible, and Administrative Controls are still in place.

LUCs include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the SRLSB OU for industrial use only, and warning signs and site use restrictions via the SRS Site Use/Site Clearance Program for the SRLSB OU. The Land Use Control Implementation Plan for SRLSB OU is included as Appendix A of the *Corrective Measure Implementation Report/Post-Construction Report/Final Remediation Report (CMIR/ PCR/FRR)* and

governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2001). All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in the physical condition of the SRLSB OU that would affect the protectiveness of the remedy.

The USEPA standards and toxicity values have been updated since the last five-year remedy review as shown in Appendix B. The changes to the values for COCs at the SRLSB OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No information has come to light that would call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for this OU.

X. Protectiveness Statement(s)

The remedy at the SRLSB OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated soil media. Threats from contaminated soil at the SRLSB OU have been addressed through excavation of PTSM soil and installation of the soil cover, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the SRLSB OU for industrial use only, and warning signs and site use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The Fifth Five-Year Remedy Review Report and subsequent reports will be segregated into five phases. As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2022.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

USDOE, 1996. *Savannah River Site Future Use Project Report,* U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1998. *RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment and Focused Corrective Measures Study/Feasibility Study for the SRL Seepage Basins Operable Unit (904-53G, -54G, and –55G) (U),* WSRC-RP-97-846, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999a. *Land Use Control Assurance Plan for the Savannah River Site,* WSRC-RP-98-4125, Revision 1.1, latest revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1999b. *Record of Decision, Remedial Alternative Selection for the SRL Seepage Basins Operable Unit (904-53G1, -53G2, -54G and –55G) (U),* WSRC-RP-97-848, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001. *Corrective Measure Implementation Report/Post-Construction Report/ Final Remediation Report (CMIR/PCR/FRR) for Closure of SRL Seepage Basins Operable Unit (904-53G, -53G, -54G, and -55G) (U),* WSRC-RP-2001-4123, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various – Inspection Data Sheets - *Field Inspection Checklist for SRL Seepage Basins*, ER-IDS-019-011, Inspection Period 2012 through 2016 (annually)

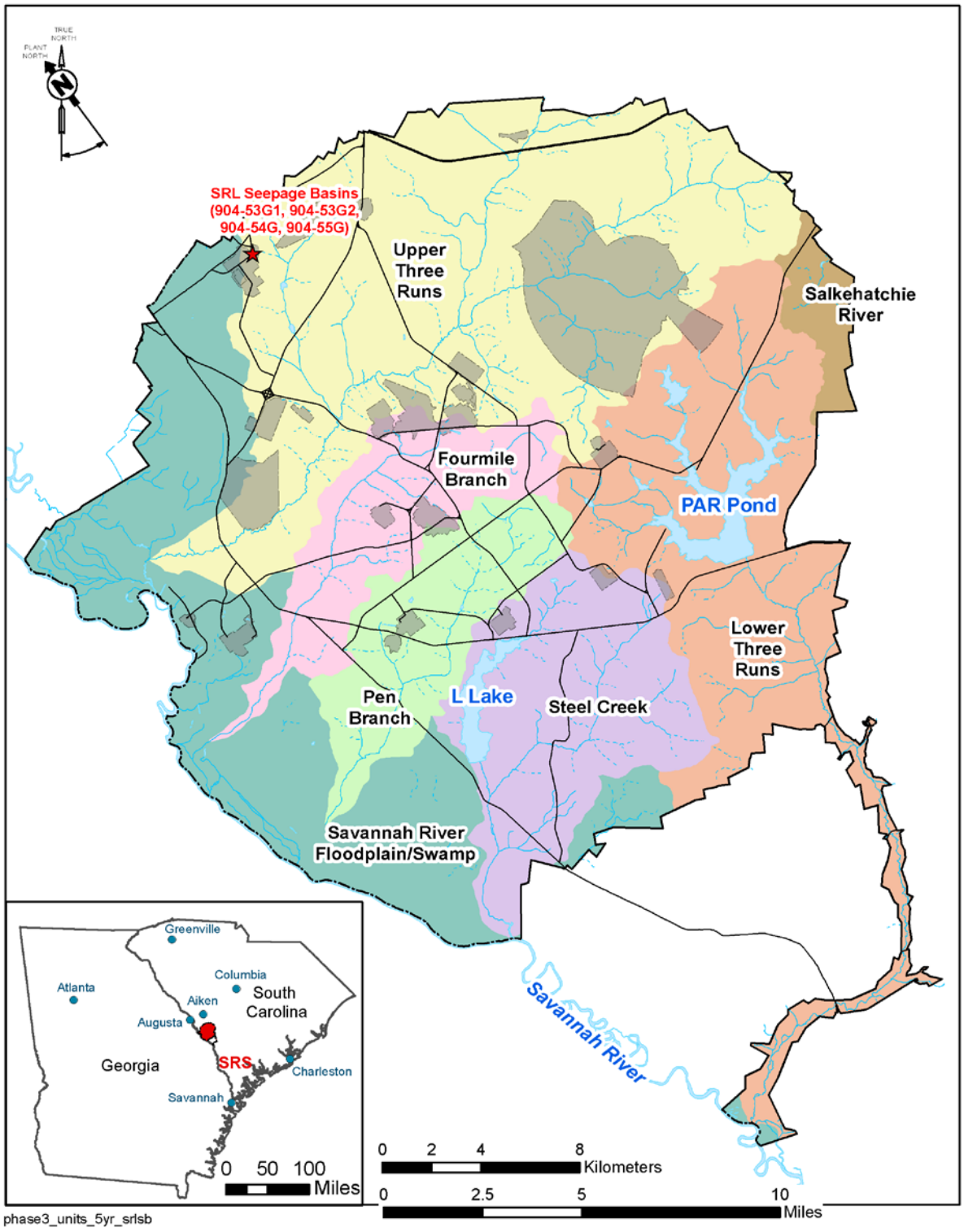

Figure L-1. Location of the SRL Seepage Basins OU at SRS

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Figure L-2. Layout of the SRLSB OU (904-53G, 904-53G, 904-54G, and 904-55G) after Construction Completion August 2001

Figure L-3. Photo of SRLSB OU Before Remediation Activities

Figure L-4. Current Photograph of the SRLSB OU (2016)

Figure L-5. Current Photo of the SRLSB OU (2016)

Table L-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	September 25, 1996 / May 27, 1997
Removal Action Start / Complete (Trees Only)	July 28, 1997 / December 9, 1997
CERCLA Removal Action Start / Complete	August 22, 1997 / October 15, 1997
ROD Issuance	April 26, 2000
Remedial Action Start / Complete	December 8, 1999 / August 20, 2003
Previous Five-Year Reviews Issuance	February 12, 2004 / January 29, 2009 / February 4, 2014

Table L-2. COC for SRL SB OU

SRLSB Subunit	Human Health COCs	Ecological COCs	Contaminant Migration COCs
Basin 1	Actinium-228, Americium-241, Cesium-137, Cobalt-60, Curium-243/244, Lead-2 12, Potassium-40, Radium-228, Plutonium-238, Plutonium-239/240, Strontium-90, Thorium-228, Thorium-230, Thorium-232, Uranium-233/234, Uranium-235, Uranium-238, Mercury, Chromium (Hexavalent).	Chromium	None
Basin 2	Actinium-228, Americium-241, Cesium-137, Cobalt-60, Curium-243/244, Neptunium-239, Potassium-40, Radium-228, Plutonium-238, Plutonium-239/240, Strontium-90, Thorium-228, Uranium-233/234, Uranium-235, Uranium-238, Mercury	None	None
Basin 3	Cesium- 137, Cobalt-60, Curium-243/244, Neptunium-239, Strontium-90, Uranium-235, Uranium-238	None	None
Basin 4	Cesium- 137, Cobalt-60, Curium-2431244, Radium-228, Strontium-90, Thorium-228, Uranium-235, Uranium-238	None	None

Table L-3. Actual versus Estimated O&M Costs

	FY2012	FY2013	FY2014	FY2015	FY2016	5-Year Total
Total Actual O&M Costs ($)	10,700	11,813	6,785	5,923	10,979	46,200
Total ROD Estimated Direct O&M Costs* ($)	25,000	0	0	0	0	25,000

*Cost for preparation of the Fourth Five-Year Remedy Review were accounted for in FY2012. Annual O&M costs were not included in the original estimate.

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Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)

I. SITE INFORMATION			
Site Name:	**SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)**	**Date of Inspection:**	**09/06/2016**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #47**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**89°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Excavation, off-site disposal

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Staff: Steve Willingham (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4145

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 9/20/2016 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ **(**Title) _____ **(**Date) _____ **(**Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ **(**Title) _____ **(**Date) _____ **(**Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ **(**Title) _____ **(**Date) _____ **(**Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for SRL Seepage Basins*, ER-IDS-019-011.

_____

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201, HAZWOPER.

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per EC&ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: OU-specific perimeter fencing is not required by the remedial action.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition.

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | IACD Federal Project Director (Title) | 11/04/2016 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey monuments located and in good condition.

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: Roads at this site are in good condition.

B. Other Site Conditions

Remarks: Annual site inspections performed during the period of FY2012 to FY2016 identified vegetation needing trimming, active ant mounds, hog damage, and downed trees and limb. These issues were addressed soon after discovery.

VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent____ Depth____

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths____ Widths____ Depths____

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent____ Depth____

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent____ Depth____

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress

Areal extent____ Depth____

Remarks: Vegetation is mowed routinely.

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent _____ Depth _____ Remarks:
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent _____ ☐ Ponding ☐ Location shown on site map Areal extent _____ ☐ Seeps ☐ Location shown on site map Areal extent _____ ☐ Soft subgrade ☐ Location shown on site map Areal extent _____ Remarks:
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent _____ Remarks:
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
C. Letdown Channels ☐ Applicable ☒ N/A (Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)
D. Cover Penetrations ☐ Applicable ☒ N/A
E. Gas Collection and Treatment ☐ Applicable ☒ N/A
F. Cover Drainage Layer ☐ Applicable ☒ N/A
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
H. Retaining Walls ☐ Applicable ☒ N/A
I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Excavation and Off-Site Disposal ☒ Applicable ☐ N/A

Excavation and off-site disposal was performed at SRLSB OU. The remedy is performing as designed.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The removal of contaminated soil and the installation of soil covers have met the remedial action objectives of protecting human health and the environment by eliminating surficial soil exposure, and removing all principal threat source material. Residual contamination (at levels below 1.0E-03 risk) will remain in place. These actions combined with both short term and long term institutional controls (i.e., LUCs) will eliminate any risk to the industrial worker. Selected remedies for the SRLSB are functioning as intended. There are no issues requiring corrective actions.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover system, fencing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs are good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A