

Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Native Soil Covers and/or Land Use Controls (U)

Aiken, South Carolina

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and
Savannah River Nuclear Solutions, LLC
Aiken, South Carolina

15 AUG 2019
Date

Jimmy E. McMillian
Assistant Manager for Infrastructure and Environmental Stewardship
U. S. Department of Energy
Savannah River Operations Office

Date

Henry J. Porter, Chief
Bureau of Land and Waste Management
S.C. Department of Health and Environmental Control

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 environmental remedies that implemented native soil covers and/or land use controls (LUCs) 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 contaminant remaining at the site be subject to a remedy review every five years.

Previous five-year remedy review reports combined into a single document all SRS operable units (OUs) that had implemented a remedial action. The Fourth Five-Year Remedy Review Report, issued in February 2014, reviewed 52 SRS remedy decision documents. 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 is also more effective in identifying and resolving issues for similar remedies. Beginning with the Fifth Five-Year Remedy Review Report, technical evaluations are conducted in five phases, approximately one year apart, with OUs grouped by the following remedy types: (1) native soil covers and/or LUCs; (2) groundwater; (3) engineered cover systems; (4) geosynthetic or stabilization/solidification cover systems; and (5) operating equipment. The Sixth Five-Year Remedy Review Report will be conducted in five phases based on the remedy type with this report evaluating SRS OUs that selected native soil covers and/or LUCs as the final remedy.

According to the data reviewed and the site inspections, the 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 remedies have been determined to still be protective of human health and the environment. No issues or recommendations resulted from the remedy review.

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LIST OF ACRONYMS AND ABBREVIATIONS

+D	plus daughter isotopes
A/M GW	A/M-Area Groundwater
ABRP/RP	A-Area Burning/Rubble Pits and Rubble Pile
AMRP	A-Area Miscellaneous Rubble Pile
ARAR	applicable or relevant and appropriate requirement
BAOU	B-Area Operable Unit
bgs	below ground surface
BPOP	Bingham Pump Outage Pits
BRA	Baseline Risk Assessment
CADC	C-Area Discharge Canal
CAGW	C-Area Groundwater
CAOU	C-Area Operable Unit
CBRP	C-Area Burning Rubble Pit
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information
CFR	Code of Federal Regulations
CKL Rx	C-, K-, and L-Reactor Complexes
CM	contaminant migration
cm/sec and cm/s	centimeter per second
CMCOC	contaminant migration constituent of concern
CMP Pits	Chemicals, Metals, and Pesticides Pits
CMS/FS	Corrective Measures Study/Feasibility Study
COC	constituent of concern
CRSB	C-Area Reactor Seepage Basin
CSBRP	Central Shops Burning/Rubble Pits (631-1G and 631-3G)
CSBRP-5G	Central Shops Burning/Rubble Pit (631-5G)
D_2O	Deuterium oxide (moderator)
D&D	deactivation and decommissioning
DAOU	D-Area Operable Unit
DDD	dichlorodiphenyldichloroethane
DDT	dichlorodiphenyltrichloroethane
DEXOU	D-Area Expanded Operable Unit
DNAPL	dense non-aqueous phase liquid
EAROD	Early Action Record of Decision
EC&ACP	Environmental Compliance and Area Completion Projects
ECODS	Early Construction and Operational Disposal Site
EIS	Environmental Impact Statement

LIST OF ACRONYMS AND ABBREVIATIONS *(continued)*

ERA	ecological risk assessment
ESD	Explanation of Significant Differences
FAGW	F-Area Groundwater
FBRP	F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)
FBSB	Ford Building Seepage Basin
FFA	Federal Facility Agreement
FONSI	Finding of No Significant Impact
ft	feet
ft^3	cubic feet
FY	fiscal year
FYR	Five-Year Remedy
gpm	gallons per minute
GPR	ground penetrating radar
GSA	General Separations Area
GSACU	General Separations Area Consolidation Unit
HAGW	H-Area Groundwater
HEWA	Heavy Equipment Wash Area
HEWB	Heavy Equipment Wash Basin (NBN)
HH	human health
HHRA	human health risk assessment
HI	hazard index
HpCDD	heptachlorodibenzo-p-dioxin
HQ	hazard quotient
HWMF	Hazardous Waste Management Facility
IOU	Integrator Operable Unit
IROD	Interim Record of Decision
ISD	in situ decommissioning
KBPOP	K-Area Bingham Pump Outage Pit (643-1G)
KBRP	K-Area Burning/Rubble Pit
KRSB	K-Area Reactor Seepage Basin
km	kilometer
km^2	square kilometer
LAOCB	L-Area Oil and Chemical Basin
LBPOP	L-Area Bingham Pump Outage Pits (643-2G and 643-3G)
lbs	pounds
LLC	Limited Liability Company
LLWF	Low-Level Waste Facility
LRSB	L-Area Reactor Seepage Basin
LTR	Lower Three Runs
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan

LIST OF ACRONYMS AND ABBREVIATIONS *(continued)*

LUC	land use control
m	meter
m^3	cubic meter
MAOU	M-Area Operable Unit
MCB/MBP	Miscellaneous Chemical Basin / Metals Burning Pit
MCL	maximum contaminant level
Met Lab	Metallurgical Laboratory
mi	mile
mi^2	square miles
MIPSL	M-Area Settling Basin Inactive Process Sewer Lines
µg/kg	microgram per kilogram
mg/kg	milligrams per kilogram
mm	millimeter
MNA	monitored natural attenuation
mR/hr	milliRoentgen-equivalent-man (REM) per hour
msl	mean sea level
MZ	mixing zone
N/A	not applicable
NBN	no building number
NC	not calculated
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NRDC	National Resource Defense Council
NTCR	non-time critical removal
O&M	operation and maintenance
OFASB	Old F-Area Seepage Basin
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PAOU	P-Area Operable Unit
PAR Pond	PAR Pond (685-G) (including the Pre-Cooler Ponds and Canals) and Lower Three Runs IOU Tail Portion (Middle and Lower Subunits)
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PBPOP	P-Area Bingham Pump Outage Pit (643-4G)
PBRP	P-Area Burning/Rubble Pit
ρCi/g	picoCuries per gram
ρCi/mL	picoCuries per milliliter
ρCi/L	picoCuries per liter
PRG	Preliminary Remediation Goal

LIST OF ACRONYMS AND ABBREVIATIONS *(continued)*

PRSB	P-Area Reactor Seepage Basin
PSL	process sewer line
PTSM	principal threat source material
RAO	remedial action objective
RAOU	R Area Operable Unit
RBPOPs	R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G)
RBRP/RP	R-Area Burning/Rubble Pits and Rubble Pile
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
RRSB	R-Area Reactor Seepage Basins
RSL	regional screening level
RUNK	R-Area Unknown Pits
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHEC	South Carolina Department of Health and Environmental Control
SEMS	Superfund Enterprise Management System
SRL	Savannah River Laboratory
SRLSB	Savannah River Laboratory Seepage Basin
SRS	Savannah River Site
SRNS	Savannah River Nuclear Solutions, LLC
SRWU	Silverton Road Waste Unit (731-3A)
SSHASP	site-specific health and safety plan
SVE	soil vapor extraction
TAOU	T-Area Operable Unit
TCFM	trichlorofluoromethane
TCE	trichloroethylene
TCR	total cumulative risk
TCRA	time critical removal action
TNX GW	TNX Groundwater
UU/UE	unlimited use and unrestricted exposure
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Department of Agriculture – Forest Service
VOC	volatile organic compound
WADB	Wetlands Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit

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

WSRC	Washington Savannah River Company, Limited Liability Company
WSRC	Westinghouse Savannah River Company, Limited Liability Company
yd^3	cubic yards
yds	Yards
ZOI	zone of influence

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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 and will continue to be 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 report also identifies any issues found during the review and provides recommendations to address the issues.

The U.S. Department of Energy (USDOE) prepared this sixth five-year remedy review for Savannah River Site (SRS) OUs that selected native soil covers and/or land use controls (LUCs) 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); the Second Five-Year Remedy Review was issued in February 2004 (WSRC 2003b); the Third Five-Year Remedy Review was issued in January 2009 (WSRC 2008); the Fourth Five-Year Remedy Review was issued in February 2014 (SRNS 2014); the Fifth Five Year Remedy Review was issued in December 2018 (SRNS 2015b, SRNS 2017, 2018a, SRNS 2018b, and SRNS 2018c).

The size of each report has increased considerably since 1997 due to the growing 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 USDOE 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. Beginning with the Fifth Five-Year Remedy Review Report, the USDOE, USEPA, and SCDHEC agreed to segregate the five-year remedy review reports 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 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. Therefore, the final signature for the last grouping of Sixth Five-Year Remedy Review Report is due no later than January 21, 2024. A more detailed discussion of the phased reviews and transition schedule are provided in Appendix A.

This report documents the Sixth Five-Year Remedy Review for OUs with native soil covers and/or LUCs selected as the final remedy and includes a review of remedy decision documents for 13 USEPA Superfund Enterprise Management System (SEMS) units at the SRS. SEMS 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 SEMS unit and/or SRS OU.

The SRS OUs evaluated in this document were grouped together because of similar remedies. Figure 1 identifies the location of the SRS OUs evaluated in this document. The data evaluation and visual inspection for the SRS OU remedies with native soil covers and/or LUCs were conducted from August 2018 through November 2018.

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 2011), *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA 2012), and *Five-Year Review Recommendation Template* (USEPA 2016). This report summarizes common elements for the entire SRS. The remedy reviews are included as Appendix C through Appendix M.

Site Chronology

A summary of the regulatory history of the SRS is provided below beginning with the 1988 National Resource Defense Council (NRDC) Consent Decree (Civil Action No. 1:85-2583-6). The Consent Decree 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 Basins (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 (RFI) 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 is the Five-Year Summary Review Form, which provides a summary status of the SRS. Table 2 provides a chronology of the decision documents for the SRS OUs with native soil covers and/or LUCs 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 M).

Background

The SRS was constructed during the 1950s to produce the basic materials used in the fabrication of nuclear weapons, primarily tritium and plutonium, in support of 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 (e.g., seepage basins, pits and piles, landfills, etc.) 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 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 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. LUCs selected as part of a remedial action will prohibit residential use of the area.

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 8 wells supply the primary drinking water system. Wells serving site process and drinking water in the larger site areas are typically 180-270 m (600-900 ft) in depth and pump water from the deeper Crouch Branch and McQueen Branch aquifers. Wells serving the smaller site facilities, such as barricades, pumphouses, and field laboratories, are shallower in depth (30-90 m [100-300 ft]) and are like large household-type wells. The SRS domestic water systems meet state and federal drinking water standards.

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 (e.g., seepage basins, pits and piles, landfills, etc.) resulting in soil and groundwater contamination.

II. RESPONSE ACTION SUMMARY

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 (RGs) 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.

Table 3 provides a summary of the LUC objectives for the OUs with native soil covers and/or LUCs.

Basis for Taking Action

The most prevalent soil contaminants at SRS are cesium-137 and organic chemicals (volatile or semi-volatile). 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.

Remedial actions which result in any hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure are reviewed every five years to ensure protection of human health and the environment. The specific contaminants and remedial actions for each OU in this five-year remedy review are described in greater detail in the OU-specific appendices (Appendix C through Appendix M).

Response Action Summary

Remedial actions may target source areas, soil, vadose zone, and/or groundwater. RGs 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, surface water, or groundwater containing unacceptable levels of contaminants.
- Prevent exposure of ecological receptors to soils, surface water, 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.

Additionally, 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. The type of LUCs and implementation and reference to the OU-specific land use control implementation plan (LUCIP) are described in detail in Section VII of the OU-specific appendices. LUCs are defined for individual OUs, but in general, LUC objectives at SRS are:

- Prevent exposure to, or ingestion of, contaminated media.
- Prohibit residential use.
- Prevent unauthorized access.
- Prevent unauthorized intrusive activity.

Table 2 lists the remedial actions for each of the OUs in this five-year remedy review report. The remedial actions are described in greater detail in the OU-specific appendices (Appendix C through Appendix M). Table 3 provides a summary of the LUC objectives for the OUs with native soil covers and/or LUCs.

Status of Implementation

Except for In Situ Decommissioning (ISD) at the C-, K-, and L-Reactor Complexes, the remedial actions listed in Table 2 have been implemented. LUCs are ongoing at all OUs discussed in this five-year remedy review report. The status of all response actions or

remedial actions for each of the remedies with native soil covers and/or LUCs is discussed in greater detail in the OU-specific appendices (Appendix C through Appendix M). These actions include final actions, removal actions, and remedial actions conducted prior to a final Record of Decision (ROD).

Systems Operation and Maintenance

A site-wide maintenance program is in place to care for cover systems, signs, 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 4 compares the actual costs incurred at SRS OUs with native soil covers and/or LUCs over the period from fiscal year (FY) 2015 to FY2018 to the estimated costs from the remedy decision documents over the same period. The review for the actual costs incurred (i.e., FY2015 to FY2018) is based on the period since the last five-year remedy review. Specific details concerning costs incurred are included for each OU in Appendix C through Appendix M.

III. PROGRESS SINCE LAST REVIEW

For the OUs evaluated in this review, the previous protectiveness statements from the Fifth Five-Year Remedy Review Report (SRNS 2015b) concluded that all OUs, except C-, K-, and L-Reactor Complexes, were found to be protective; C-, K-, and L-Reactor Complexes were found to be protective in the short-term (Table 5). There were no recommendations from the Fifth Five-Year Remedy Review Report that impact the OUs with native soil covers and/or LUCs evaluated in this report. This is the first remedy review for the CAOU.

IV. FIVE-YEAR REMEDY REVIEW PROCESS

USDOE has implemented the Sixth Five-Year Remedy Review for SRS OUs with native soil covers and/or LUCs. The review specifically evaluated remedies by comparing them to the OU-specific decision documents. The following actions were taken to perform the Sixth Five-Year Remedy Review for this category:

- Submitted a scoping summary to USDOE, USEPA, and SCDHEC on August 5, 2018 and conducted a scoping meeting on August 28, 2018. The USDOE, USEPA, and SCDHEC agreed to the scope and schedule of the remedy review report, which is discussed in the scoping summary;
- Published an announcement on September 28, 2018 that the USDOE is conducting the Sixth Five-Year Remedy Review in phases. The announcement stated that the first phased submittal will focus on OUs with native soil covers and/or LUCs. The public was notified through mailings of *The Savannah River Site Environmental Bulletin*, a newsletter sent to citizens in South Carolina and Georgia on an extensive mailing list, including landowners adjacent to SRS, and through notices in the *Aiken Standard* (Aiken, SC), *The Augusta Chronicle* (Augusta, GA), *The People Sentinel* (Allendale and Barnwell, SC), and *The State* (Columbia, SC) newspapers. The Environmental Bulletin and newspaper affidavits of publication are available in the Administrative Record File;
- Reviewed appropriate data, documentation (i.e., including RODs, Early Action RODs [EARODs], Interim RODs [IRODs], and Explanation of Significant Differences [ESDs]), LUCIP 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 M;
- 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 M;

- Reviewed changes in standards and to-be-considered guidance including federal and state promulgated standards (i.e., chemical specific applicable or relevant and appropriate requirements [ARARs]) that would call into question whether the prescribed remedy was meeting the newer standards or guidance. Any problems or discrepancies are reported in Section VII (Technical Assessment), Section VIII (Issues), and Section IX (Recommendations and Follow-up Actions) of the OU-specific appendices; and
- Submitted a draft Fact Sheet to USEPA and SCDHEC for review with Revision 0 of the Sixth Five-Year Remedy Review Report for SRS OUs with Native Soil Covers and/or LUCs.

Community Notification and Involvement

USDOE will address any comments received from USEPA and SCDHEC and provide a Revision 1 report for USEPA and SCDHEC approval. After the USEPA and SCDHEC approve this report and USDOE, USEPA, and SCDHEC sign this report, a notice of its availability will be published in the *Aiken Standard* (Aiken, SC), *The Augusta Chronicle* (Augusta, GA), *The People Sentinel* (Allendale and Barnwell, SC), and *The State* (Columbia, SC) newspapers. 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.

Data Review, Site Inspections, and Interviews

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 OUs included in this report. No new information has come to light that calls into question the protectiveness of the remedies.

USEPA and SCDHEC performed site inspections of OUs with native soil covers and/or LUCs with issued RODs/IRODs/ESDs on March 19 and 21, 2019 and April 25, 2019. The Revision 0 report was submitted on December 20, 2018.

V. 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 (Appendix C through Appendix M) 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?

Answer: Yes. SRS environmental remedies are functioning as intended as demonstrated below.

- Contaminated material has been excavated and consolidated or left in place under protective native soil covers breaking the pathway for worker exposure.
- The cover system maintenance program and LUCs have been effective in maintaining the integrity of the cover systems at SRS OUs. The annual inspection reports indicate no significant deficiencies.

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

Answer: Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid for all OUs included in this report. An evaluation

of chemical and radiological standards including federal and state promulgated standards (i.e., chemical specific ARARs) that were in place when the last five-year remedy review was initiated in 2015 to the current 2018 standards 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 remedy. 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?

Answer: No other information that could call into question the protectiveness of the selected remedies and no outstanding issues have been identified in this Sixth Five-Year Remedy Review. The selected early action remedy chosen for the final end-state decision for the C-, K-, and L-Reactor Complexes is ISD with LUCs. This remedy was determined to be protective in the short-term for the C-, K-, and L-Reactor Complexes because the selected remedy component currently being implemented is LUCs, while the remainder of the remedy to implement ISD will be completed upon closure of the C-, K-, and L-Reactor Complexes.

For all OUs evaluated in this report, current and reasonably anticipated future land use at SRS remains consistent with assumptions in the respective decision documents.

VI. ISSUES/RECOMMENDATIONS

Remedial actions evaluated in this Five-Year Remedy Review Report for SRS remain protective of human health and the environment and are functioning as intended. No issues were identified for the remedies evaluated (Table 6).

There are no recommendations or follow-up actions.

VII. PROTECTIVENESS STATEMENT(S)

The protectiveness statements for each remedy are based on the recommended language from the *Comprehensive Five-Year Review Guidance* (USEPA 2001), *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA 2012) and *Five-Year Review Recommended Template* (USEPA 2016).

For OUs evaluated in this Five-Year Remedy Review Report, the remedies were determined to be protective of human health and the environment (Table 8). The remedy for the C-, K-, and L-Reactor Complexes was determined to be protective in the short-term. ISD with LUCs has been chosen as the final remedy for the C-, K-, and L-Reactor Complexes. The ISD portion of the remedy will be implemented upon closure of the C-, K-, and L-Reactor Complexes. In the interim, exposure pathways that could result in unacceptable risk are being controlled and LUCs are in place.

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. The type of LUCs and implementation and reference to the OU-specific LUCIP is described in detail in Section VII of the OU-specific appendices. For the OUs evaluated in this report, pathways for contaminants to reach human and ecological receptors have been successfully broken.

A protectiveness statement for each of the OUs evaluated in this report is included in the OU-specific remedy review located in Appendix C through Appendix M.

VIII. 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 final signature date for the last grouping of the Seventh Five-Year Remedy Review Report is due no later than January 21, 2029.

IX. 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 M.

X. REFERENCES

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

SRNS, 2010a. *Early Action Land Use Control Implementation Plan (EALUCIP) for the C-, K-, and L-Reactor Complexes (U),* SRNS-RP-2009-01470, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010b. *Land Use Control Implementation Plan (LUCIP) for the Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, and R-1A, -1B, -1C Operable Unit (OU) (U),* SRNS-RP-2009-01373, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Land Use Control Implementation Plan (LUCIP) for the Gunsite 012 Operable Unit (OU) (NBN) (U),* SRNS-RP-2011-00293, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Early Action Land Use Control Implementation Plan (EALUCIP) for the Lower Three Runs Integrator Operable Unit Tail Portion (Middle and Lower Subunits) (U),* SRNS-RP-2013-00046, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

SRNS, 2015a. *Early Action Land Use Control Implementation Plan for the C-Area Operable Unit (U),* SRNS-RP-2015-00034, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2015b. *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, LLC, Savannah River Site, Aiken, SC

SRNS, 2017. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Groundwater Remedies (U)* Aiken, South Carolina, SRNS-RP-2015-00419, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2018a. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Engineered Cover Systems (U)* Aiken, South Carolina, SRNS-RP-2016-00609, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2018b. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Geosynthetic or Stabilization/Solidification Cover Systems (U)* Aiken, South Carolina, SRNS-RP-2016-00610, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2018c. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Operating Equipment (U),* Aiken, South Carolina, SRNS-RP-2017-00567, Revision 1, 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

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540-R-01-007, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

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

USEPA, 2012. *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews*, OSWER 2012 Directive 9200.2-11, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

USEPA, 2016. *Five-Year Review Recommended Template*, OSWER Directive 9200.0-89, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

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, 1998a. *Final Remediation Report for the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) (U)*, WSRC-RP-97-193, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998b. *Final Remediation Report for the K-Area Bingham Pump Outage Pit (643-1G) (U)*, WSRC-RP-98-4003, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998c. *Final Remediation Report for the Silverton Road Waste Unit (731-3A) (U)*, WSRC-RP-97-153, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000. *Final Remediation Report for the L- and P-Area Bingham Pump Outage Pits (643-3G and 643-4G) (U)*, WSRC-RP-2000-4030, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003a. *Final Remediation Report for the R-Area Bingham Pump Outage Pits, 643-8G, -9G, and -10G and R-Area Unknown Pits #1, #2, and #3, RUNKS-1, -2, and -3,*

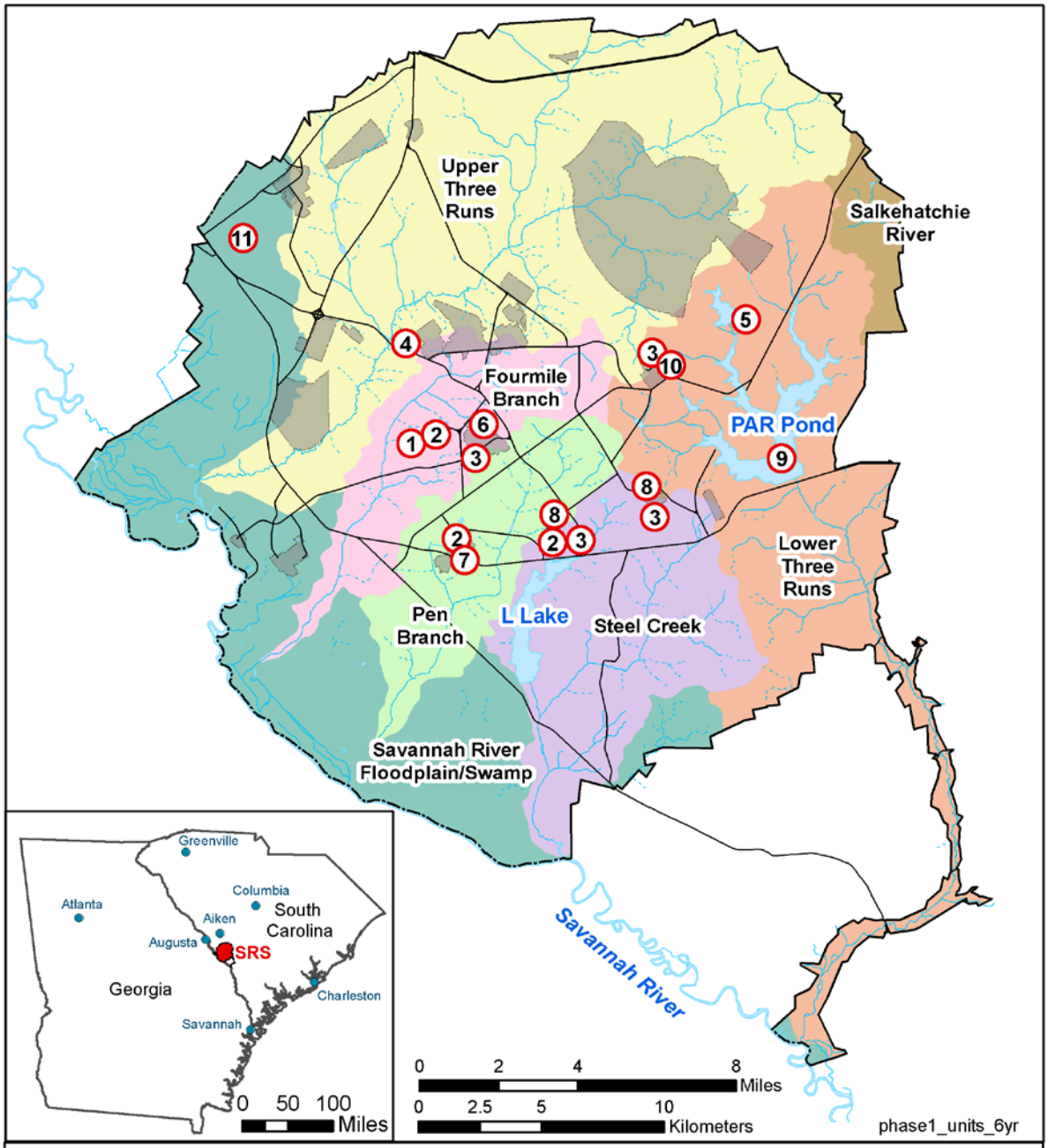
WSRC-RP-2003-4061, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003b. *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, 2005. *Land Use Control Implementation Plan (LUCIP) for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) Operable Unit (U)*, WSRC-RP-2005-4015, Revision 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. C-Area Operable Unit
2. C-, K-, and L-Reactor Complexes
3. Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, R-1B, R-1C
4. F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)
5. Gunsite 012
6. Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G)
7. K-Area Bingham Pump Outage Pit (643-1G)
8. L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)
9. PAR Pond (685-G)(incl. Pre-Cooler Ponds and Canals) and Lower Three Runs IOU Tail Portion (Middle and Lower Subunits)
10. R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G) and R-Area Unknown Pits #1, #2, and #3
11. Silverton Road Waste Unit (731-3A)

Figure 1. Location Map for SRS OUs with Native Soil Covers and/or LUCs

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Table 1. 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:** US Department of Energy		
Author name (Federal or State Project Manager): N/A		
Author affiliation: Savannah River Nuclear Solutions, LLC		
Review period: July 15, 2018 – January 21, 2020 (SRS OUs with Native Soil Covers and/or LUCs)		
Date of site inspection: August 2018 to November 2018 (SRS OUs with Native Soil Covers and/or LUCs)		
Type of review: Statutory		
Review number: 6		
Triggering action date: January 21, 2019		
Due date *(five years after triggering action date)*: January 21, 2024 (includes all five phases)		

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Table 2. SRS OUs with LUCs

#	Appendix	Operable Unit	SEMS No.	Remedy Decision Document Year[a]	Remedial Action[b]	Area with Native Soil Cover (acres)	LUCs (acres)
1	C	C-Area Operable Unit	79	2015	LUCs	NA	93.86
2	D	C-, K-, and L-Reactor Complexes[c]	79, 90, 91, 95	2009	In situ Decommissioning (ISD), LUCs	NA	10.6
3	E	Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, R-1B, R-1C	22	2010	LUCs	1.22	6.4
4	F	F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	14	1997	LUCs	1.18	3.8
5	G	Gunsite 012 (including ECODS G-3)	78	2011	LUCs	NA	8.9
6	H	Heavy Equipment Wash Basin (NBN) and Central Shops Burning/Rubble Pit (631-5G)	53	2005	LUCs	0.28	0.3
7	I	K-Area Bingham Pump Outage Pit (643-1G)	20	1998	LUCs	0.59	0.6
8	J	L-Area Bingham Pump Outage Pits (643-2G, 643-3G) and P-Area Bingham Pump Outage Pits (643-4G)	26, 39	2000	LUCs	1.18	1.2
9	K	PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and Lower Three Runs (LTR) Integrator Operable Unit (IOU) Tail Portion (Middle and Lower Subunits)	35	1995, 2012	Repair Dam and Maintain the Level at 58.5 m (195 ft) Elevation Minimum, Excavation, LUCs for LTR IOU	NA	5535.2
10	L	R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3	38	2003	LUCs	1.75	3.1
11	M	Silverton Road Waste Unit (731-3A)	13	1997, 2005	LUCs	5.3	5.3

a Reflects year the decision document (i.e., RODs, IRODS, EARODs, and ESDs) was issued.
b LUCs are identified as the remedial action for SRS OUs with native soil covers in place prior to selection of the final remedy.
c The decision document included R-Reactor Complex. However, R-Reactor Complex is evaluated in R-Area Operable Unit (Phase 2: Groundwater OUs) and is not discussed in this phase.
NA Not applicable

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Table 3. LUC Summary Table

Operable Units	Media, Engineered Controls, and Areas that do not support UU/UE based on current conditions	LUCs Needed	LUCs Called for in the Decision Documents	Impacted Parcel(s)	LUC Objectives[a]	Title of LUC Instrument Implemented and Date (or Planned)
C-Area Operable Unit	Soil, Concrete, Steel, Gravel, Sediment, Surface Water	Yes	Yes	79	• Restrict unauthorized worker access to prevent contact, removal, or excavation of contaminated media • Prohibit the development and use of property for residential house, elementary and secondary schools, child care facilities and playgrounds	SRNS 2015a
C-, K-, L-Reactor Complexes[b]	Concrete, Sediment, Metal, Soil, Groundwater	Yes	Yes	79, 90, 91	• Restrict unauthorized worker access to prevent contact, removal, or excavation of contaminated media • Prohibit the development and use of property for residential house, elementary and secondary schools, child care facilities and playgrounds • Maintain the integrity of any current or future remedial or monitoring systems • Prevent access or use of contaminated groundwater until cleanup levels are met • Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion	SRNS 2010a
Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, R-1B, R-1C	Soil	Yes	Yes	22	• Prevent contact, removal, or excavation of subsurface soil • Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities, and playgrounds	SRNS 2010b

Table 3. LUC Summary Table *(continued)*

Operable Units	Media, Engineered Controls, and Areas that do not support UU/UE based on current conditions	LUCs Needed	LUCs Called for in the Decision Documents	Impacted Parcel(s)	LUC Objectives[a]	Title of LUC Instrument Implemented and Date (or Planned)
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	Soil	Yes	Yes	14	• Restrict the land to future industrial use	WSRC 1998a (Section 2.0)
Gunsite 012 (including ECODS G-3)	Soil and Groundwater	Yes	Yes	78	• Prevent unrestricted use of the Building Pad Subunit and the Parking Area Subunit • Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities, and playgrounds	SRNS 2011
Heavy Equipment Wash Basin (NBN) and Central Shops Burning/ Rubble Pit (631-5G)	Soil	Yes	Yes	53	• Maintain the use of the HEWB for industrial activities only to prevent exposure to the future industrial worker • Prevent unauthorized access to the HEWB as long as the waste remains a potential threat to human health or the environment in order to protect the industrial worker • Provide public notices for disclosing former waste management and disposal activities and remedial actions taken on the site in order to protect the future residents, trespassers, and industrial workers • Prevent disturbance of the soil in the HEWB	WSRC 2005

Table 3. LUC Summary Table *(continued)*

Operable Units	Media, Engineered Controls, and Areas that do not support UU/UE based on current conditions	LUCs Needed	LUCs Called for in the Decision Documents	Impacted Parcel(s)	LUC Objectives[a]	Title of LUC Instrument Implemented and Date (or Planned)
K-Area Bingham Pump Outage Pit (643-1G)	Soil	Yes	Yes	20	• Prevent contact, removal or excavation of buried waste in the area • Preclude residential use of the area	WSRC 1998b (Section 2.0)
L-Area Bingham Pump Outage Pits (643-2G and 643-3G) and P-Area Bingham Pump Outage Pits (643-4G)	Soil	Yes	Yes	26, 39	• Prevent contact, removal or excavation of buried waste in the area • Preclude residential use of the area	WSRC 2000 (Section 2.0)
PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and Lower Three Runs (LTR) Integrator Operable Unit (IOU) Tail Portion (Middle and Lower Subunits)	Surface Water, Sediment/Soil	Yes	Yes	35	• Prevent exposure of the adolescent trespasser to cesium-137-contaminated sediment/soil in the LTR IOU Middle and Lower Subunits at levels that would exceed a risk of 1.0E-04.	SRNS 2013
R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3	Soil	Yes	Yes	38	• Maintain the use of the site for industrial activities only • Prevent unauthorized access, contact, removal and excavation of buried RCOCs exceeding remedial goals at the closed CERCLA unit as long as the waste remains a threat to human health or the environment	WSRC 2003a (Appendix B)

Table 3. LUC Summary Table *(continued)*

Operable Units	Media, Engineered Controls, and Areas that do not support UU/UE based on current conditions	LUCs Needed	LUCs Called for in the Decision Documents	Impacted Parcel(s)	LUC Objectives[a]	Title of LUC Instrument Implemented and Date (or Planned)
Silverton Road Waste Unit (731-3A)	Soil	Yes	Yes	13	• Preclude residential use of the area	WSRC 1998c (Section 2.0)

a The LUC objectives statements were obtained directly from the referenced LUC document. LUC objective statements vary in complexity due to the age of the document and guidance in place at the time the remedial decision was selected.

b The decision document included R-Reactor Complex. However, R-Reactor Complex is evaluated in R-Area Operable Unit (Phase 2: Groundwater OUs) and is not discussed in this phase.

UU/UE – unlimited use/unrestricted exposure

Table 4. Operation and Maintenance Cost Comparison for SRS OUs with LUCs

Operable Unit	Main Remedy[a]	ROD Issue Date	FY2015-FY2018 O&M Estimated Cost	FY2015-FY2018 O&M Actual Cost	% of Estimate	Comments
C-Area Operable Unit	LUCs	2015	$28,000	$21,261[b]	75.9%	Actual costs are as expected.
C-, K-, L-, R-Reactor Complexes[c]	LUCs	2009	$42,000	$25,318	60.4%	O&M shown for C-, K-, and L-Reactor Complexes only.
Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, R-1B, R-1C	LUCs	2010	$55,000	$93,697	170%	Inspections/maintenance costs were underestimated. Based on inspections, maintenance activities completed on the ECODS include additional trimming of areas surrounding the ECODS, addressing active ant mounds on soil covers, repairing a depression within ECODS R-1A, R-1B, and R-1C unit boundary, clearing trees from access roads and trails, removing vegetation that was blocking signs.
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	LUCs	1997	$5,000	$41,390	828%	Maintenance costs were not included in the estimate. Based on inspections, maintenance activities completed on FBRP include repairs to the soil cover to fix damage from hogs rutting and active ant mounds.
Gunsite 012 (including ECODS G-3)	LUCs	2011	$25,000	$76,868	307%	Maintenance costs were underestimated. Based on inspections, maintenance activities completed on Gunsite 012 include addressing active ant mounds and trimming of vegetation within the LUC boundary and access roads.
Heavy Equipment Wash Basin (NBN) and Central Shops Burning/Rubble Pit (631-5G)	LUCs	2005	$23,000	$50,053	218%	Maintenance costs were slightly underestimated. Additional maintenance activities completed included cutting vegetation at signs.
K-Area Bingham Pump Outage Pit (643-1G)	LUCs	1998	$13,436	$36,237	270%	Five-year remedy review and maintenance costs were underestimated. Additional maintenance activities completed included cutting vegetation at OU perimeter.

Table 4. Operation and Maintenance Cost Comparison for SRS OUs with LUCs *(continued/end)*

Operable Unit	Main Remedy	ROD Issue Date	FY2015-FY2018 O&M Estimated Cost	FY2015-FY2018 O&M Actual Cost	% of Estimate	Comments
L-Area Bingham Pump Outage Pits (643-2G, 643-3G) and P-Area Bingham Pump Outage Pits (643-4G)	LUCs	2000	$27,467	$59,270	216%	Five-year remedy review and maintenance costs were underestimated. Additional maintenance activities completed included addressing active ant mounds, removing dead trees, and repairing soil cover damaged from pig rutting.
PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and Lower Three Runs IOU Tail Portion (Middle and Lower Subunits)	LUCs	1995, 2012	$190,056	$62,136	33%	The actual costs for maintaining the water level in PAR Pond was not included in the comparison because this activity is part of Site Infrastructure maintenance.
R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3	LUCs	2003	$29,000	$35,032	121%	Maintenance costs were slightly underestimated. Additional maintenance activities completed included addressing active ant mounds on the soil cover and removing dead trees.
Silverton Road Waste Unit (731-3A)	LUCs	1997, 2005	$5,000	$55,764	1,115%	Five-year remedy review, inspection, and mowing costs were underestimated. Additional maintenance activities completed at SRWU include removing dead trees that had fallen onto the soil cover, addressing active ant mounds, repairing damage caused by hog rutting, cutting vegetation from drainage ditches.

a LUCs are identified as the main remedy for SRS OUs with native soil covers in place prior to selection of the final remedy. Maintenance of the native soil covers is a component of remedy implementation.

b The actual O&M Costs for CAOU are for FY2017 and FY2018 since work did not begin until FY2017.

c The decision document included R-Reactor Complex. However, R-Reactor Complex is evaluated in R-Area Operable Unit (Phase 2: Groundwater OUs) and is not discussed in this phase.

Table 5. Protectiveness Determinations/Statements from the Fifth Five Year Remedy Review for SRS OUs with Native Soil Covers and/or LUCs (SRNS 2015b)

SEMS No.	Operable Unit	Protectiveness Determination	Protectiveness Statement
79	C-Area Operable Unit[a]	NA	NA
79, 90, 91	C-, K-, L-Reactor Complexes[b]	Short-Term Protective	The remedy at the C-, K-, and L-Reactor Complexes is protective of human health and the environment by implementing LUCs to prevent exposure. However, for the remedy to be protective in the long-term, the remainder of the remedy in the Early Action Record of Decision (EAROD) to implement In Situ Decommissioning (ISD) for the C-, K-, and L-Reactor Building Complexes must be completed.
22	Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, -1B, -1C	Protective	The remedy at the ECODs L-1, N-2, P-2, and R-1A, R-1B, R-1C OU is protective of human health and the environment.
14	F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	Protective	The remedy at the FBRP OU is protective of human health and the environment.
78	Gunsite 012 (including ECODS G-3)	Protective	The remedy at the Gunsite 012 OU is protective of human health and the environment.
53	Heavy Equipment Wash Basin (NBN) and Central Shops Burning/Rubble Pit (631-5G)	Protective	The remedy at the HEWB/CSBRP OU is protective of human health and the environment.
20	K-Area Bingham Pump Outage Pit (643-1G)	Protective	The remedy at the KBPOP OU is protective of human health and the environment.
26, 39	L-Area Bingham Pump Outage Pits (643-2G and 643-3G) and P-Area Bingham Pump Outage Pits (643-4G)	Protective	The remedy at the LBPOP/PBPOP OU is protective of human health and the environment.
35	PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and Lower Three Runs IOU Tail Portion (Middle and Lower Subunits)	Protective	The remedy at PAR Pond is protective of human health and the environment.

Table 5. Protectiveness Determinations/Statements from the Fifth Five Year Remedy Review for SRS OUs with Native Soil Covers and/or LUCs (SRNS 2015b) *(continued/end)*

SEMS No.	Operable Unit	Protectiveness Determination	Protectiveness Statement
38	R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3	Protective	The remedy at the RBPOPs/RUNKs OU is protective of human health and the environment.
13	Silverton Road Waste Unit (731-3A)	Protective	The remedy at the Silverton Road OU is protective of human health and the environment.

a – OUs not included in the Fifth Five-Year Remedy Review for Native Soil Covers and/or LUCs
b - The decision document included R-Reactor Complex. However, R-Reactor Complex is evaluated in R-Area Operable Unit (Phase 2: Groundwater OUs) and is not discussed in this phase.

Table 6. Operable Units without Issues and Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
SEMS # 13, 14, 20, 22, 26, 35, 38, 39, 53, 78, 79, 90, 91

Table 7. Issues and Recommendations Identified in the Five-Year Review Report

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**	**Party Responsible**	**Oversight Party**	**Milestone Date**
N/A	N/A	N/A	N/A	N/A

Table 8. Protectiveness Statements for the Sixth Five-Year Review Report for SRS OUs with Native Soil Covers and/or LUCs

Protectiveness Statement(s)		
Operable Unit: C-AREA OPERABLE UNIT SEMS # 79	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the C-Area Operable Unit is protective of human health and the environment by implementing LUCs to prevent exposure.		
Operable Unit: C-, K-, AND L-REACTOR COMPLEXES, SEMS # 79, 90, 91[a]	*Protectiveness Determination:* Short-Term Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the C-, K-, and L-Reactor Complexes is protective of human health and the environment by implementing LUCs to prevent exposure. However, in order for the remedy to be protective in the long-term, the remainder of the remedy in the EAROD to implement ISD for the C-, K-, and L-Reactor Building Complexes must be completed.		
Operable Unit: EARLY CONSTRUCTION AND OPERATIONAL DISPOSAL SITE (ECODS) L-1, N-2, P-2, and R-1A, -1B, -1C, SEMS #22	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the ECODS L-1, N-2, P-2, and R-1A, R-1B, R-1C OU is protective of human health and the environment.		
Operable Unit: F-AREA BURNING/RUBBLE PITS (FBRP) (231-F, 231-1F, AND 231-2F), SEMS #14	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the FBRP OU is protective of human health and the environment.		
Operable Unit: GUNSITE 012 (INCLUDING ECODS G-3), SEMS #78	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the Gunsite 012 OU is protective of human health and the environment.		
Operable Unit: HEAVY EQUIPMENT WASH BASIN (HEWB) (NBN) AND CENTRAL SHOPS BURNING/RUBBLE PIT (CSBRP) (631-5G), SEMS #53	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the HEWB/CSBRP OU is protective of human health and the environment.		

Table 8. Protectiveness Statements for the Sixth Five-Year Remedy Review Report for SRS OUs with Native Soil Covers and/or LUCs *(continued/end)*

Protectiveness Statement(s) *(continued)*		
Operable Unit: K-AREA BINGHAM PUMP OUTAGE PIT (KBPOP) (643-1G), SEMS #20	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the KBPOP OU is protective of human health and the environment.		
Operable Unit: L-AREA AND P-AREA BINGHAM PUMP OUTAGE PITS (L&P BPOPs) (643-2G, 643-3G, AND 643-4G), SEMS #26, 39	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the L&P BPOPs OU is protective of human health and the environment.		
Operable Unit: PAR POND (685-G) (INCLUDING THE PRE-COOLER PONDS AND CANALS) AND LOWER THREE RUNS INTEGRATOR OPERABLE UNIT TAIL PORTION (MIDDLE AND LOWER SUBUNITS), SEMS #35	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at PAR Pond is protective of human health and the environment.		
Operable Unit: R-AREA BINGHAM PUMP OUTAGE PITS (RBPOPs) (643-8G, 643-9G AND 643-10G) AND R-AREA UNKNOWN PITS (RUNKs) #1, #2, AND #3, SEMS #38	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the RBPOPs/RUNKs OU is protective of human health and the environment.		
Operable Unit: SILVERTON ROAD WASTE UNIT (731-3A), SEMS #13	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date (if applicable):* N/A
Protectiveness Statement: The remedy at the Silverton Road OU is protective of human health and the environment.		

a The decision document included R-Reactor Complex. However, R-Reactor Complex is evaluated in R-Area Operable Unit (Phase 2: Groundwater OUs) and is not discussed in this phase.

SIXTH 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 report 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. Beginning with 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;
(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 Sixth Five-Year Remedy Review Report is due no later than January 21, 2024. For the sixth five-year remedy review reports, Table A-1 provides a schedule for issuance of the remedy reviews for the five OU remedy groupings to ensure that the five-year limit required between decision document reviews remains in compliance with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency.

A list of the SRS OUs with remedy decision documents grouped into one of the five remedy types 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 sixth 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 in 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 the SRS OUs discussed in this report, native soil covers were already in place prior to selection of the remedial action, and only LUCs were required as the final remedial action.

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

For purposes of the sixth five-year phased remedy review, SRS OUs that have monitoring activities 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 to remediate vadose zone soils with the purpose of preventing groundwater contamination. These 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 sixth 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 like native soil covers to protect against human and/or ecosystem exposure to waste or contaminated material left in place. Although clay 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 is to promote more effective surface drainage and to minimize infiltration.

SRS OUs were placed in this grouping if the selected cover features/performance 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 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 sixth 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 sixth 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 groundwater 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 volatilize 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.

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 provides a summary of SRS OUs for remedial actions without operating equipment;
- Table A-4 provides a summary of SRS OUs for remedial actions with operating equipment;
- Table A-5 chronologically lists all SRS issued decision documents. Document numbers are provided for reference;
- Table A-6 provides a summary of SRS OUs with the no remedial actions selected in the decision documents; and
- Table A-7 provides the list of OUs with remedial actions selected and their associated Superfund Enterprise Management System (SEMS) number.

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

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

a Indicates the issue year for this report: Sixth Five-Year Remedy Review Report for SRS OUs with Native Soil Covers and/or LUCs.

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Table A-2. Sixth 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***
2018	**2020**	**2019**	**2021**	**2020**	**2022**	**2021**	**2023**	**2022**	**2024**
C-Area Operable Unit		C-Area Groundwater		Central Shops Burning/Rubble Pits (631-1G and 631-3G)		B-Area Operable Unit		A-Area Burning/Rubble Pits (731-A and 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, 080-190G)		D-Area Burning/Rubble Pits (431-D and 431-1D)		C-Area Reactor Seepage Basins (904-64G, 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, R -1B, R -1C		D-Area Oil Seepage Basin (631-G)		F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 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 Southern Groundwater		Ford Building Seepage Basin (904-91G)		E-Area Low-Level Waste Facility (643-26E)		C-Area Burning/Rubble Pit (131-C)	
Gunsite 012		R-Area Operable Unit[c]		H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G)		F-Area Retention Basin (281-3F)		D-Area Operable Unit	
Heavy Equipment Wash Basin (NBN)		R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, and 904-104G) and 108-4R Overflow Basin		K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G)		F-Area Tank Farm		F-Area Groundwater Operable Unit	
K-Area Bingham Pump Outage Pit (643-1G)				M-Area Hazardous Waste Management Facility (904-51G and 904-112G)		General Separations Area Consolidation Unit		H-Area Groundwater Operable Unit	

Table A-2. Sixth 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***
2018	**2020**	**2019**	**2021**	**2020**	**2022**	**2021**	**2023**	**2022**	**2024**
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		M-Area Settling Basin Inactive Process Sewer Lines (081-M)	
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)		TNX Area Operable Unit	
Wetland Area at Dunbarton Bay in Support of Steel Creek IOU[b]						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 ROD was issued in June 2018. This OU is not included in the first phase of the sixth five-year review (i.e., native soil covers and/or LUCs) because the remedy has not been implemented.
c R-Reactor Complex will be discussed as part of R-Area Operable Unit.

Table A-3. Summary of Remedial Actions without Operating Equipment at SRS

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
Compacted Native Soil								
C-Reactor Complex	1	CKL Rx	0	0	0	0	0	3.4
K-Reactor Complex	1	CKL Rx	0	0	0	0	0	3.8
L-Reactor Complex	1	CKL Rx	0	0	0	0	0	3.5
Early Construction and Operational Disposal Site (ECODS) C-1	1	CAOU	0.16	0	0	0	0	1.27
ECODs L-1	1	ECODS	0.40	0	0	0	0	0.94
ECODs N-2	1	ECODS	0.47	0	0	0	0	1.31
ECODs P-2	1	ECODS	0.18	0	0	0	0	2.42
ECODs R-1A, R-1B, R-1C	1	ECODS	0.3	0	0	0	0	1.76
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	1	FBRP	1.18	0	0	0	0	3.8
K-Area Bingham Pump Outage Pit (BPOP) (643-1G)	1	KBPOP	0.55	0	0	0	0	0.59
L-Area BPOP (643-2G and 642-3G)	1	L/P-BPOP	0.31	0	0	0	0	0.73
P-Area BPOP (643-4G)	1	L/P-BPOP	0.28	0	0	0	0	0.41
R-Area BPOP (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3	1	RBPOP	0.88	0	0	0	0	3.1
Silverton Road Waste Unit (731-3A)	1	SRWU	1.36	0	0	0	0	5.3
Central Shops Burning/Rubble Pits (631-1G and 631-3G)	3	CSBRP	0.43	0	0	0	0	2.81
D-Area Burning/Rubble Pits (431-D and 431-1D)	3	DBRP	0.54	0	0	0	0	0.73
A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A), Metals Burning Pit (731-5A)	5	ABRP/RP MCB/MBP	9.95	0	0	0	10,200	10.1
M-Area Operable Unit	5	MAOU	0.84	3,600	0	4,350	0	70.9
Land Use Controls Only								
C-Area Operable Unit	1	CAOU	0	0	0	0	0	56.5
Gunsite 012	1	Gunsite 012	0	0	0	0	0	8.9
Heavy Equipment Wash Basin (NBN)	1	HEWB	0	0	0	0	0	0.3
Lower Three Runs IOU Tail Portion (Middle and Lower Subunits)	1	PAR Pond	5535.2	0	0	0	0	5535.2
Water Cover								
PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals)	1	PAR Pond	1,340	0	0	0	0	2556.1

Table A-3. Summary of Remedial Actions without Operating Equipment at SRS *(continued)*

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
Geosynthetic Clay (hydraulic conductivity 1E-07 cm/sec, 1E-08 cm/sec)								
General Separations Area Consolidation Unit	4	GSACU	77.3	0	0	50,950	0	86
D-Area Expanded Operable Unit consisting of D-Area Ash Basin (488-D) and D-Area Rubble Pit (431-2D)	4	DEXOU	25	0	0	110,110	74	43.27
E-Area Low-Level Waste Facility (643-26E)	4	E-Area LLWF	13.6	123,072	0	0	0	0
T-Area Operable Unit	4	TAOU	9.4	0	0	1,531	0	47.58
P-Area Reactor Seepage Basin (904-61G, 904-62G, and 904-63G)	4	PRSB	2.3	0	7,400	1,928	0	3.13
R-Area Burning/Rubble Pits (131-R and 131-1R) and Rubble Pile (631-25G)	4	RBRP/RP	0.32	0	0	0	250	0.44
Compacted Clay (hydraulic conductivity 1E07 cm/sec)								
F-Area Hazardous Waste Management Facilities (HWMFs) (904-41G, 904-42G, and 904-43G)	3	F-HWMF	6.8	0	0	0	0	10
H-Area HWMFs (904-44G, 904-45G, 904-46G, 904-56G)	3	H-HWMF	22.1	0	0	0	0	25
M-Area HWMFs (904-51G and 904-112G)	3	M-HWMF	2.4	0	37,800	39,700	0	4.5
Metallurgical Laboratory HWMF (904-110G)	3	Met Lab HWMF	0.2	0	0	0	0	3.5
Mixed Waste Management Facility (943-28E)	3	MWMF	58	0	0	0	0	85
P-Area Burning/Rubble Pit (131-P)	5	PBRP	1.33	0	0	0	0	0.89
Compacted Clay w/Waste Solidification (hydraulic conductivity 1E-05 cm/sec)								
C-Area Reactor Seepage Basins (904-64G, 904-66G, and 904-68G)	4	CRSB	3.1	0	2,667	0	0	3.1
F-Area Retention Basin (281-3F)	4	FRB	0.59	0	1,150	42	0	1.07
Old F-Area Seepage Basin (904-49G)	4	OFASB	1.8	0	10,154	0	0	1.8
L-Area Reactor Seepage Basin (904-64G)	4	LRSB	1.73	0	0	0	0	1.73
L-Area Oil and Chemical Basin (904-83G)	4	LAOCB	0.45	0	2,170	200	0	1.32
K-Area Reactor Seepage Basin (904-65G)	4	KRSB	0.2	0	583	0	0	0.74
Asphalt/Concrete								
R-Area Reactor Disassembly Basin	2	RAOU	1.55	0	123,091	0	13,404	450
R-Area Reactor Seepage Basin (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, and 904-104G) and 108-4R Overflow Basin	2	RRSB	18.1	0	0	370	0	37.8
Heavy Water Components Test Reactor	4	BAOU	0.15	0	7,208	0	0	0.15
P-Area Operable Unit	4	PAOU	0.86	0	117,981	0	10,905	85.32

Table A-3. Summary of Remedial Actions without Operating Equipment at SRS *(continued/end)*

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
Compacted Common Fill (no hydraulic conductivity requirement)								
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G)	2	CMP Pits	0.3	0	0	0	0	7.1
R-Area Ash Basin (188-R)	2	RAOU	15	0	0	0	0	15
Ford Building Seepage Basin (904-91G)	3	FBSB	0.22	0	0	0	0	0.28
K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G)	3	KBRP	0.8	0	0	10,000	0	1.15
SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)	3	SRL SB	2.1	0	0	0	6,200	2.56
P-007 Outfall	4	PAOU	4.5	0	0	0	8,000	4.5
P-Area Ash Basin (188-P)	4	PAOU	13.7	0	0	0	0	13.7
A-Area Miscellaneous Rubble Pile (731-6A)	5	AMRP	1.2	0	0	0	23.7	3.08
D-Area Operable Unit (Bubble Tower and Moderator Processing)	5	DAOU	0.7	0	0	16,500	116.7	165
C-Area Burning/Rubble Pit (131-C)	5	CBRP	0.6	0	0	0	0	141.2
D-Area Coal Pile Runoff Basin (489-D) (25% northern portion)	5	DAOU	4.8	0	0	5,720	0	4.96
New TNX Seepage Basin (904-102G)	5	NTSB	0.51	0	0	0	0	2.24

ABRP/RP = A-Area Burning/Rubble Pits and Rubble Pit
AMRP = A-Area Miscellaneous Rubble Pile
BAOU = B-Area Operable Unit
BPOP = Bingham Pump Outage Pits
CAOU = C-Area Operable Unit
CBRP = C-Area Burning/Rubble Pit
CKL Rx = C-, K-, and L-Reactor Complexes
CMP Pits = Chemicals, Metals, and Pesticides
CSBRP = Central Shops Burning/Rubble Pit
CRSB = C-Area Reactor Seepage Basin
DAOU = D-Area Operable Unit
DBRP = D-Area Burning/Rubble Pit
DEXOU = D-Area Expanded Operable Unit
ECODS = Early Construction and Operational Disposal Site
FBRP = F-Area Burning/Rubble Pits
FBSB = Ford Building Seepage Basin
FRB = F-Area Retention Basin
GSACU = General Separations Area Consolidation Unit
HEWB = Heavy Equipment Wash Basin (NBN)
HWMF = Hazardous Waste Management Facility
KBRP = K-Area Burning/Rubble Pit
KRSB = K-Reactor Seepage Basin
LAOCB = L-Area Oil and Chemical Basin
LLWF = Low-Level Waste Facility
LRSB = L-Area Reactor Seepage Basin
MAOU = M-Area Operable Unit
MCB/MBP = Miscellaneous Chemical Basin / Metals Burning Pit
Met Lab = Metallurgical Laboratory
MWMF = Mixed Waste Management Facility
NBN = no building number
NTSB = New TNX Seepage Basin
OFASB = Old F-Area Seepage Basin
PAOU = P-Area Operable Unit
PAR Pond = PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and Lower Three Runs IOU Tail Portion (Middle and Lower Subunits)
PBRP = P-Area Burning/Rubble Pit (131-P)
PRSB = P-Reactor Seepage Basin
RAOU = R-Area Operable Unit
RBRP/RP = R-Area Burning/Rubble Pits and Rubble Pile
RRSB = R-Area Reactor Seepage Basin
SRLSB = SRL Seepage Basin
SRWU = Silverton Road Waste Unit
TAOU = T-Area Operable Unit

cm/sec = centimeter per second
FYR = Five-Year Remedy
yd^3 = cubic yards

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Table A-4. Summary of Remedial Actions with Operating Equipment at SRS

Unit Name	FYR Phase	OU	Start	Finish	ZOI Area (acres)	Volume Treated	Volume Removed	COCs
Pump-and-Treat								
Water Treatment Units								
F-Area Groundwater OU	5	FAGW	1997	2003	250	345,718,674 gal	--	--
H-Area Groundwater OU	5	HAGW	1997	2003	250	347,165,473 gal	--	--
Air Stripper								
A-Area Groundwater OU	5	A/M GW	1992	Ongoing	1,600	1,914,506,457 gal	17,306 lbs	PCE, TCE
M-Area Groundwater OU	5	A/M GW	1983	Ongoing	--	5,267,510,897 gal	508,684 lbs	PCE, TCE
TNX-Area Groundwater OU	5	TNX GW	1996	2007	80	3,500,000 gal	--	--
Airlift Recirculation Pumps								
A/M-Area Groundwater OU	5	A/M GW	1997	Ongoing	0.08	1,900,000,000 gal	--	--
Thermal Treatments								
Dynamic Underground Stripping								
A/M-Area Groundwater OU	5	A/M GW	2000	2011	1.1	1,600,000 gal	70,000 lbs	VOC
A/M-Area Groundwater OU	5	A/M GW	2005	2010	--	12,000,000 gal	450,000 lbs	VOC
Electrical Resistance Heating with Soil Vapor Extraction								
C-Area Groundwater OU	5	A/M GW	2006	2006	0.02	1,800 gal	730 lbs	TCE
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G)	2	CMP Pits	2008	2009	0.05	5,300 gal	2,300 lbs	VOC
Detritiation								
D-Area Operable Unit	5	DAOU	2009	2011	--	1,650 gal	472 Ci	Tritium
Soil Vapor Extraction								
Mechanical								
A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A), Metals Burning Pit (731-5A)	5	ABRP/RP MCB/MBP	2008	2017	0.34	55,000 yd^3	143 lbs	TCE
Miscellaneous Chemical Basin (731-4A)	5	A/M GW	2001	2002	--	582 yd^3	170 lbs	TCE
A-Area Miscellaneous Rubble Pile (731-6A)	5	AMRP	2004	2017	--	6,000 yd^3	146 lbs	VOC
A/M-Area Groundwater OU (WSTS)	5	A/M GW	2012	Ongoing	--	--	2,078 lbs	VOC
A/M-Area Groundwater OU (A014 - 782-3M)	5	A/M GW	1995	Ongoing	--	--	7,424 lbs	VOC

Table A-4. Summary of Remedial Actions with Operating Equipment at SRS *(continued)*

Unit Name	FYR Phase	OU	Start	Finish	ZOI Area (acres)	Volume Treated	Volume Removed	COCs
Soil Vapor Extraction (continued)								
Mechanical (continued)								
A/M-Area Groundwater OU (A-014 - Mobile #3)	5	A/M GW	2008	Ongoing	--	--	9,211 lbs	VOC
C-Area Burning/Rubble Pit (131-C)	5	CBRP	2000	2004	0.28	4,500 yd^3	2,100 lbs	VOC
M-Area Settling Basin Inactive Process Sewer Lines (081-M)	5	MIPSL	2007	Ongoing	0.05	1,200 yd^3	4,474 lbs	PCE, TCE
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) Field A	2	CMP Pits	2002	2005	0.56	9,000 yd^3	9,300 lbs	VOC
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) Field B	2	CMP Pits	2001	2002	0.21	3,400 yd^3	230 lbs	VOC
MicroBlowers™								
A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A)	5	ABRP/RP MCB/MBP	2003	Ongoing	0.07	1,200 yd^3	0.44 lbs	VOC
Miscellaneous Chemical Basin (731-4A), Metals Burning Pit (731-5A)	5	ABRP/RP MCB/MBP	2001	Ongoing	0.04	580 yd^3	9 lbs	VOC
A/M-Area Groundwater OU (DUS)	5	A/M GW	2006	Ongoing	--	--	2,536 lbs	VOC
C-Area Burning/Rubble Pit (131-C)	5	CBRP	2004	Ongoing	--	--	682 lbs	VOC
D-Area Operable Unit (Bubble Tower)	5	DAOU	2010	Ongoing	0.03	465 yd^3	257 lbs	VOC
M-Area Settling Basin Inactive Process Sewer Lines (081-M)	5	MIPSL	2008	Ongoing	--	4,033 yd^3	40 lbs	VOC
A-Area Miscellaneous Rubble Pile (731-6A)	5	AMRP	2017	Ongoing	--	--	5 lbs	VOC
P-Area Operable Unit PSAs 3A and 3B	4	PAOU	2010	2012	--	94,622 yd^3	45 lbs	VOC
TNX-Area Groundwater OU	5	TNX GW	2007	Ongoing	--	1,500 yd^3	4.81 lbs	VOC
BaroBalls™								
A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A)	5	ABRP/RP MCB/MBP	2003	Ongoing	0.22	3,500 yd^3	--	--
M-Area Settling Basin Inactive Process Sewer Lines (081-M)	5	MIPSL	2001	Ongoing	0.19	3,200 yd^3	--	--
A/M-Area Groundwater OU	5	A/M GW	1998	Ongoing	--	--	--	--

Table A-4. Summary of Remedial Actions with Operating Equipment at SRS *(continued/end)*

Unit Name	FYR Phase	OU	Start	Finish	ZOI Area (acres)	Volume Treated	Volume Removed	COCs
Soil Vapor Extraction (continued)								
BaroBalls™ (continued)								
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) Field B	2	CMP Pits	2002	Ongoing	--	--	--	--
M-Area Operable Unit	5	MAOU	2010	Ongoing	0.59	4,350 yd^3	--	--
P-Area Burning/Rubble Pit (131-P)	5	PBRP	2004	Ongoing	0.03	1,400 yd^3	--	--
Injection								
Base Injection with Vertical Barrier Walls								
F-Area Groundwater OU	5	FAGW	2005	Ongoing	--	--	--	--
H-Area Groundwater OU	5	HAGW	2010	Ongoing	--	--	--	--
Edible Oil								
TNX-Area Groundwater OU	5	TNX GW	2008	2010	--	--	--	--

A/M GW = A/M-Area Groundwater
ABRP/RP = A-Area Burning/Rubble Pits and Rubble Pit
AMRP = A-Area Miscellaneous Rubble Pile
CBRP = C-Area Burning/Rubble Pit
CMP Pits = Chemical, Metals, and Pesticides Pits
COC = contaminant of concern
DAOU = D-Area Operable Unit
DUS = Dynamic Underground Stripping
FAGW = F-Area Groundwater
HAGW = H-Area Groundwater
MAOU = M=Area Operable Unit
MCB/MBP = Miscellaneous Chemical Basin / Metals Burning Pit
MIPSL = M-Area Settling Basin Inactive Process Sewer Lines
PAOU = P-Area Operable Unit
PBRP = P-Area Burning/Rubble Pit
PSA = Potential Source Area
TNX GW = TNX Groundwater
WSTS = Western Sector Treatment System
Ci = curies
FYR = Five-Year Remedy
gal = gallon lbs = pounds
OU = operable unit
PCE = tetrachloroethylene
TCE = trichloroethylene
VOC = volatile organic compound
yd^3 = cubic yards
ZOI = zone of influence

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Table A-5. 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 Interim ROD (RCRA)	WSRC-RP-92-744	0	September 16, 1992
M-Area Hazardous Waste Management Facility (904-51G, 904-112G) Interim ROD (RCRA)	WSRC-RP-92-743	0	September 16, 1992
Metallurgical Laboratory Hazardous Waste Management Facility (904-110G) Interim ROD (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, -42G, -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)[d]	WSRC-RP-93-1511	1	September 23, 1994
Tank 105-C Hazardous Waste Management Facility ROD (RCRA)[d]	WSRC-RP-94-106	1	September 23, 1994
TNX Groundwater Operable Unit Interim ROD[d]	WSRC-TR-94-0375	1	November 16, 1994
PAR Pond (685-G) Interim ROD[d]	**WSRC-RP-93-1549**	**0**	**February 16, 1995**
F-Area Groundwater Operable Unit IROD (RCRA)[d]	WSRC-RP-94-1162	1	April 13, 1995
H-Area Groundwater Operable Unit IROD (RCRA)[d]	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) Interim ROD	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, 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
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**

Table A-5. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P) ROD[d]	WSRC-RP-97-850	1	November 10, 1998
L-Area Oil and Chemical Basin and L-Area Acid/Caustic Basin (904-83G, 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) Interim ROD	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) Interim ROD	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-Area Reactor Seepage Basins (904-66G, 904-67G, 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[d]	WSRC-RP-98-4170	1	February 6, 2001
A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Interim ROD	WSRC-RP-2000-4001	1	February 9, 2001
Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/5A) Interim ROD	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[d]	WSRC-RP-2000-4079	1	June 7, 2001
K-Area Burning/Rubble Pit (131-K & 631-20G) ROD[d]	WSRC-RP-97-862	1	August 8, 2001
ORWBG Old Solvent Tanks (650-01E - 22E) Interim ROD	WSRC-RP-2000-4193	1	September 27, 2001
Ford Building Seepage Basin ROD	WSRC-RP-2000-4156	1	April 5, 2002
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[d]	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 & L-Area Reactor Seepage Basin 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

Table A-5. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
L-Area Burning/Rubble Pit (131-L) & 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[d]	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[d]	***WSRC-RP-2001-4163***	***1.1***	***February 12, 2004***
R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 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 (808-16G) ROD	WSRC-RP-2003-4164	1	September 20, 2004
R-Area Burning/Rubble Pits (131-R, 131-1R) and 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 OU ESD	WSRC-RP-2005-4030	1	November 7, 2005

Table A-5 Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
Hydrofluoric Acid Spill (631-4G) ROD	WSRC-RP-2005-4000	0	December 28, 2005
T-Area OU 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, 731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/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 L-1, N-2, P-2, R-1A, R-1B, R-1C ROD	**SRNS-RP-2009-00072**	**1**	**March 30, 2010**
E-Area Low Level Waste Facility (Slit Trench Disposal Units 3 and 5) ESD	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***

Table A-5. Chronological Listing of SRS Issued Decision Documents *(continued/end)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
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	0	April 20, 2017
Fifth Five-Year Remedy Review for SRS OUs with Engineered Covers	***SRNS-RP-2016-00609***	***1***	***February 21, 2018***
Fifth Five-Year Remedy Review for SRS OUs with Geosynthetic or S/S Cover Systems	***SRNS-RP-2016-00610***	***1***	***March 27, 2018***
Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit ROD[c]	**SRNS-RP-2013-00730**	**1**	**June 20, 2018**
Fifth Five-Year Remedy Review Report for SRS OUs with Operating Equipment	***SRNS-RP-2017-00567***	***1***	***December 5, 2018***

a Shaded text identifies the SRS OUs evaluated in this report for the first phase of the sixth five-year review (i.e., native soil covers and/or LUCs).

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

c Wetland Area at Dunbarton Bay (WADB) is included in the native soil covers and/or LUCs phase. However, since the sixth five-year review remedy review document development will occur before completion of the remedy implementation, WADB will not be included in this review cycle.

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

RCRA – Resource Conservation and Recovery Act

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Table A-6. 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 Burning/Rubble Pit (131-L)	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)	No Action
L-Area Rubble Pile (131-3L)	No Action
L-Area Acid/Caustic Basin (904-79G)[5]	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, 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 Oil and Chemical Basin (904-83G)

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Table A-7. List of OUs with Remedial Actions

#	OU Subunits[a,b]	SEMS #
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	48
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 N-2, NBN	
	ECODS P-2, NBN	
	ECODS R-1A, -1B, -1C, NBN	

Table A-7. List of OUs with Remedial Actions *(continued)*

#	OU Subunits[a,b]	SEMS #
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 Operable Unit	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	23
	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	Gunsite 012 Rubble Pile, NBN	78
26	H-Area Groundwater OU	9
27	H-Area Hazardous Waste Management Facility (H-Area Seepage Basin, 904-44G)	7
	H-Area Hazardous Waste Management Facility (H-Area Seepage Basin, 904-45G)	
	H-Area Hazardous Waste Management Facility (H-Area Seepage Basin, 904-46G)	
	H-Area Hazardous Waste Management Facility (H-Area Seepage Basin, 904-56G)	
28	H-Area Tank Farm, Waste Tank 12[c]	89
	H-Area Tank Farm, Waste Tank 16[c]	
29	Heavy Equipment Wash Basin, NBN	53
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 Oil Chemical Basin, 904-83G	17
35	L-Area Reactor Seepage Basin, 904-64G	65
36	L-Area Southern Groundwater, NBN	77
37	M-Area Hazardous Waste Management Facility: Lost Lake, 904-51G	1
	M-Area Hazardous Waste Management Facility: M-Area Settling Basin, 904-51G	
38	M-Area Settling Basin Inactive Process Sewers to Manhole 1, 081-M	19

Table A-7. List of OUs with Remedial Actions *(continued)*

#	OU Subunits[a,b]	SEMS #
39	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	
40	Metallurgical Laboratory Hazardous Waste Management Facility, 904-110G	2
41	Mixed Waste Management Facility, 643-28E	33
42	Old F-Area Seepage Basin, 904-49G	16
43	PAR Pond (including the Pre-Cooler Ponds and Canals), 685-G	35
	PAR Pond: Lower Three Runs Integrator Operable Unit Tail Portion (Middle and Lower Subunits)	
44	P-Area Burning/Rubble Pit, 131-P	59
45	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	
46	P-Area Reactor Seepage Basin, 904-61G	66
	P-Area Reactor Seepage Basin, 904-62G	
	P-Area Reactor Seepage Basin, 904-63G	
47	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	
48	R-Area Burning/Rubble Pit, 131-1R	43
	R-Area Burning/Rubble Pit, 131-R	
	R-Area Rubble Pit, 631-25G	
49	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-7. List of OUs with Remedial Actions *(continued/end)*

#	OU Subunits[a,b]	SEMS #
50	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	
51	Silverton Road Waste Unit, 731-3A	13
52	SRL Seepage Basin, 904-53G1	47
	SRL Seepage Basin, 904-53G2	
	SRL Seepage Basin, 904-54G	
	SRL Seepage Basin, 904-55G	
53	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	
54	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)	
55	Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit[c]	71

a OUs 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 first phase of the sixth five-year review (i.e., native soil covers and/or LUCs).

c WADB is included in the native soil covers and/or LUCs phase. However, since the sixth five-year remedy review document development will occur before completion of the remedy implementation, WADB will not be included in this review cycle.

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 2014 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 2015).

This document presents the review of the SRS OUs that implemented native soil covers and/or land use controls (LUCs) to address contaminants in soil. Groundwater was not a medium of concern for any of the OUs evaluated in this review. Therefore, maximum contaminant levels for groundwater are not presented.

The United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for Non-Radiological Constituents (May 2018) and the USEPA Preliminary Remediation Goals (PRGs) for Radionuclides (May 2018) were evaluated in this review. These values were compared to the values available in 2014 when the last five-year remedy review for SRS OUs with native soil covers and/or LUCs was initiated.

An evaluation was performed for analytes that were identified as constituents of concern (COCs) for the SRS OUs discussed in Appendix C through Appendix M. Table B-1 shows the nonradiological (i.e., chemical) soil RSLs available in 2014 compared to the 2018 nonradiological soil RSLs. Table B-2 shows the radiological soil PRGs available in 2014 compared to the 2018 radiological soil PRGs. Soil media for most OUs are remediated to human health industrial cleanup standards as designated by the anticipated future land use. However, the levels for both the industrial worker and hypothetical residential receptor are provided for comparative purposes.

Rather than generate a comparison table for each of the remedy reviews contained in this report, Tables B-1 and B-2 were developed to serve as a comprehensive reference for the OUs evaluated. In Tables B-1 and B-2, Superfund Enterprise Management Systems (SEMS) numbers (formerly known as Comprehensive Environmental Response, Compensation and Liability Information

System [CERCLIS] numbers) are shown for each analyte to identify the OU(s) where the analyte was initially identified as a COC.

A change in a standard or value can be irrelevant because the analyte(s) may no longer be present or significantly reduced due to biodegradation, decay, or excavation and offsite disposal activities. In addition, exposure to contaminants left in place may be effectively prevented by a native soil cover. Tables B-1 and B-2 do not make any distinction between COCs that were the primary drivers for selection of the remedial action and other analytes that were simply addressed through the same remedy. Most importantly, the values presented in Tables B-1 and B-2 are not cleanup levels and should not be considered remedial goals unless otherwise noted in the OU-specific remedy reviews. For these reasons, the information in Appendix B is not stand alone and must be considered in context with the information and selected remedy presented in the OU-specific reviews located in Appendix C through Appendix M.

Changes to screening levels are unique to each analyte and are often related to revisions in exposure assumptions, reference doses, cancer potency factors, and exposure pathways used to calculate the screening values. 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 2017, RSLs for benzo(a)pyrene and chemicals associated with relative potency factors (i.e. polynuclear aromatic hydrocarbons [PAHs]) were updated based on a new Integrated Risk Information System Profile, resulting in a slightly higher (less than an order of magnitude) screening level (less stringent). The uranium (soluble salts) RSL was also revised based on updated Agency for Toxic Substances and Disease Registry toxicity information, resulting in an order of magnitude decrease in the screening level (more stringent). The update to the uranium, benzo(a)pyrene and PAH screening values did not affect protectiveness of the remedies as demonstrated in the OU-specific reviews.

In 2016, a major revision to the approach for calculating PRGs was announced by USEPA. The primary change was that the plus daughters (+D) isotopes designation was removed and the secular equilibrium PRG calculation was identified as the preferred (i.e., default) value. The PRGs for each daughter are combined with the parent on a fractional basis to produce a single PRG for the

parent, and the resulting PRG is based on secular equilibrium of the full chain regardless of half-life. By comparison, the PRG (+D) values available in 2014 only included daughter products with a half-life of six months or less. For this reason, the difference in the criteria for inclusion of the daughter products must be considered when comparing the 2014 and 2018 PRG values.

There are two entries for the 2018 PRGs in Table B-2. For each constituent, the top entry is the PRG for the individual radionuclide (i.e., no daughter products). The bottom entry (in parentheses) is the default secular equilibrium PRG that includes the subsequent daughter products from the entire decay chain.

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 M. The evaluations shown in Tables B-1 and B-2 confirm that there have been no significant changes in standards or toxicity factors for the COCs identified for each OU that would affect the protectiveness of the remedies evaluated in this report.

DOCUMENTS REVIEWED

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

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Table B-1. Comparison of Nonradiological Standards in Soil Media

Analyte	2014 RSLs[a]		2018 RSLs[b]		SEMS Number(s)[c]
	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	
Antimony	3.1E+01	4.7E+02	3.1E+01	4.7E+02	78
Arsenic	6.7E-01	3.0E+00	6.8E-01	3.0E+00	13, 14
alpha-Chlordane	1.8E+00	8.0E+00	1.7E+00	7.7E+00	53
gamma-Chlordane	1.8E+00	8.0E+00	1.7E+00	7.7E+00	53
p,p'-DDD	2.2E+00	9.6E+00	1.9E+00	9.6E+00	53
p,p'-DDT	1.9E+00	8.6E+00	1.9E+00	8.5E+00	53
Dioxin (HpCDD)	1.0E-04	4.7E-04	1.0E-04	4.7E-04	14
Heptachlor epoxide	5.9E-02	2.5E-01	7.0E-02	3.3E-01	53
Polychlorinated biphenyls (PCBs)					
~Aroclor 1254	2.4E-01	1.0E+00	2.4E-01	9.7E-01	14, 26, 39
~Aroclor 1260	2.4E-01	1.0E+00	2.4E-01	9.9E-01	26, 39
Polynuclear Aromatic Hydrocarbons (PAHs)					
~Benzo[a]anthracene	1.5E-01	2.9E+00	1.1E+00	2.1E+01	26, 39, 78
~Benzo[a]pyrene	1.5E-02	2.9E-01	1.1E-01	2.1E+00	13, 14, 26, 38, 39, 53, 78
~Benzo[b]fluoranthene	1.5E-01	2.9E+00	1.1E+00	2.1E+01	26, 39, 78
~Benzo[k]fluoranthene	1.5E+00	2.9E+01	1.1E+01	2.1E+02	78
~Dibenzo[a,h]anthracene	1.5E-02	2.9E-01	1.1E-01	2.1E+00	13, 26, 38, 39, 78
~Indeno[1, 2, 3-d]pyrene	1.5E-01	2.9E+00	1.1E+00	2.1E+01	78
Uranium	2.3E+02	3.5E+03	1.6E+01	2.3E+02	79, 90, 91

a USEPA Nonradiological RSLs for soil media, May 2014.
b USEPA Nonradiological RSLs for soil media, May 2018.
c OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-7.

mg/kg = milligram per kilogram

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

Analyte[c]	2014 PRGs[a]		2018 PRGs[b]		SEMS Number(s)[d]
	Resident Soil (pCi/g)	Industrial Worker Soil (pCi/g)	Resident Soil (pCi/g)	Industrial Worker Soil (pCi/g)	
Americium-241	1.89E+00	4.82E+00	2.27E+00 (5.19E-02)	4.67E+00 (8.40E-02)	79, 90, 91
Americium-243(+D)	1.57E-01	2.88E-01	9.47E-01 (3.56E-02)	1.62E+00 (5.67E-02)	79, 90, 91
Antimony-125	4.72E-01	6.88E-01	4.13E-01 (6.30E-02)	6.01E-01 (9.55E-02)	79, 90, 91
Barium-133	1.73E-01	2.69E-01	1.68E-01 (8.05E-02)	2.49E-01 (1.22E-01)	79, 90, 91
Carbon-14	2.79E+02	1.11E+03	3.17E+02 (3.16E+02)	1.11E+03 (1.11E+03)	79, 90, 91
Cesium-137(+D)	6.23E-02	1.03E-01	2.53E+01 (4.55E-02)	5.71(E+01 (6.90E-02)	13, 14, 20, 35, 38, 79, 90, 91
Cobalt-60	3.90E-02	5.78E-02	3.30E-02 (9.35E-03)	4.83E-02 (1.42E-02)	35, 38, 79, 90, 91
Curium-243	3.33E-01	5.75E-01	3.50E-01 (3.85E-02)	5.41E-01 (6.16E-02)	79, 90, 91
Curium-244	7.25E+00	3.41E+01	8.76E+00 (9.79E-03)	3.30E+01 (1.52E-02)	79, 90, 91
Curium-245	3.95E-01	7.40E-01	3.87E-01 (4.57E-02)	6.15E-01 (7.39E-02)	79, 90, 91
Europium-152	4.06E-02	6.43E-02	3.87E-02 (2.14E-02)	5.74E-02 (3.24E-02)	79, 90, 91
Europium-154	4.80E-02	7.35E-02	4.73E-02 (1.98E-02)	6.97E-02 (2.99E-02)	79, 90, 91
Molybdenum-93	1.14E+02	2.99E+02	1.38E+02 (1.02E+02)	3.17E+02 (2.82E+02)	79, 90, 91
Nickel-59	1.08E+03	1.11E+04	7.44E+02 (7.44E+02)	2.10E+03 (2.10E+03)	79, 90, 91
Nickel-63	4.93E+02	4.99E+03	5.72E+02 (5.23E+02)	4.88E+03 (4.48E+03)	79, 90, 91
Niobium-94	1.60E-02	2.79E-02	1.60E-02 (1.60E-02)	2.43E-02 (2.43E-02)	79, 90, 91
Plutonium-238	3.23E+00	1.44E+01	4.28E+00 (1.26E-02)	1.41E+01 (2.02E-02)	79, 90, 91
Plutonium-239	2.82E+00	1.25E+01	3.79E+00 (4.53E-02)	1.22E+01 (7.27E-02)	79, 90, 91
Plutonium-240	2.83E+00	1.27E+01	3.81E+00 (9.80E-03)	1.23E+01 (1.52E-02)	79, 90, 91
Potassium-40	1.50E-01	2.65E-01	1.44E-01 (1.44E-01)	2.19E-01 (2.19E-01)	14, 79, 90, 91
Radium-226(+D)	1.27E-02	2.23E-02	1.03E+00 (1.27E-02)	3.05E+00 (2.03E-02)	79, 90, 91

Table B-2. Comparison of Radiological Standards in Soil Media *(continued/end)*

Analyte[c]	2014 PRGs[a]		2018 PRGs[b]		SEMS Number(s)[d]
	Resident Soil (pCi/g)	Industrial Worker Soil (pCi/g)	Resident Soil (pCi/g)	Industrial Worker Soil (pCi/g)	
Radium-228(+D)	3.19E-02	4.84E-02	1.47E+00 (9.87E-03)	7.50E+00 (1.53E-02)	79, 90, 91
Sodium-22	9.04E-02	1.32E-01	7.77E-02 (1.12E-02)	1.13E-02 (1.70E-02)	79, 90, 91
Strontium-90(+D)	3.71E+00	8.91E+00	1.34E+01 (3.13E+00)	3.84E+01 (6.76E+00)	14, 79, 90, 91
Thorium-228(+D)	1.54E-01	2.30E-01	2.80E+01 (1.56E-02)	1.07E+02 (2.38E-02)	79, 90, 91
Tritium (H-3)	9.34E-01	1.27E+00	2.37E-01 (1.25E-01)	2.99E-01 (1.61E-01)	79, 90, 91
Uranium-238(+D)	7.25E-01	1.49E+00	6.48E+00 (1.24E-02)	3.12E+01 (2.00E-02)	79, 90, 91

a Soil PRGs available in 2014 were the August 2010 USEPA Radiological PRGs for soil media.
b USEPA Radiological PRGs for soil media, May 2018. Top entry for each constituent is the PRG for the individual radionuclide (no progeny included, with decay). Bottom entry (in parenthesis) is the default secular equilibrium PRG that includes daughter products from the entire decay chain.
c Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix M of this document.
d OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-7.

pCi/g = picoCuries per gram

C-AREA OPERABLE UNIT

I. INTRODUCTION

This report is the first five-year review for the C-Area Operable Unit (CAOU). Contaminants have been left in place at CAOU at levels that do not allow for unlimited use and unrestricted exposure. The review was conducted from July 2018 through November 2018. The purpose of this review is to determine whether the early action remedy in place at CAOU 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 events for the CAOU.

III. BACKGROUND

The CAOU 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 of concern is soil, sediment, gravel, concrete, steel, and surface water.

The scope of the early action remedial decision for the CAOU does not include the C-Reactor Complex (105-C). The remedy review for the C-Reactor Complex (105-C) is presented in Appendix D of this document. In addition, groundwater is addressed separately under the C-Area Groundwater (CAGW) OU.

Physical Characteristics

The CAOU is located within the Fourmile Branch watershed (Figure C-1). CAOU is approximately 23 hectares (56.5 acres). Figure C-2 shows an aerial photograph of C Area. CAOU is approximately 87 m (286 ft) above mean sea level.

The CAOU is comprised of the following (Figure C-3):

- Fuel Unloading Facilities Power – Area Supv (108-3C)[1];
- Contaminated Maintenance Facility (717-C);
- Retention Basin for 100-C Containment (904-89G);
- C-Area Process Sewer Lines (PSLs) as Abandoned (no building number [NBN]) (including the Process Water Storage Tank [105-6], Cooling Water Effluent Sump [107-C], and Storage Basin [109-C];
- C-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN);
- C-Area Reactor Discharge Canal (CADC) (NBN);
- Containment Tank C803-7-1 (NBN);
- Early Construction and Operational Disposal Site (ECODS) C-1 (Near CADC) (NBN);
- Potential Release from C-Area Disassembly Basin (NBN) (including the Pre-Manufactured Metal Shelter [710-C]); and
- Potential Release from C-Area Reactor Cooling Water System (186-C/190-C).

The following outfalls are identified as potential source areas of the CAOU due to their association with the C-Area PSLs as Abandoned (NBN):

- Outfall C-01; and
- Outfall C-03.

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 CAOU as being within the site industrial area. The future land use for CAOU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

[1] The Fuel Unloading Facilities Power – Area Supv (108-3C) has been moved to the CAGW OU and is not addressed by the CAOU early action.

History of Contamination

In 1955, C-Reactor began operations with a mission of producing nuclear materials for the defense program. SRS reactors were both low pressure and low temperature reactors with heavy water cooling of the core. C-Reactor was placed on cold standby in 1987, followed by shutdown due to reduced requirements for defense-related products. Reactor operations resulted in the generation of chemical and radioactive wastes. Spills, leaks, accidental releases, or simply the operation itself resulted in releases of hazardous and/or radioactive substances. The C-Reactor is currently used as a storage site for tritiated-moderator water in tanks.

Initial Response

Several CAOU subunits have undergone removal actions. A Non-Time Critical Removal (NTCR) action was completed for the C-Area PSLs subunit in May 2012 to stabilize radioactive contamination that exceeded principal threat source material (PTSM) levels (SRNS 2011a and SRNS 2013a). This action included dewatering of the PSLs and structures, removal of equipment and placement within below grade structures, and grouting accessible openings.

A NTCR action was completed for the C-Area Reactor Area Cask Car Railroad Tracks as Abandoned subunit in June 2011 to remove surface cesium-137 contamination in soil and rail bed gravel, and offsite disposal of the contaminated material (SRNS 2010b and SRNS 2013b). A NTCR action was also completed for the C-Reactor (105-C) Disassembly Basin to evaporate the basin water and grout the basin to ground surface in September 2012 (SRNS 2011b and SRNS 2013c). This NTCR action also included removal and evaporation of the tritiated water from the Containment Tank (C803-7-1).

Basis for Taking Action

The nature and extent of contamination in soil, gravel, and concrete at the CAOU were characterized during 2011. A comprehensive approach was implemented to address potential impact to human and ecological receptors at the CAOU.

Table C-2 identifies the refined constituents of concern (RCOCs) for each unit that requires remedial action.

Subunits located inside the C Area perimeter fence line for which RCOCs were determined include:

- *Building 717-C, Contaminated Maintenance Facility* - surface concrete media: RCOCs identified for the future industrial worker scenario include cesium-137 and strontium-90 with a total cumulative risk (TCR) = 1.2E-05;
- *C-Area Cask Car Railroad Tracks as Abandoned* – surface soil/gravel media: cesium-137 identified as a RCOC for future industrial worker scenario with a risk = 2.8E-06; and
- *C-Area Process Sewer Lines as Abandoned* – potential exposure to fixed radiological contaminants within subsurface pipelines (concrete/soil media).

The other subunits located within the current C Area perimeter fence (i.e., Potential Release from C-Area Disassembly Basin and Potential Release from C-Area Reactor Cooling Water System [186-/190-C]) were determined to have no problems warranting action under the industrial land use scenario. However, these subunits will be managed with land use controls (LUCs) because of their proximity to the C-Reactor Building (105-C).

Subunits located outside the perimeter fence line for which RCOCs were determined include:

- *ECODS C-1* – surface soil media: RCOCs identified for the future resident scenario include Aroclor 1254 and polycyclic aromatic hydrocarbons (PAHs) that include benzo(a)pyrene and benzo(b)fluoranthene, with a TCR = 2.2E-05. Aroclor 1254 was also identified as a RCOC for the future industrial worker scenario with a risk = 3.6E-06.
- *Outfall C-03* = surface soil media: cesium-137 identified as a RCOC for the future resident scenario with a risk = 1.9E-05 and the future industrial worker scenario with a risk = 1.2E-05.

No ecological or CM RCOCs were identified for any of the subunits that comprise the CAOU.

IV. REMEDIAL ACTIONS

The USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) agreed to an Area OU based remedial strategy to manage surface units and waste units and facilities at the CAOU. An early remedial action is needed at portions of the CAOU because residual hazardous substances remain in place that may pose a threat to human health. The residual potential risks remaining after the NTCR actions at the C-Area PSLs subunit and the C-Area Reactor Area Cask Car Railroad Tracks as Abandoned subunit were considered in the early remedial action strategy.

In order to prevent the potential exposure to the industrial worker and/or future resident to the contaminated or potentially contaminated media at CAOU, LUCs were selected as the remedial action in the Early Action Record of Decision (EAROD) (SRNS 2015b) to prevent unrestricted land use for the following CAOU subunits:

- Contaminated Maintenance Facility (717-C);
- C-Area Process Sewer Lines as Abandoned (including the Process Water Storage Tank [106-C]. Cooling Water Effluent Sump [107-C], and Storage basin [109-C]);
- C-Area Reactor Area Cask Care Railroad Tracks as Abandoned (NBN);
- Potential Release from C-Area Disassembly Basin (including the Pre-Manufactured Metal Shelter [710-C]);
- Potential Release from C-Area Reactor Cooling Water System (186-/190-C);
- Early Construction and Operational Disposal Site (ECODS) C-1; and
- Outfall C-03.

In addition, there are two subunits not in the immediate vicinity of the C-Reactor Building (105-C) that do not pose a threat to human health and the environment and qualify for unrestricted land use. The early action remedial alternative for the following subunits is No Action:

- Retention Basin for 100-C Containment (904-89G) (including Containment Tank C803-7-1 [NBN]); and
- Outfall C-01.

The following deactivation and decommissioning (D&D) facilities listed on FFA Appendix K.2 (D&D Facilities [or remnants] that Require No Further Evaluation) are located within C Area and were included in the decision document. However, these D&D facilities do not pose a threat to human health and the environment, and require no further action:

- Air Compressor Building (607-9C);
- Effluent Monitoring Building (614-2C); and
- Gatehouse Entrance at Building 105 (701-2C).

Groundwater is not part of the CAOU. Groundwater is being addressed separately under the CAGW OU.

Remedy Selection

As stated in the EAROD (SRNS 2015b), the Remedial Action Objectives (RAOs) for the CAOU are as follows:

- Prevent future resident exposure to contaminated media or structures located within the perimeter fence line.
- Prevent industrial worker exposure to cesium-137(+D) and strontium-90(+D) contaminated concrete media that exceed 1E-06 risk levels in Building 717-C, Contaminated Maintenance Facility subunit.
- Prevent industrial worker exposure to fixed radiological contamination in concrete and/or steel inside the inactive C-Area PSLs as Abandoned that exceeds 1E-06 risk or PTSM levels.
- Prevent residential and industrial exposure to Aroclor 1254 in soils that exceed the polychlorinated biphenyl (PCB) applicable, relevant and appropriate requirement (ARAR) and 1E-06 risk at ECODS C-1 subunit.

- Prevent residential exposure to PAHs in surface soil that exceed 1E-06 risk at ECODS C-1 subunit.
- Prevent residential and industrial worker exposure to cesium-137(+D) in surface soil at Outfall C-03 subunit.

The remedial action selected to meet the RAOs and the threshold criteria to provide overall protection of human health and the environment and comply with applicable or relevant and appropriate requirements for the CAOU involves the use of LUCs. LUCs limit access to, and use of, the contaminated portions of the CAOU so human exposure to contaminated media is controlled within acceptable limits.

The following CAOU LUC objectives are necessary to ensure protectiveness of the remedy:

- Restrict unauthorized worker access to prevent contact, removal, or excavation of contaminated media (i.e., soil, gravel, concrete, and steel).
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.

Remedy Implementation

The selected remedy meets the RAOs at CAOU based on successful completion of the early action remedial action listed below:

- LUCs were placed on the 23 hectares (56.5 acres) (Figure C-4) comprising the CAOU and include the following:
  - Signage will be located at the LUC boundaries to alert on-site workers to the presence of hazardous substances and to require contacting the waste unit custodian prior to conducting any work to prevent contact with hazardous substances;
  - Access controls 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

- SRS access controls to prevent exposure to trespassers, as described in the 2013 RCRA Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.
- 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 CAOU waste management and disposal activities and remedial actions taken on the site. The deed would also include deed restrictions precluding residential use of the property.

System Operations/Operation and Maintenance

Currently, there are no systems in operation at the CAOU. Inspections are performed annually to verify that the access control warning signs are in acceptable condition and to ensure there are no unauthorized excavations, digging, or construction activities at the CAOU.

The operation and maintenance (O&M) cost associated with the selected remedy for the CAOU includes the annual inspections, maintenance, and LUCs. Table C-3 compares the actual O&M costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (SRNS 2015b). The estimated O&M cost for Fiscal Year (FY) 2015 to FY2018 was $28,000 for annual inspections, maintenance, and LUCs. The actual O&M cost for FY2017 to FY2018 is $21,261 (i.e., work did not begin until FY2017). The actual costs are as expected.

V. PROGRESS SINCE LAST REVIEW

This is the first five-year remedy review. Therefore, there is no previous protectiveness statement, or recommendations or follow-up actions.

VI. FIVE-YEAR REVIEW PROCESS

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, References;
- Confirmed the implementation of the Remedial Actions;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment C-1; 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, on October 16, 2018, and George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues were identified during these interviews. The CAOU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on October 29, 2018. No issues were identified during this inspection.

The CAOU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2018. No issues were identified for the CAOU during this inspection.

A site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on March 19, 2019. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from FY2017 to FY2018 identified overgrown vegetation. These findings were documented on the field inspections checklists and resolved soon after discovery.

Disturbance of the ECODS C-1

On January 21, 2016, SRS initially notified USEPA and SCDHEC of a soil disturbance discovered on January 12, 2016 at the ECODS C-1 including a statement that additional details would be provided in a follow-up notification no later than February 1, 2016 (SRNS 2016a). The soil disturbance occurred prior to the installation of the access control

warning signs. As part of the follow-up notification on February 1, 2016, SRS included a description of the discovery, photos of the subunit, map of the area disturbed, and an explanation of how the disturbance would be managed going forward (SRNS 2016b). The U.S. Department of Agriculture – Forest Service (USFS) planted pine seedlings in and around the ECODS C-1 during the month of December 2015. During clearing and grubbing of the vegetation in preparation for the planting activities, the USFS disturbed the top foot of soil at the ECODS C-1 based on a misunderstanding of the previous site use permit conditions applicable to this planting activity. The SCDHEC and USEPA responded to the notification with a request for a meeting to discuss the protocols for the site use permits, implementation of LUCs, and the plan for soil sampling (SCDHEC 2016, USEPA 2016). A walkdown of ECODS C-1 occurred on March 1, 2016 to discuss the details of the discovery. USDOE agreed to perform additional sampling to determine the extent of soil disturbance and responded to the SCDHEC's and USEPA's comments (USDOE 2016). Subsequent sampling indicated benzo(a)pyrene exceeded the 1E-06 residential risk level at one surface soils location beyond the proposed LUC boundary on the western portion of the ECODS C-1. The LUC boundary was modified to include this area of disturbance (Figure C-4). No activities inconsistent with the CAOU LUCs have occurred since the resolution of this discovery.

VII. TECHNICAL ASSESSMENT

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy of LUCs for the CAOU is effective in preventing human health exposure to the RCOCs and is functioning as intended.

The above remedial activities are meeting the RAOs established for the CAOU, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Early Action Land Use Control Implementation Plan for CAOU governs LUC implementation, maintenance, monitoring, reporting, and enforcement (SRNS 2015a). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restrictions to prevent unauthorized contact,

removal or excavation of subsurface soils, and restrictions to prevent disturbance of the CAOU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. All LUC objectives are being met.

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

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

The USEPA standards and toxicity values have been updated since submittal of the five-year remedy review for the CAOU as shown in Appendix B. The changes to the values for COCs at the CAOU 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 unit.

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 currently prevent the remedy for the CAOU from being protective.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

There are no recommendations or follow-up actions for CAOU.

X. PROTECTIVENESS STATEMENT(S)

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

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to, or ingestion of, contaminated soils. All threats to the CAOU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the CAOU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. NEXT REVIEW

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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, 2016. *Discussion and Resolution of Soil Disturbance at ECODS C-1,* ERD-EN-2016-0003 received February 1, 2016, South Carolina Department of Health and Environmental Control, Columbia, SC

SRNS, 2010b. *Removal Site Evaluation Report/Engineering Evaluation / Cost Analysis (RSER/EE/CA) for C-Area Reactor Area Cask Car Railroad Tracks as Abandoned (U),* SRNS-RP-2009-00856, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011a. *Removal Site Evaluation Report/Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the C-Area Operable Unit (CAOU) C-Area Process Sewer Lines as Abandoned (CPSLA) (NBN) (U),* SRNS-RP-2011-00297, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011b. *Removal Site Evaluation Report/Engineering Evaluation / Cost Analysis (RSER/EE/CA) for In Situ Decommissioning of the 105-C Disassembly Basin (U),* SRNS-RP-2010-01143, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013a. *Removal Action Report for the C-Area Operable Unit C-Area Process Sewer Lines as Abandoned Subunit (NBN) (U),* SRNS-RP-2012-00593, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013b. *Removal Action Report for the C-Area Reactor Cask Car Railroad Tracks as Abandoned (U),* SRNS-RP-2012-00584, Revision 1, Savannah River Nuclear Solutions LLC, Savannah River Site, Aiken, SC

SRNS, 2013c. *Removal Action Report (RAR) for the In Situ Decommissioning of the 105-C Disassembly Basin (U),* SRNS-RP-2012-00837, Revision 1, Savannah River Nuclear Solutions LLC, Savannah River Site, Aiken, SC

SRNS, 2015a. *Early Action Land Use Control Implementation Plan for the C-Area Operable Unit (U),* SRNS-RP-2015-00034, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2015b. *Early Action Record of Decision Remedial Alternative Selection for the C-Area Operable Unit (U),* SRNS-RP-2014-00836, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2016a. *Notification of the Early Construction and Operational Disposal Site (ECODS) C-1 of the C-Area Operable Unit (CAOU) Land Use Control Discovery,* SRNS-J2000-2016-00048, dated January 21, 2016, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2016b. *Notification of the Early Construction and Operational Disposal Site (ECODS) C-1 of the C-Area Operable Unit (CAOU) Land Use Control Discovery,* SRNS-J2000-2016-00067, dated February 1, 2016, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 2016. *Addendum to the Sampling and Analysis Plan for the Pre-Work Plan Characterization of the C-Area Operable Unit (SRNS-RP-2012-01696) (U), SRNS-RP-2016-00287, Revision 0, April 2016), and Savanah River Site's Responses to the Regulatory Comments on the DOE Notification of the Land Use Control Violation at the C-Area Operable Unit Subunit Early Construction and Operational Disposal Site C-1 Discovered January 12, 2016,* CERCLIS Number 79, IACD-16-138, dated May 10, 2016, U.S. Department of Energy, Savannah River Operations Office, 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, 2016. *EPA Response to DOE Notification of LUC Violation at the C-Area Operable Unit subunit, Early Construction and Operational Disposal Site C-1 discovered January 12, 2016, Savannah River Site NPL Site, South Carolina*, United States Environmental Protection Agency, Atlanta, GA

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

Various – Inspection Data Sheets - *Field Inspection Checklist for C-Area Reactor Operable Unit*, ER-IDS-019-074, Inspections begin in 2017 (annually)

Various – Inspection Data Sheets - *Field Inspection Checklist for Early Construction and Operational Disposal Sites (ECODS) C-1*, ER-IDS-019-075, Inspections begin in 2017 (annually)

Various – Inspection Data Sheets - *Field Inspection Checklist for Outfall C-03,* ER-IDS-019-076, Inspections begin in 2017 (annually)

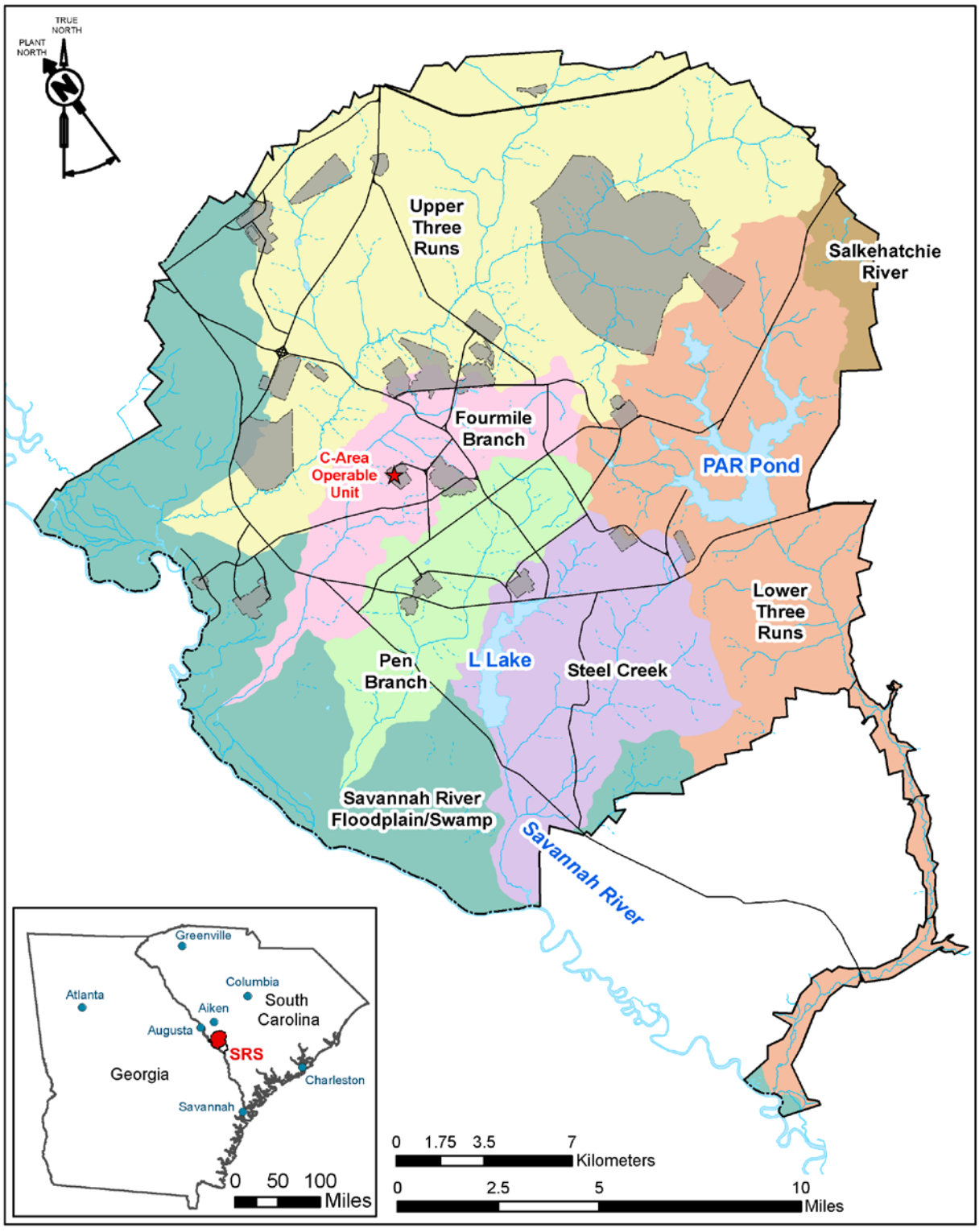


Figure C-1. Location of CAOU at SRS



Figure C-2. Aerial Photograph of CAOU (2011)

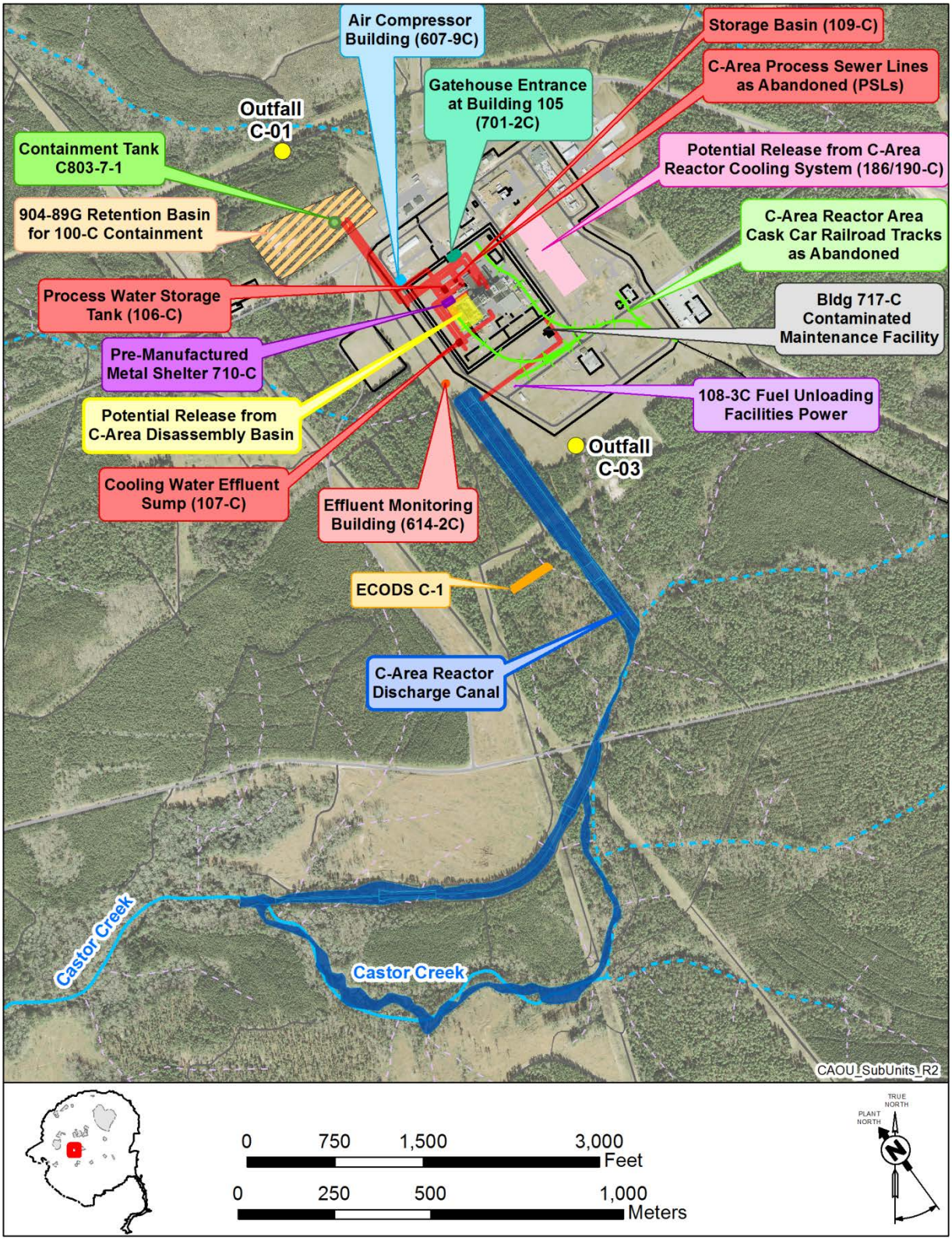


Figure C-3. Location of CAOU Subunits

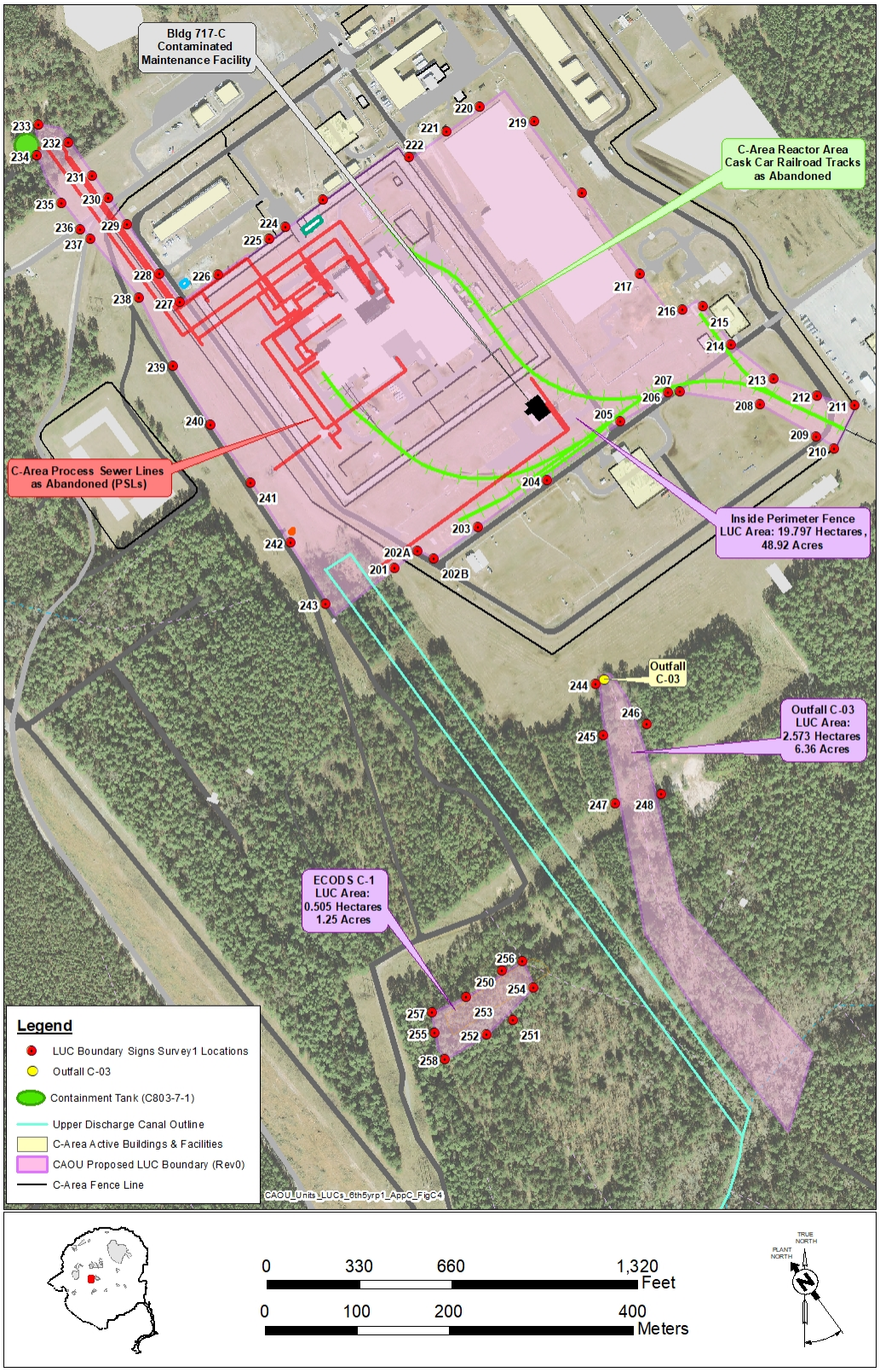


Figure C-4. LUC Boundaries for CAOU Subunits

Table C-1. Chronology of OU Events

Event	Date
C-Area Rector Area Cask Car Railroad Tracks as Abandoned Removal Action Start / Complete	May 27, 2011 / June 14, 2011
105-C Disassembly Basin Removal Action Start / Complete	June 6, 2011 / August 27, 2012
C-Area Operable Unit C-Area Process Sewer Lines as Abandoned Removal Action Start / Complete	November 28, 2011 / May 24, 2012
EAROD Issuance	September 2, 2015
Early Action Remedial Action Start / Complete	October 20, 2015 / August 16, 2016
Early Action Corrective Measures Implementation Report /Remedial Action Completion Report Approved	September 29, 2016
Previous Five-Year Reviews Issuance	None

Table C-2. RGs for CAOU

Subunit	Media	RCOC	Type of COC	RG	Basis
Building 717-C, Contaminated Maintenance Facility (pCi/g)	Concrete	Cesium-137 (+D)	HH	1.04E-01	HH – Future Industrial Worker
		Strontium-90 (+D)	HH	1.19E+01	HH – Future Industrial Worker
C-Area Process Sewer Lines as Abandoned (pCi/g)	Concrete / Steel	Radionuclides[1]	PTSM	NC	PTSM – Process History[1]
C-Area Reactor Area Cask Car Railroad Tracks as Abandoned (pCi/g)	Soil/Gravel	Cesium-137 (+D)	HH	1.03E-01	HH – Future Industrial Worker
ECODS C-1 (mg/kg)	Soil	Aroclor 1254	ARAR	2.50E+01	ARAR
		Benzo(a)pyrene	HH	1.5E-02	HH – Future Resident
		Benzo(b)fluoranthene	HH	1.50E-01	HH – Future Resident
Outfall C-03 (pCi/g)	Soil	Cesium-137 (+D)	HH	1.0E+00	Other[2]

1 – Radionuclides generically identified as PTSM based on process history. Therefore, constituent specific RGOs are not available.
2 – 95th percentile SRS background concentration may not be technically achievable; a concentration of 1 pCi/g established as RGO based on generally accepted upper bound of typical fallout levels.

ARAR – applicable or relevant and appropriate requirement
COC – constituent of concern
HH – human health
NC – not calculated
RCOC – refined COC

k

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

	FY2015	FY2016	FY2017	FY2018	4-Year Total
Total Actual O&M Costs ($)	NA	NA	$11,417	$9,843	$21,261[a]
Total ROD Estimated Direct O&M Costs* ($)	$750	$750	$20,750	$5,750	$28,000

* Source of Estimate: The estimated direct O&M costs as shown in the ROD (SRNS 2015) and show the direct O&M cost for CAOU for 30 years. Remedy review costs were estimated at $15,000 every 5 years for 30 years, which were included with the annual maintenance cost in FY2017.
[a] The actual O&M costs for the CAOU are for FY2017 and FY2018 since work did not begin until FY2017.

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Attachment C-1. Five-Year Review Site Inspection Checklist – C-Area Operable Unit

I. SITE INFORMATION			
Site Name:	**C-Area Operable Unit**	**Date of Inspection:**	**10/29/2018**
Location and Region	**SRS, USEPA Region 4**	**SEMS #:**	**#79**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**73°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 _____

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

II. INTERVIEWS *(Click all that apply)*

1. O&M Staff: George Joyner (Name) | EC&ACP Post Closure Waste Site Post Closure Manager (Title) | 10/16/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment C-1. Five-Year Review Site Inspection Checklist – C-Area Operable Unit *(continued)*

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: Annual site inspections are performed per SRS procedure *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for C-Area Reactor Operable Unit* (ER-IDS-019-074), *Field Inspection Checklist for ECODS C-1, C-Area* (ER-IDS-019-075), and *Field Inspection Checklist for Outfall C-03, C-Area* (ER-IDS-019-076).

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, HAZWOPER. A SSHASP is prepared if needed.

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 C-1. Five-Year Review Site Inspection Checklist – C-Area 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.

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

Describe costs and reasons: N/A

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.

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 five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Karen Adams (Name) | Federal Project Director (Title) | 12/03/2018 (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:

Attachment C-1. Five-Year Review Site Inspection Checklist – C-Area Operable Unit *(continued)*

D. General

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

Remarks: Activities inconsistent with the LUCs for CAOU were discovered in January 2016 (SRNS 2016a, SRNS 2016b). Based on the sampling results, the LUC boundary was modified. No activities inconsistent with the LUCs have occurred since resolution of this discovery

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

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: Annual site inspections conducted from 2017 through 2018 identified the presence of overgrown vegetation. These findings were document on the field inspection checklist and resolved soon after discovery.

Remarks: Site vegetation is mowed routinely.

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

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

X. OTHER REMEDIES ☐ 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 LUCs to prevent human exposure to contaminants in soil. 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.

The O&M procedures consisting of annual (2017-2018) site inspections and site maintenance (repairing of 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 CAOU and the condition of 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

End of Checklist

C-, K-, L-REACTOR COMPLEXES

I. Introduction

This report is the third five-year review for the C-, K-, and L-Reactor Complexes (CKL Rx). The three Reactor Complexes were first evaluated together with the R-Reactor Complex to obtain regulatory approval for in situ decommissioning (ISD) as an early remedial action (SRNS 2009a). In 2009, the U.S. Department of Energy (USDOE) decided to proceed with removal actions to support accelerated remediation of several subunits of the R-Area Operable Unit (RAOU) under the American Recovery and Reinvestment Act of 2009. These removal actions included implementation of ISD for the R-Reactor Complex as described in the Non-Time Critical Removal Action (SRNS 2009c). The remedy review for the R-Reactor Complex will be presented with the RAOU in a subsequent phase of the Sixth Five-Year Remedy Review. The remedy review in this report will focus on the CKL Rx.

Contaminants have been left in place at the CKL Rx 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 CKL Rx is protective of human health and the environment. The review for CKL Rx was conducted from July 2018 through November 2018. This report documents the results of the review.

II. OU Chronology

Table D-1 lists the chronology of events for the CKL Rx.

III. Background

The CKL Rx are listed as Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) units in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media of concern are metal components, concrete, and sediment. Groundwater was not included as part of the scope for the Early Action Record of Decision (EAROD).

Physical Characteristics

CKL Rx are located within separate watersheds near the central portion of SRS with a minimum of 8 km (5 mi) to the nearest site boundary (Figures D-1 and D-2). C-Reactor Complex resides in the Fourmile Branch watershed. K-Reactor Complex resides in the Pen Branch watershed. L-Reactor Complex resides in the Steel Creek watershed. Each Reactor Complex covers less than 1.6 hectares (4 acres). The concrete structure of each Reactor Complex extends approximately 15 m (50 ft) below ground surface and rises over 45 m (150 ft) above ground surface (Figure D-3). The CKL Rx are a subunit of their respective Area Operable Unit (OU).

Each of the Reactor Complexes includes the following subunits:

- Reactor Vessel Subunit - used for the nuclear fission process to produce nuclear materials;
- Disassembly Basin Subunit - used to cool (both thermally and radiologically) and process fuel and target assemblies for transfer to the separations facilities; and
- Reactor Building and Attached Structures Subunit – Assembly Area, Process Area, and Purification Area received and prepared fuel and target rods, housed the reactor vessel, and were used to remove fission and activation products from moderator water and blanket gas, respectively.

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 CKL Rx as being within an industrial area. The future land use for CKL Rx is reasonably anticipated to remain industrial with the USDOE maintaining control of the land.

Although the Reactor Complexes are no longer producing nuclear material, CKL Rx have continuing USDOE missions. The C-Reactor Complex is being used for storage and handling of former reactor components and radioactive material; the K-Reactor Complex is being used for nuclear material disposition activities; and the L-Reactor Complex is

being used for nuclear materials storage. These missions will cease prior to implementation of the ISD end-state.

History of Contamination

Operations in the CKL Rx resulted in the generation of chemical and radioactive waste that remains primarily with the reactor vessel, Disassembly Basin, and building and attached structures subunits of each Reactor Complex (Figures D-4 through D-6). Nuclear material is no longer being produced at the reactor facilities. C-Reactor began operating in 1955 and was shut down in 1986. K-Reactor began operating in 1954, was placed in standby in 1988, and restarted in 1992 for power ascension tests before being shut down in 1993. L-Reactor operated from 1954 to 1968 and again from 1985 to 1988.

Initial Response

No initial response actions have been taken at the CKL Rx.

Basis for Taking Action

The P-Reactor Complex was the subject of numerous investigations to determine conditions of the Reactor Vessel subunit, Disassembly Basin subunit, and Buildings and Attached Structures subunit (SRNS 2008). The evaluations performed for the three subunits at the P-Reactor Complex were used as a basis of expected conditions within the CKL Rx to provide comparative analysis for the proposed early action alternatives for the areas and to reduce or eliminate redundant analysis. The remedial goals (RGs) established for the P-Reactor Complex are included in Table D-2. Additionally, investigations conducted for the R-Reactor Complex provided additional characterization information (SRNS 2009b). The findings of these investigations were used to recommend a range of expected conditions for the CKL Rx due to similar designs and operational histories. The potential risks associated with the CKL Rx are described below:

Reactor Vessel Subunit

In each reactor vessel subunit, embedded in the floor of the process room, is a low-pressure and low-temperature reactor with deuterium oxide (D_2O [moderator]) cooling of the core.

The nuclear fission process took place within the reactor tank, a cylinder composed of stainless steel containing a lattice of fuel and target assemblies, control rods, and instrumentation submerged in the primary heavy water moderator/coolant.

No fuel or target assemblies remain within the reactor vessel. The components of the reactor vessel are in solid form and contain activated products that are part of and within the matrix material of the reactor vessel.

Because of the operations of the reactor vessel subunits, the reactor vessels contain activated components with radionuclides at concentrations exceeding the 1E-06 industrial worker risk threshold and 1E-03 principal threat source material (PTSM) risk threshold. Additionally, the reactor vessels are impacted with radionuclides at concentrations that may have a potential to migrate to groundwater above regulatory standards (i.e., maximum contaminant levels [MCLs]).

Disassembly Basin Subunit

Each disassembly basin subunit was used to cool (both thermally and radiologically) process fuel and target assemblies for transfer to the separations facilities. The disassembly basins hold aqueous and solid (sludge) media that contain fission and activation products. In addition, the disassembly basins contain activated scrap metal and failed assembly storage containers.

Because of historical operations, contaminated water, equipment, and sludge within the disassembly basins contain contamination with concentrations exceeding 1E-06 industrial worker risk threshold. Contaminants in sludge and equipment at the bottom of the disassembly basin exceed the 1E-03 PTSM risk threshold. In addition, the presence of contamination contained in water, equipment, and sludge within the disassembly basin has the potential to migrate to groundwater at levels that exceed regulatory standards (i.e., MCLs).

Reactor Building and Attached Structures Subunit

Each building subunit is a reinforced-concrete structure with walls and floors several feet thick in some areas for blast resistance. The buildings extend from -15.2 m (-50 ft) to

+45.4 m (+149 ft). Most of the processing equipment and components are located below grade.

The building is subdivided into areas based on activities performed in support of operations. These areas include the Assembly Area, Process Area, and Purification Area (Figure D-3). The Assembly Area received and prepared fuel and target rods from another area of SRS (M Area). The fuel and target rods were then sent to the Process Area. The Process Area houses the reactor vessel subunit, which is embedded in the floor of the process room. The Process Area also contains the shield water system, control and safety rod-actuating mechanisms, heat exchangers, primary coolant circuit pumps, helium blanket gas system, and the main control room. The Purification Area was used to remove fission and activation products from moderator water and blanket gas. In the Purification Area, moderator water passed through filters, ion exchange resin, and then through distillation columns before being returned to the primary cooling water circuit. This process resulted in the accumulation of radionuclides in process vessels contained within shielded cells.

Attached structures are outside of the main building, but physically connected to the main building. These attached structures include the Engine Houses (108-1 and 108-2) and the Standby Pumphouse (191). The Engine Houses are two-level facilities that provided emergency backup power for operations. These facilities contained diesel generators, direct current generators, and air compressors. The exhaust pipes for these facilities used asbestos insulation. The basement for these facilities contained support equipment including diesel tanks, coolant tanks, and pumps.

Because of activities conducted in the building and attached structures subunits, structural concrete and components may be impacted with fixed contamination at concentrations exceeding the 1E-06 industrial worker risk threshold and 1E-03 PTSM thresholds in portions of the building (i.e., sumps, Purification Area). The building concrete and components could also be impacted with contaminants at concentrations that may have the potential to migrate to groundwater at levels exceeding regulatory standards (i.e., MCLs).

IV. Remedial Actions

Remedy Selection

Based on the detailed evaluation of alternatives performed for the P-Reactor Complex (SRNS 2008), the EAROD for the CKL Rx, which was approved in September 2009, selected ISD with Land Use Controls (LUCs) as the remedy for the final end-state decision.

The basic premise of ISD is that the most cost-effective approach to isolating and containing residual radioactivity from past nuclear operations is internment of the radiological contamination in place to allow natural radioactive decay to reduce hazards to manageable levels. This method limits release of radiological contamination to the environment, minimizes radiation exposure to workers, prevents human/animal access into the building, and allows for ongoing monitoring of the decommissioned facility.

The ISD remedy for reactor complexes consists of l) maintaining the structural integrity of the above-ground portions of each facility for at least a period of 200 years, preventing exposure to receptors from residual short-lived radioisotopes in building structure and preventing tritium migration from the Reactor Complex due to infiltration; 2) stabilizing contaminants in place as necessary to prevent unacceptable release to the environment; and 3) sealing the building to eliminate routes of human and animal intruder access thereby eliminating unacceptable exposure to radiological or hazardous contamination.

Under the ISD scenario for the CKL Rx, the specific end-state configuration will be determined at the time the specific Reactor Complex is addressed. It is likely that a majority of the Reactor Building would remain, with the below-grade equipment and spaces grouted, as well as the Reactor Vessel. The Reactor Vessel would be stabilized in place using a grout with appropriate physical and chemical characteristics. The existing water would be removed from the Disassembly Basin. It is also likely that the stack and the above-grade structure of the Disassembly Basin would be removed due to safety and structural integrity concerns. In addition, the below-grade structure of the Disassembly Basin would be grouted and capped.

LUCs would also be implemented to prevent direct human/animal exposure and to preclude uses other than industrial while operational activities occur at these facilities between

signature of the EAROD and the completion of the USDOE's missions involving these facilities. The LUC objectives defined in the EAROD for the Reactor Complexes include: 1) restricting unauthorized worker access and preventing unauthorized contact, removal, or excavation of contaminated media; 2) prohibiting the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playgrounds; 3) maintaining the integrity of any current or future remedial or monitoring systems; 4) preventing access or use of contaminated groundwater until cleanup levels are met; and 5) preventing construction of habitable buildings without an evaluation of indoor air quality to address vapor intrusion. Final LUC objectives would be determined in the final Records of Decision (RODs) for the specific Area OUs.

The Selected Remedies for CKL Rx will meet the remedial action objectives (RAOs) (SRNS 2009a), which are presented below:

Reactor Vessel Subunits

- Prevent migration of radionuclides from the reactor vessel to groundwater at concentrations that exceed regulatory standards (i.e., MCLs) to the extent practicable.
- Prevent industrial worker exposure to activated reactor vessel components that exceed 1E-06 industrial worker risk and 1E-03 PTSM risk thresholds.

Disassembly Basin Subunits

- Prevent migration of radionuclides from the disassembly basin structure, water, and/or sludge to groundwater at concentrations that exceed regulatory standards (i.e., MCLs) to the extent practicable.
- Prevent industrial worker exposure to disassembly basin water, sludge, and activated metal scrap that exceed 1E-06 industrial worker risk and lE-03 PTSM risk thresholds.

Building and Attached Structures Subunits

- Prevent migration of radioactive or hazardous contaminants from the building to groundwater in concentrations that exceed regulatory standards (i.e., MCLs) to the extent practicable.

- Prevent industrial worker exposure to radioactive or hazardous contamination that exceeds 1E-06 industrial worker risk and 1E-03 PTSM risk thresholds.
- Prevent animal intruder exposure to radioactive and hazardous contamination.

The remedial actions selected to meet the RAOs and the threshold criteria to provide overall protection of human health and the environment and comply with Applicable or Relevant and Appropriate Requirements for the CKL Rx are as follows:

- ISD End State – to be completed in the future upon closure of the Reactor Building Complexes; and
- LUCs to maintain industrial land use.

Remedy Implementation

The selected remedy component currently implemented for the CKL Rx is LUCs to maintain industrial land use. The remainder of the remedy selected in the EAROD (SRNS 2009a) to implement ISD will be completed in the future upon closure of the Reactor Complexes. For this reason, final remedial goals (RGs) will be selected following subsequent engineering efforts and regulatory decisions documented in the final Area OU Proposed Plans and RODs.

The EAROD does not propose additional LUCs other than those currently used at SRS. Therefore, the Reactor Building Complexes will be maintained as an industrial use area by the following LUCs:

- Entrance requirements, warning signs and/or notices posted around the perimeter and at the entrances to the buildings designated as a Property Protection Area;
- Locations within the Reactor Complexes that contain hazardous or radiological materials/contaminants are identified by posting (existing signs) for those individuals granted access through entrance requirements;
- 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;

- SRS access controls to prevent exposure to trespassers, as described in the 2013 RCRA Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary; and
- In the long term, if the property, or any portion thereof, is ever transferred from USDOE, notice of the type and quantity of any hazardous substances that were known to have been stored (for more than one year), released, or disposed of on the property will be provided. In addition, if the property, or any portion thereof, is ever transferred by deed, the U.S. Government will also satisfy the requirements of CERCLA 120(h)(3) to include a description of the remedial action taken, a covenant, and an access clause.

System Operations/Operation and Maintenance

Inspection activities are performed annually to verify that the existing warning signs are in acceptable condition and to verify that required access controls to the Reactor Complexes are in place and functioning.

The operation and maintenance (O&M) costs associated with the selected remedy for CKL Rx include annual inspections and periodic repair/replacement of roofs and covers. Table D-3 compares the actual O&M cost over the last four years to the estimated cost from the EAROD for the CKL Rx. The EAROD estimated a direct O&M cost of $700,000 for 200 years of maintenance activities for a single reactor complex. The estimated direct O&M cost for the three reactor complexes from fiscal year (FY) 2015 to FY2018 is $42,000 as compared to the actual O&M cost of $25,318 for project support and other post-construction expenses for the same period. The EAROD estimate had O&M starting in FY2008 instead of the actual of FY2011.

V. Progress Since Last Review

This is the third five-year review for the CKL Rx. The previous protectiveness statement concluded that because the remedial actions of LUCs and in situ decommissioning are

protective, the site is protective of human health and the environment. However, for the remedy to be protective in the long-term, the remainder of the remedy for implementing ISD for the CKL Rx must be completed.

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, References; and
- Inspected the CKL Rx, 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.

Data Review

Characterization activities for the CKL Rx have not begun. The information to support the early action remedial decision for the CKL Rx was based on a range of expected conditions for the reactor complexes due to similar designs and operational histories with the P- and R-Reactor Complexes.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues were identified for the CKL Rx during these interviews. The CKL Rx were inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on September 26, 2018. No issues were identified during these inspections.

The CKL Rx were inspected by SRNS EC&ACP and USDOE personnel on December 3, 2018. No issues were identified for the CKL Rx during the inspection.

A site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on March 19, 2019. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from FY2014 through FY2018 did not identify any findings that needed to be addressed.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy of LUCs for the CKL Rx is effective in preventing the exposure of industrial receptors to contaminated media or structures. The remainder of the remedy selected in the EAROD, to implement ISD, will be completed upon closure of the Reactor Building Complexes to address all threats associated with the Reactor Building Complexes.

The Early Action Land Use Control Implementation Plan for the CKL Rx governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (SRNS 2010). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restriction to prevent unauthorized contact, removal, or excavation of subsurface soils, and restrictions to prevent disturbance of the CKL Rx. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. 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 standards or physical conditions of the CKL Rx that would affect the protectiveness of the remedy.

Since the CKL Rx have not begun characterization activities, a final list of constituents of concern (COCs) and RGs have not been determined. The methods to calculate preliminary remediation goals, COCs, and RGs will be determined prior to conducting the formal remedial investigation/baseline risk assessment and issuing the final ROD. The USEPA standards and toxicity values have been updated since the last five-year remedy review as shown in Appendix B. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy. The RAOs at CKL Rx continue to be met by the remedial action.

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 unit.

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 current site conditions or activities that would prevent the remedy from being protective once it is implemented.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for CKL Rx.

X. Protectiveness Statement(s)

The selected remedies for CKL Rx are currently protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to or ingestion of contaminated soil and concrete media. All threats to CKL Rx are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain CKL Rx for industrial use only, and warning signs and use restrictions via the Site Use/Site Clearance Program. However, for the remedy to be protective in the long-term, the remainder of the remedy in the EAROD to implement ISD for the Reactor Complexes must be completed.

XI. Next Review

As shown in Appendix A, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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, 2008. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study (CMS/FS) for P-Area Operable Unit (U),* WSRC-RP-2007-4032, Revision 1.2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009a. *Early Action Record of Decision Remedial Alternative Selection for the C-, K-, L-, and R-Reactor Complexes (U),* SRNS-RP-2009-00707, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009b. *RCRA Facility Investigation/ Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment and Corrective Measure Study/Feasibility Study (CMS/FS) for the R-Area Operable Unit (U),* WSRC-RP-2008-4035, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2009c. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for the R-Reactor Building (105-R) Complex (U),* SRNS-RP-2009-00801, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Early Action Land Use Control Implementation Plan (EALUCIP) for the C-, K-, and L-Reactor Complexes (U),* SRNS-RP-2009-01470, Revision 1, 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

Various – Inspection Data Sheets - *Field Inspection Checklist C-Reactor Complex (U),* ER-IDS-019-060, Inspection period 2015 through 2018 (annually)

Various - Inspection Data Sheets – *Field Inspection Checklist K-Reactor Complex (U),* ER-IDS-019-058, Inspection period 2015 through 2018 (annually)

Various - Inspection Data Sheets – *Field Inspection Checklist L-Reactor Complex (U),* ER-IDS-019-059, Inspection period 2015 through 2018 (annually)

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

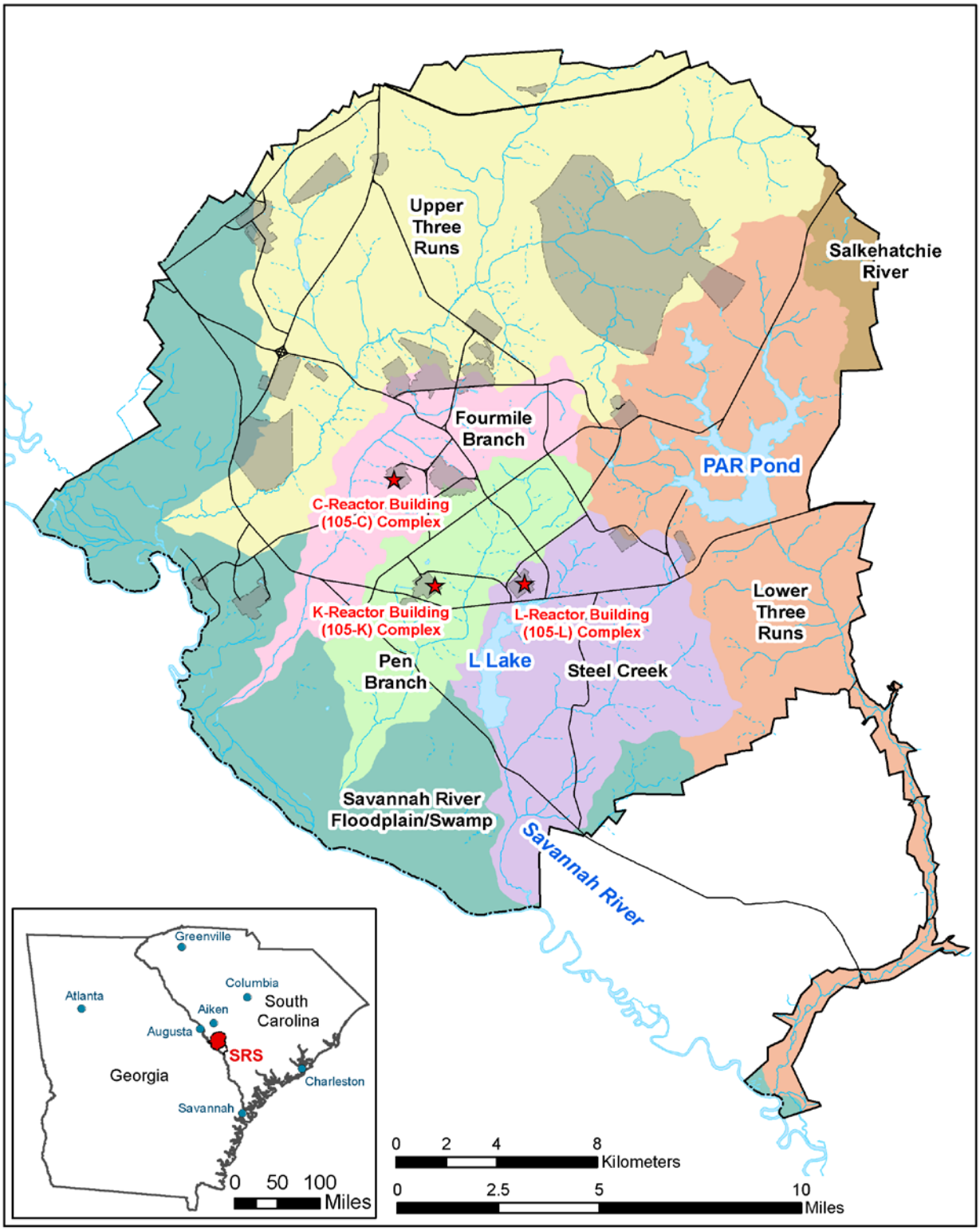


Figure D-1. Location of C-, K-, L-Reactor Complexes at Savannah River Site

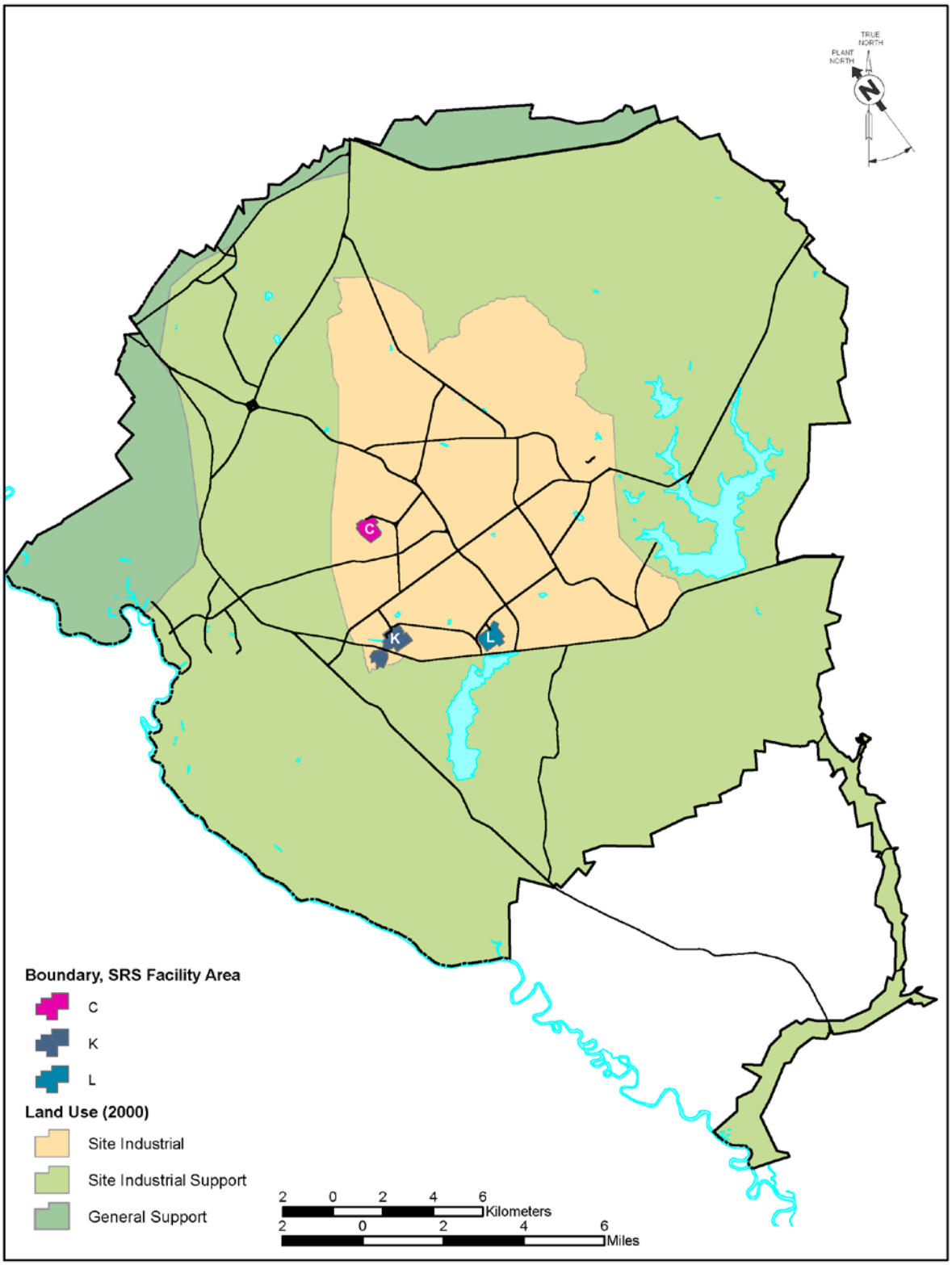


Figure D-2. Location of C-, K-, and L-Reactor Complexes within the SRS Site Industrial Land Use Boundary

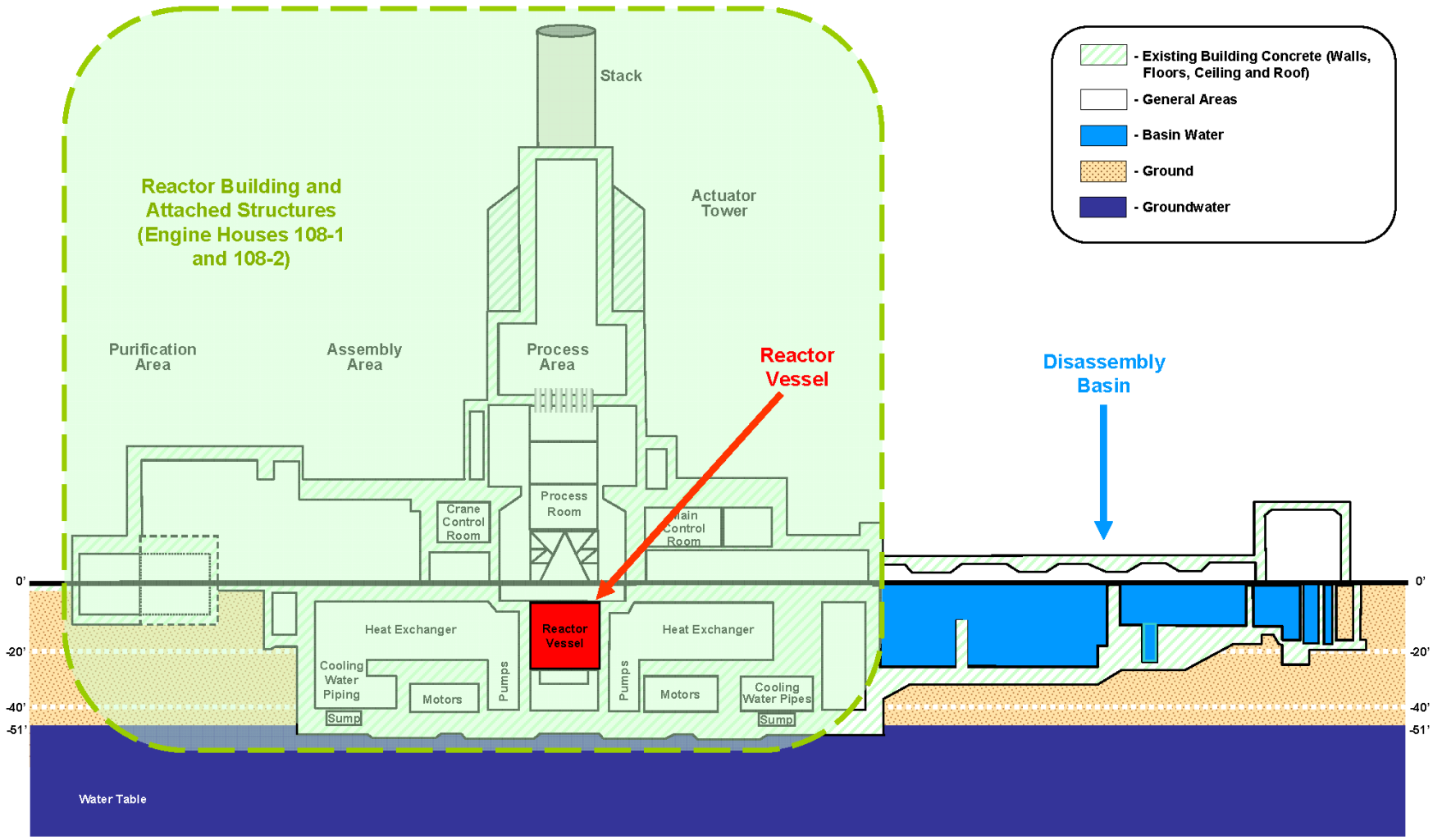


Figure D-3. Generic Layout of the Reactor Complexes Subunits

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Figure D-4. Aerial View of the C-Reactor Complex (2010)



Figure D-5. Aerial View of the K-Reactor Complex (2010)



Figure D-6. Aerial View of the L-Reactor Complex (2010)

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Table D-1. Chronology of OU Events

Event	Date
EAROD Issuance	December 8, 2009
Remedial Action Start/Finish	October 4, 2010 / March 28, 2011
Previous Five-Year Review Issuance	February 4, 2014 / November 30, 2015

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Table D-2. PAOU Refined COCs and RGs (used for CKL Rx evaluations)

Waste Unit	Refined COCs	Type of Refined COCs				RG
		PTSM	HH	ECO	CM	
105-P Reactor Vessel (metal media)	Barium-133 (ρCi/g)	X	X			3.06E-01
	Carbon-14 (ρCi/g)		X		X	8.83E+03
	Cobalt-60 (ρCi/g)	X	X			6.02E-02
	Europium-152 (ρCi/g)	X	X			7.37E-02
	Europium-154 (ρCi/g)		X			8.58E-02
	Iron-155 (ρCi/g)		X			2.21E+05
	Molybdenum-93 (ρCi/g)		X		X	8.47E+02
	Nickel-59 (ρCi/g)		X		X	1.23E+05
	Nickel-63 (ρCi/g)	X	X			5.55E+04
	Niobium-94 (ρCi/g)		X			3.00E-02
	Potassium-40 (ρCi/g)		X		X	2.74E-01
	Technetium-99 (ρCi/g)				X	
Reactor Building (105-P) and Ancillary Structures (concrete media)	Aroclor 1254 (mg/kg)		X			7.44E+00
	Cesium-137 (+D) (ρCi/g)	X	X			1.13E-01
	Cobalt-60 (ρCi/g)	X	X			6.02E-02
	Strontium-90 (+D) (ρCi/g)		X			1.43E+01
	Uranium-238 (+D) (ρCi/g)		X			1.90E+00

Table D-2. PAOU Refined COCs and RGs (used for CKL Rx evaluations) *(continued/end)*

Waste Unit	Refined COCs	Type of Refined COCs				RG
		PTSM	HH	ECO	CM	
105-P Disassembly Basin[1] (sediment media)	Americium-241 (ρCi/g)	X	X			5.71E+00
	Americium-243 (+D) (ρCi/g)	X	X			3.41E-01
	Antimony-125 (+D) (ρCi/g)	X	X			7.50E-01
	Carbon-14 (ρCi/g)		X		X	1.23E+03
	Curium-243/244 (ρCi/g)	X	X			6.74E-01
	Curium-245 (ρCi/g)	X	X			8.70E-01
	Cobalt-60 (ρCi/g)	X	X			5.96E-02
	Cesium-137 (+D) (ρCi/g)	X	X			1.12E-01
	Europium-152 (ρCi/g)	X	X			7.31E-02
	Europium-154 (ρCi/g)	X	X			8.50E-02
	Tritium (ρCi/g)	X	X			4.23E+00
	Potassium-40 (ρCi/g)	X	X		X	2.71E-01
	Molybdenum-93 (ρCi/g)				X	
	Sodium-22 (ρCi/g)	X	X			1.40E-01
	Niobium-94 (ρCi/g)	X	X			2.97E-02
	Nickel-59 (ρCi/g)				X	
	Nickel-63 (ρCi/g)		X		X	5.55E+03
	Plutonium-238 (ρCi/g)	X	X			1.66E+01
	Plutonium -239/240 (ρCi/g)	X	X			1.45E+01
	Radium-228 (+D) (ρCi/g)	X	X			1.49E-01
	Thorium-228 (+D) (ρCi/g)	X	X			2.52E-01
	Strontium-90 (+D) (ρCi/g)	X	X			1.07E+01
	Uranium (mg/kg)	X	X			2.04E+02

1 - Only the major risk drivers (i.e., risk > 1E-03) for the Disassembly Basin are identified in this table, unless they are also considered CMCOCs. Several other radiological constituents have a risk < 1E-03 but > 1E-06.

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

	FY2015	FY2016	FY2017	FY2018	4-Year Total
Actual O&M Costs	$13,946	$4,626	$3,452	$3,294	$25,318
Estimated Direct O&M Costs*	$10,500	$10,500	$10,500	$10,500	$42,000

* Source of Estimate: The EAROD (SRNS 2009a) provides the direct O&M cost for a single reactor as $700,000 for 200 years or $3,500/year. Estimated costs were combined for the CKL Rx (i.e., $10,500/year). The original cost estimate did not account for five-year remedy reviews.

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Attachment D-1. Five-Year Review Site Inspection Checklist – C-, K-, and L-Reactor Complexes

I. SITE INFORMATION			
Site Name:	**C-, K-, and L-Reactor Complexes**	**Date of Inspection:**	**09/26/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #70,90,91**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**90°F and 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 *In situ* decommissioning

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 10/16/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached

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: N/A

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

Attachment D-1. Five-Year Review Site Inspection Checklist – C-, K-, and L-Reactor Complexes *(continued)*

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: Annual site inspections are performed per SRS procedure *Waste Unit Inspection and Maintenance* (ER-SOP-019), *Field Inspection Checklist for C-Reactor Complex* (ER-IDS-019-060); *Field Inspection Checklist for K-Reactor Complex* (ER-IDS-019-058); *Field Inspection Checklist for L-Reactor Complex* (ER-IDS-019-059)

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 Site-Specific Health and Safety Plan (SSHAP) under 29 CFR 1910.1201, *Hazardous Waste Operations*. A SSHASP is prepared if needed.

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 – C-, K-, and L-Reactor Complexes *(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.

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

Describe costs and reasons: N/A

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 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.

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 five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Karen Adams (Name) | Federal Project Director (Title) | 12/03/2018 (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 of decision document 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:

Attachment D-1. Five-Year Review Site Inspection Checklist – C-, K-, and L-Reactor Complexes *(continued/end)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
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:
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A
B. Other Site Conditions:
Remarks: Site vegetation is mowed routinely.
VII. LANDFILL COVER/CONTAINMENT ☐ **Applicable** ☒ **N/A**
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
X. OTHER REMEDIES ☐ **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 selected remedy for the CKL Rx is *in situ* decommissioning with LUCs to maintain industrial land use. Warning signs have been posted around the CKL Rx and site administrative controls are in place to prevent unauthorized invasive activities at the CKL Rx. The remedy is 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. The O&M procedures consisting of annual (2014-2018) site inspections and site maintenance (verify no invasive activities have occurred 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 CKL Rx and the condition of its 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 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

End of Checklist

EARLY CONSTRUCTION AND OPERATIONAL DISPOSAL SITES (ECODS) L-1, N-2, P-2, R-1A, R-1B, AND R-1C OPERABLE UNIT

I. Introduction

This report is the third five-year review for the Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit (OU). The review was conducted from July 2018 through November 2018. Contaminants have been left in place at the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C 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 ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table E-1 lists the chronology of site events for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU.

III. Background

ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C 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 ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is surface and subsurface soil.

Due to the similar history and nature of contaminants located at these ECODS, the six ECODS (L-1, N-2, P-2, R-1A, R-1B, and R-1C) were grouped together in a single decision document.

Physical Characteristics

Twenty-five ECODS have been identified at SRS. Six of the ECODS, L-1, N-2, P-2, R-1A, R-1B, and R-1C, were selected for remedial action because of their similar history and nature of contaminants. These six ECODS are in the southern portion of the SRS

(Figure E-1). The ECODS were typically shallow (less than 3.6 m [12 ft] below ground surface) land disposal pits created during construction of area support buildings. ECODS L-1, N-2, and P-2 consist of two trenches 18 m by 45 m (60 ft by 150 ft) each. ECODS L-1 is located immediately east of L Area within the Steel Creek Integrator Operable Unit (IOU) (Figure E-2). ECODS N-2 is located near the southwestern edge of N Area within the Pen Branch IOU (Figure E-3). ECODS P-2 is located immediately south of P Area within the Steel Creek IOU (Figure E-4). ECODS R-1A, R-1B and R-1C are trenches 12 m by 24 m (40 ft by 80 ft) each and are located northeast of R Area within the Lower Three Runs IOU (Figure E-5).

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River* (WSRC 1999) designates ECODS, L-1, N-2, P-2, R-1A, R-1B, and R-1C as being outside of a site industrial area. However, according to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for this OU is reasonably anticipated to be industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The ECODS were used between 1951 and 1955 to dispose of waste material associated with the construction of SRS facilities. Construction waste was buried in these shallow, elongated trenches, with some trenches also used as burn pits for combustible waste disposal (Figure E-6).

Initial Response

After waste disposal operations ended, the trenches were backfilled with at least 0.3 m (1 ft) of natural soil. Site Evaluation Reports were developed for ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C and contain detailed information and analytical data for the investigations conducted. The investigations determined that the ECODs were not likely to be viable candidates for a No Further Action remedial decision since they contained polycyclic aromatic hydrocarbons, polychlorinated biphenyls, volatile organic compounds,

metals, and potentially friable asbestos. ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C were subsequently transferred to Appendix C of the FFA as a RCRA/CERCLA OU for further evaluation. An abbreviated RCRA Facility Investigation (RFI) /Remedial Investigation (RI), Baseline Risk Assessment (BRA), and Corrective Measures Study/Feasibility Study (CMS/FS) were prepared for each of the ECODs and presented in a Statement of Basis/Proposed Plan.

Basis for Taking Action

The RFI/RI/BRA/CMS/FS evaluations determined that there were no refined constituents of concern (COCs) that warranted a remedial action for human health (i.e., industrial worker and residential receptors), ecological receptors, contaminant migration concerns, or principal threat source material. However, asbestos is likely present in the buried waste and there is the potential for friable asbestos exposure to human receptors if buried debris below 0.3-m (1-ft) depth were brought to the surface. Soil, dust, or air samples were not taken for asbestos; however, the USDOE exercised the option to proceed directly to a response action because there is a potential threat of release and exposure to friable asbestos (USEPA 2008). Therefore, there are no risks or remedial goals associated with ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (SRNS 2009), the remedial action objective (RAO) developed for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is as follows:

- Prevent human exposure to contaminants including buried asbestos present in the subsurface soils that may present a risk to a future industrial worker or resident.

As stated in the ROD, the selected remedy for the ECODS is land use controls (LUCs) (i.e., institutional controls) to limit access to the areas.

Remedy Implementation

Following waste disposal activities, the trenches were backfilled with soil to create a native soil cover. Implementation of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU remedial action included the following:

- Establishing LUCs for 2.6 hectares (6.43 acres) [0.71 hectares (1.76 acres) for ECODS R-1A, R-1B, and R-1C; 0.98 hectares (2.42 acres) for ECODS P-2; 0.53 hectares (1.31 acres) for ECODS N-2; and 0.38 hectares (0.94 acres) for ECODS L-1] to prevent land disturbance activities and to prevent exposure to subsurface soils that may contain friable asbestos. LUCs will consist of signage at the waste unit and use restrictions via the Site Use/Site Clearance program.
- Implementation of existing access controls to prevent exposure to trespassers, as described in the 2013 RCRA Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

Discussions pertaining to these elements are provided in the Corrective Measures Implementation Report/Remedial Action Completion Report for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU (SRNS 2011). Figure E-7 includes photographs of the ECODS in 2018.

System Operations/Operations & Maintenance

There are no system operational requirements.

Maintenance requirements consist of annual site inspections and site maintenance (if needed to repair erosion damage, filling depressions [i.e., subsidence] and upkeep of warning signs).

The operation and maintenance (O&M) cost associated with the selected remedy for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU includes the annual inspections and LUCs. Table E-2 compares the actual O&M cost over the last four years to the estimated cost from the ROD for the four ECOD areas. The ROD estimated direct O&M cost is

$2,500 per year for 30 years for a single ECOD area. The estimated O&M cost for the four ECOD areas from fiscal year (FY) 2015 until the end of FY2018 is $55,000 as compared to the actual O&M cost of $93,697 for the same period. The difference between estimated and actual costs can be attributed to inspection and maintenance costs for the ECODS being underestimated. Based on inspections, maintenance activities completed on the ECODs include additional trimming of the areas surrounding the ECODs, addressing active ant mounds on the native soil covers, repairing a depression within the ECODs R-1A, R-1B, and R-1C unit boundary, clearing trees from access roads and trails, and removing vegetation that was blocking the signs.

V. Progress Since Last Review

This is the third five-year review for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU. The previous protectiveness statement concluded that because the remedial actions of LUCs are protective, the sites are protective of human health and the environment.

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-1; 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 George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues were identified for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU during these interviews. The ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area

Completion Projects (EC&ACP) on October 13, 2018 (ECODS L-1), September 17, 2018 (ECODS N-2), and September 27, 2018 (ECODS P-2, R-1A, R-1B, and R-1C). No issues were identified during these inspections.

The ECODS L-1 and P-2 were inspected by SRNS EC&ACP and USDOE personnel on November 29, 2018; the ECODS N-2, R-1A, R-1B, and R-1C OU were inspected on December 3, 2018. No issues were identified for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU during this inspection.

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 March 19, 2019. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from FY2015 through FY2018 identified the presence of down trees, overgrown vegetation near signs, and ant mounds on native soil covers. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy of LUCs for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU, is effective in preventing human exposure to buried asbestos and is functioning as intended.

The above remedial activities are meeting the RAOs established for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Land Use Control Implementation Plan for ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (SRNS 2010). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restrictions to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C

OU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. 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. There have been no changes in standards or physical conditions of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C 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 ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C 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 these sites. None of the listed emerging contaminants were identified as applicable to these units.

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

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 currently prevent the remedy for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU 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 ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to, or ingestion of, contaminated soil. All threats to the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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, 2009. *Record of Decision Remedial Alternative Selection for the Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2 and R-1A, -1B, -1C, Operable Unit (formerly Site Evaluation Areas) (U),* SRNS-RP-2009-00072, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2010. *Land Use Control Implementation Plan for the ECODS L-1, N-2, P-2 and R-1A, -1B, -1C Operable Unit (U),* SRNS-RP-2009-01373, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2011. *Corrective Measures Implementation Report/Remedial Action Completion Report for Early Construction and Operational Disposal Site L-1, N-2, P-2 and R-1A, -1B, -1C Operable Unit (U),* SRNS-RP-2010-01524, Revision 1, 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

USEPA, 2008. *Framework for Investigating Asbestos-Contaminated Superfund Sites*, Office of Solid Waste and Emergency Response, OSWER Directive #9200.0-68, Washington, D.C.

Various - *Inspection Data Sheets – Field Inspection Checklist, L-Area ECODS L-1*, ER-IDS-019-053, Inspection period 2015 through 2018 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, N-Area ECODS N-2*, ER-IDS-019-054, Inspection period 2015 through 2018 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, P-Area ECODS P-2*, ER-IDS-019-055, Inspection period 2015 through 2018 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, R-Area ECODS R-1A, R-1B, and R-1C*, ER-IDS-019-052, Inspection period 2015 through 2018 (annually)

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

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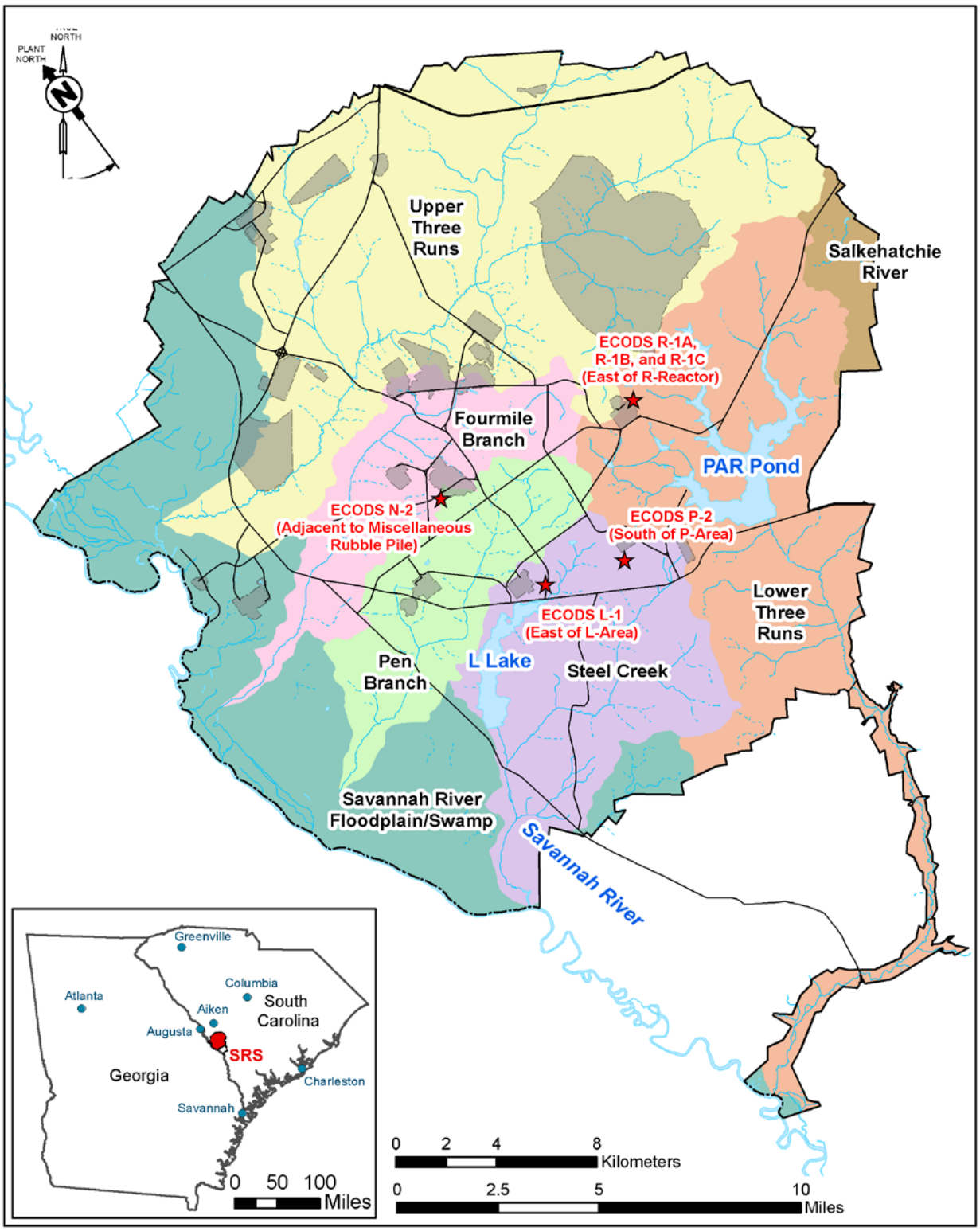


Figure E-1. Location of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU

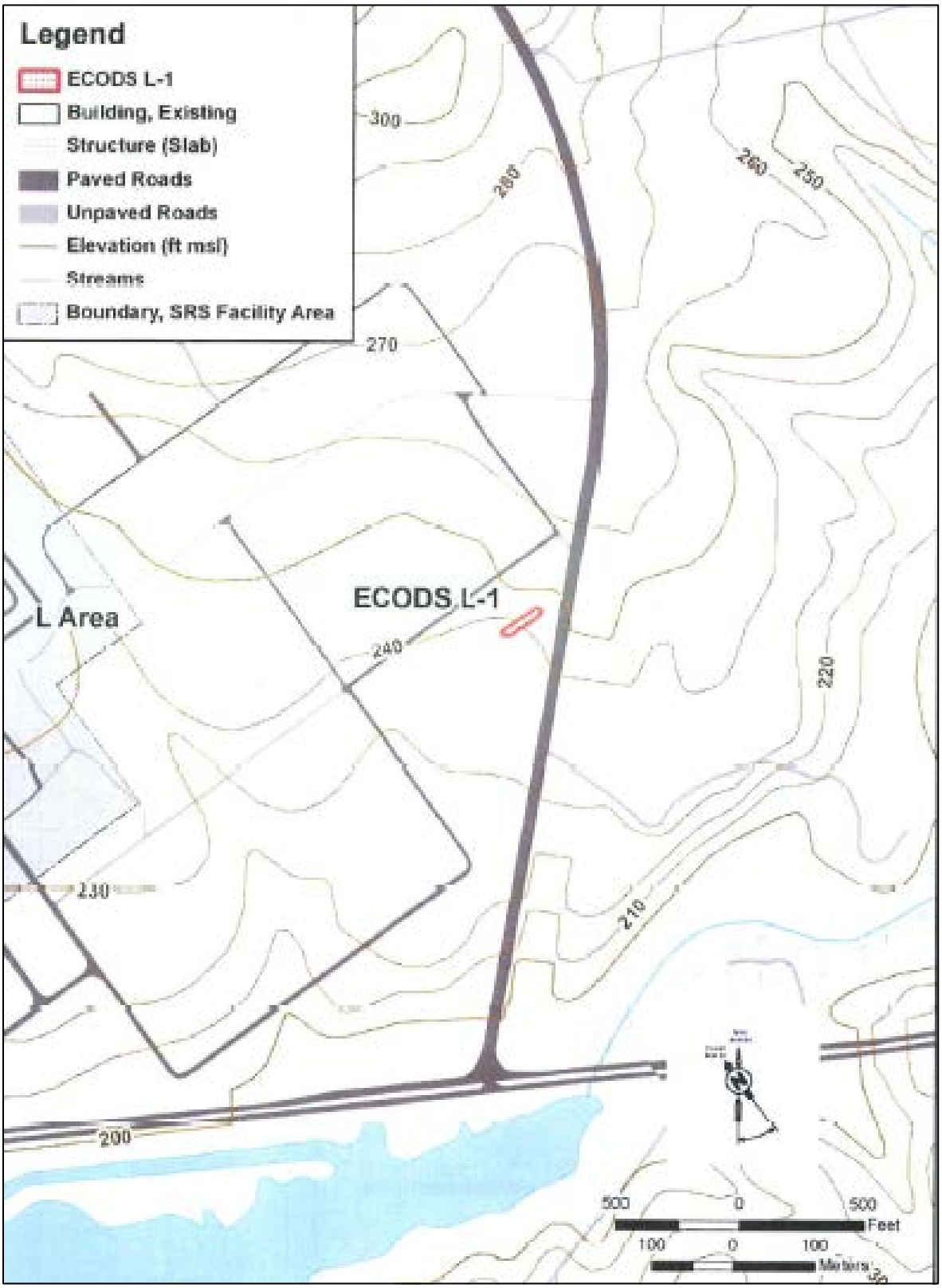


Figure E-2. Layout of the ECODS L-1

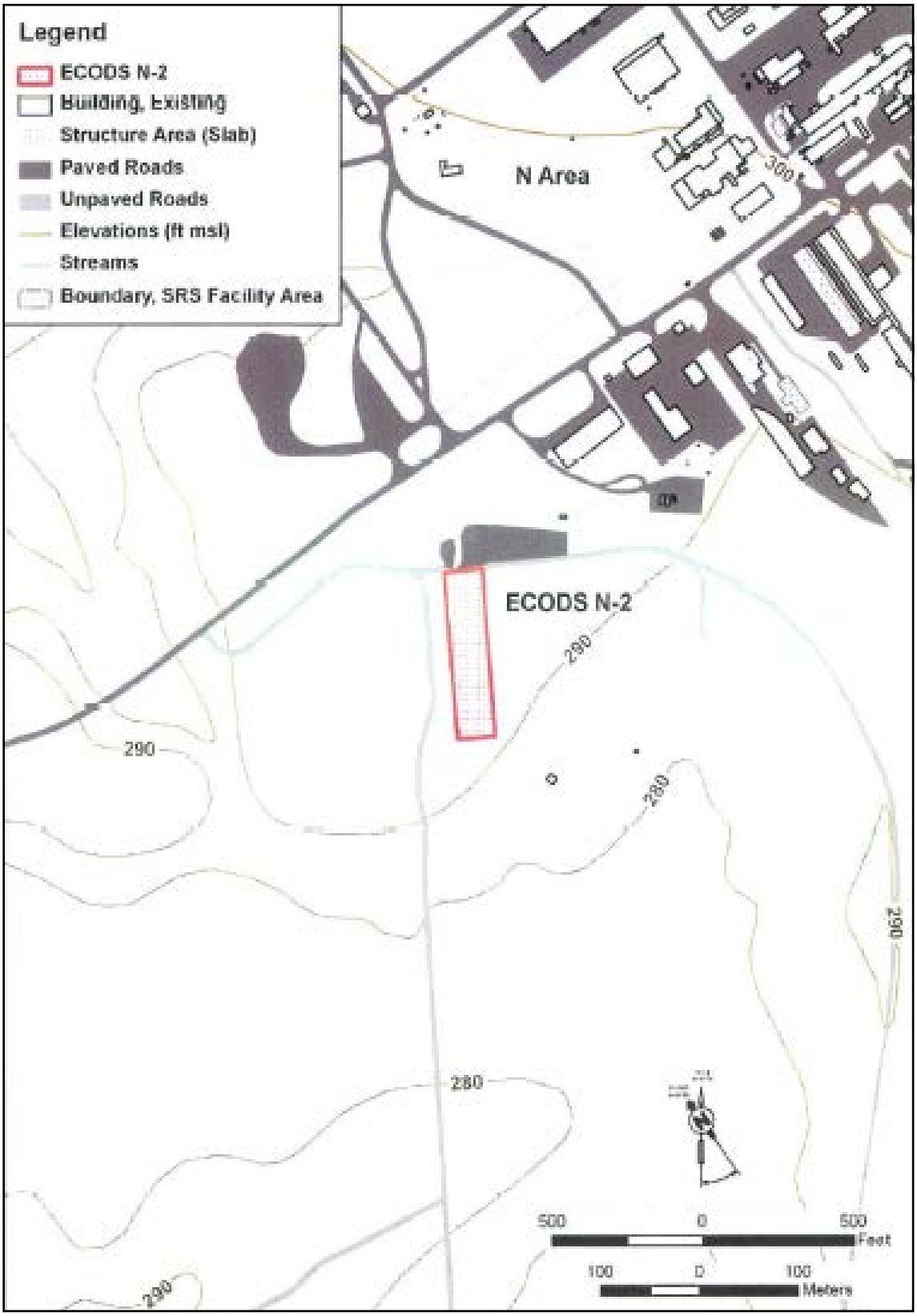


Figure E-3. Layout of the ECODS N-2

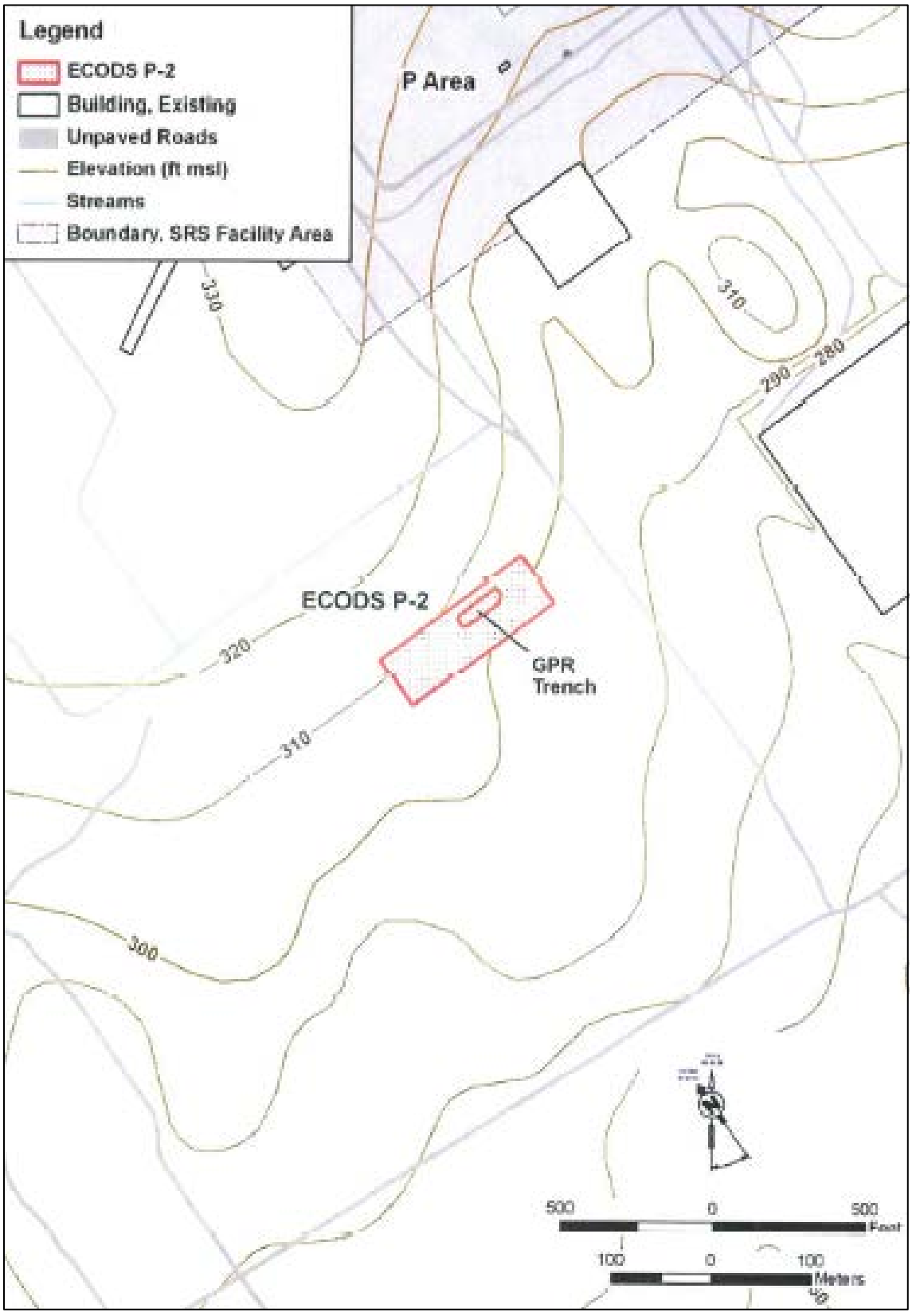


Figure E-4. Layout of the ECODS P-2

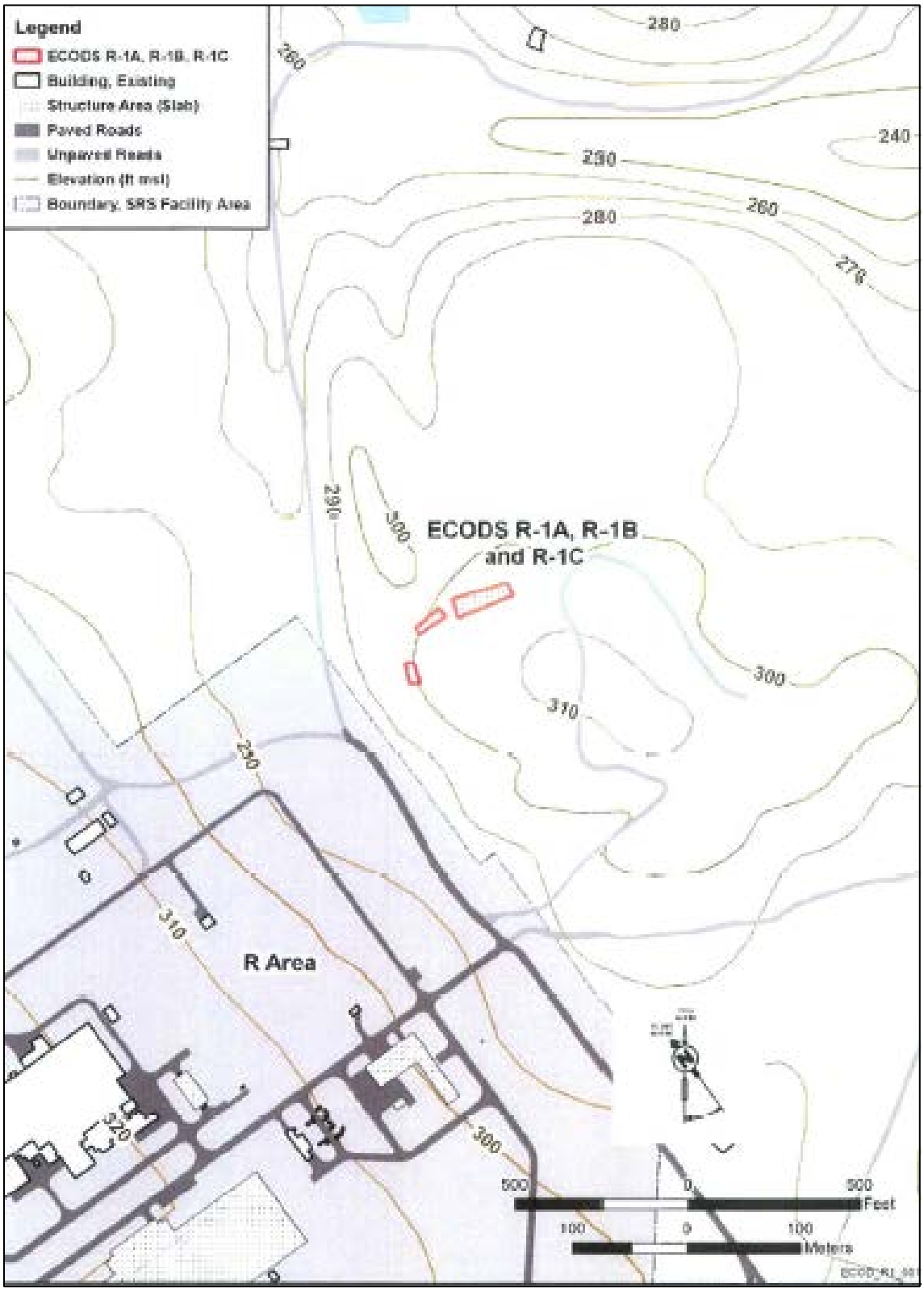


Figure E-5. Layout of the ECODS R-1A, R-1B and R-1C

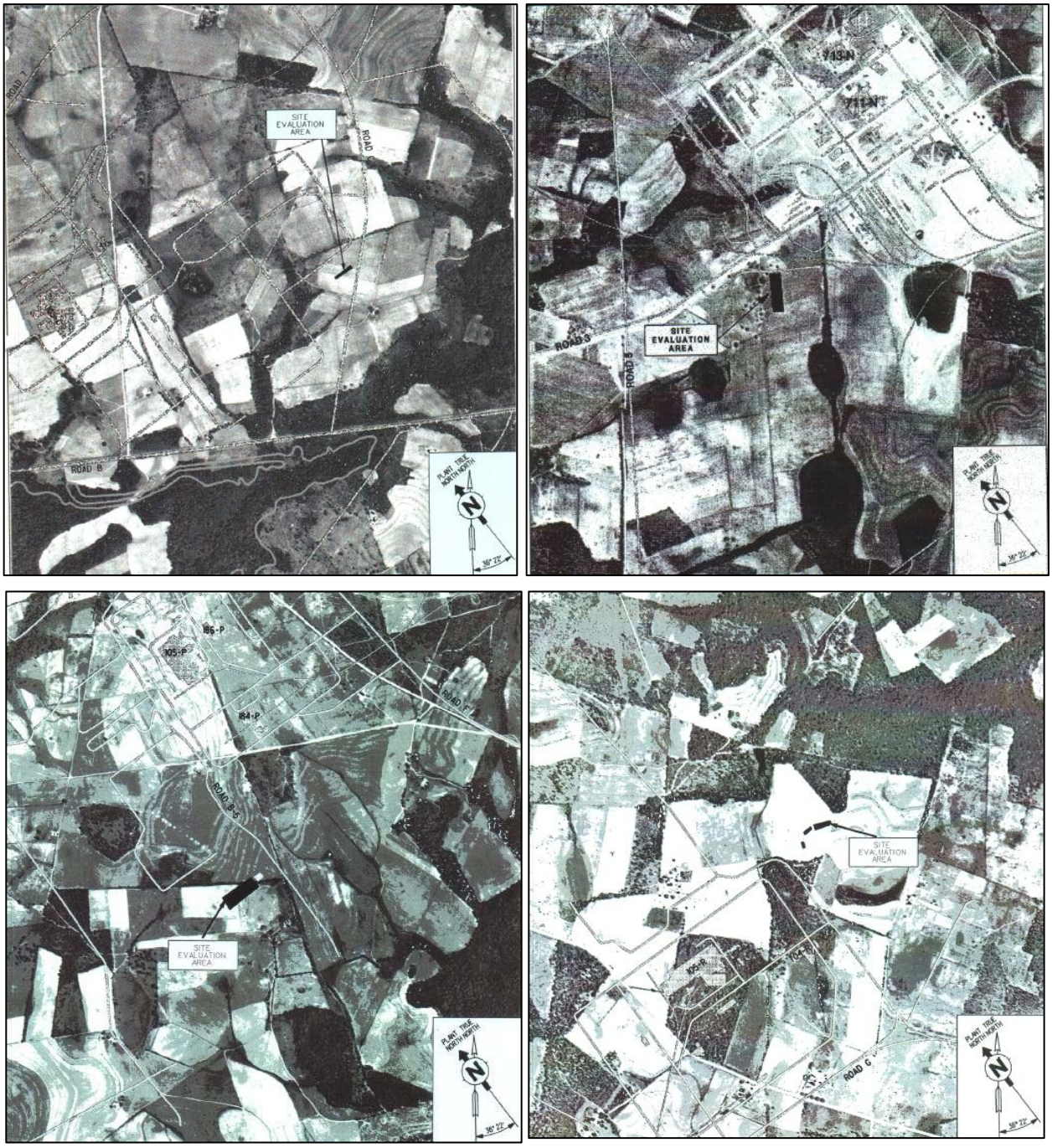


Figure E-6. Photo before Remediation (clockwise from upper left) ECODS L-1, N-2, R-1A, R-1B and R-1C, and P-2 (estimated 1951 to 1955)



Figure E-7. **Current Photographs of ECODS - clockwise from upper left - L-1, N-2, R-1A, R-1B and R-1C, and P-2 (2018)**

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Table E-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	May 2000/May 2002
ROD Issuance	March 30, 2010
Remedial Action Start/Complete	August 26, 2010 / November 2, 2010
Previous Five-Year Review Issuance	February 4, 2014 / November 30, 2015

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

	FY2015	FY2016	FY2017	FY2018	4-Year Total
Actual O&M Costs	$31,771	$25,502	$19,333	$17,090	$93,697
Estimated Direct O&M Costs*	$10,000	$10,000	$25,000	$10,000	$55,000

* Source of Estimate: The ROD (SRNS 2009) provides the annual direct O&M cost for a single ECODS area as $2,500/year for 30 years. Estimated costs were combined for the four ECODS areas (i.e., $10, 000/year). Because the remedy reviews for the four ECODS areas are combined, the estimated remedy review cost of $15,000 every five years was included with the annual maintenance cost in FY2017.

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Attachment E-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit

I. SITE INFORMATION			
Site Name:	**Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit**	**Date of Inspection:**	**09/17/2018 (N-2)** **08/27/2018 (P-2, R-1A, R-1B, R-1C)** **09/17/2018 (L-1)**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #22**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**85°F and Sunny (N-2)** **91°F and Sunny (P-2, R-1A, R-1B, R-1C)** **85°F and Sunny (L-1)**

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 ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 10/16/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment E-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

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: Annual site inspections are performed per SRS procedure *Waste Unit Inspection and Maintenance (*ER-SOP-019), *Field Inspection Checklist for the R-Area ECODS 1A, 1B, 1C OU (*ER-IDS-019-052), *Field Inspection Checklist for the L-Area ECODS L-1 OU* (ER-IDS-019-053), *Field Inspection Checklist for the N-Area ECODS N-2 OU* (ER-IDS-019-054), *Field Inspection Checklist for the P-Area ECODS P-2 OU* (ER-IDS-019-055).

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, Hazardous Waste Operations. A SSHASP is prepared if needed.

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 E-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C 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

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

Describe costs and reasons: N/A

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 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.

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 five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Phil Prater (Name) DOE Program Manager (Title) 11/29/2018 (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 of decision document 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:

Attachment E-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued/end)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

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: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A
Remarks: _____

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

B. Other Site Conditions: Annual site inspections conducted from 2015 through 2018 identified the presence of downed trees, overgrown vegetation near signs, and ant mounds on the native soil covers. These findings were documented on the field inspection checklist and resolved soon after discovery.

Remarks: _____

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

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

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

X. OTHER REMEDIES ☐ **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 LUCs to prevent human exposure to contaminants in soil. 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.

The O&M procedures consisting of annual (2015-2018) site inspections and site maintenance (repair of 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 ECODS OU and the condition of 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

End of Checklist

F-AREA BURNING/RUBBLE PITS (231-F, 231-1F, AND 231-2F) OPERABLE UNIT

I. Introduction

This report is the sixth five-year review for the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) (FBRP) Operable Unit (OU). The review was conducted from July 2018 through November 2018. Contaminants have been left in place at the FBRP 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 FBRP 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 FBRP OU.

III. Background

The FBRP OU is 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 the Savannah River Site (SRS) (FFA 1993). The media associated with this OU is soil. The groundwater is being addressed as part of the General Separations Area (GSA) Western Groundwater OU.

Physical Characteristics

The FBRP OU is located within the SRS, approximately 90 m (300 ft) west of F Area (Figure F-1). Upper Three Runs is located approximately 690 m (2,300 ft) northwest of the FBRP. The FBRP consists of two contiguous burning rubble pits (231-F and 231-1F) covering 0.43 hectares (1.05 acres), and one rubble pit (231-2F) covering 0.05 hectares (0.13 acres). Pit 231-F is 82.5 m (275 ft) long by 15 m (50 ft) wide by 3 m (10 ft) deep. Pit 231-1F is 97.5 m (325 ft) long by 15 m (50 ft) wide by 3 m (10 ft) deep. Pit 231-2F is 60 m (200 ft) long by 12 m (40 ft) wide by 3 m (10 ft) deep. The local topography of the area is flat upland and the pits are at an elevation of 87 m (290 ft) above mean sea level. The water table is 21 to 30 m (70 to 100 ft) below ground surface (bgs) in the area of the

FBRP OU. Surface drainage is to the northwest toward an ephemeral tributary of the Upper Three Runs, about 12 km (7.5 mi) upstream of its confluence with the Savannah River. Figure F-2 shows a plan view of FBRP OU with monitoring stations.

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 FBRP OU as being within the site industrial support area. The future land use for the FBRP OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The Burning/Rubble Pits (231-F and 231-1F) operated from 1951 to 1973. During operation of the pits, spent organic solvents, waste oils, rags, paper, plastics, wood, telephone poles, and rubber were disposed of and periodically (monthly) burned (Figure F-3). In 1973, the burning of wastes ceased at SRS. A layer of soil was placed over the pit debris and then was filled with rubble such as concrete, brick, tile, asphalt, plastics, wallboard, rubber, and non-returnable empty drums.

The Rubble Pit (231-2F) operated from approximately 1951 to 1970 and was used exclusively as a rubble pit for disposal of dry inert concrete, lumber, cement, fence and telephone poles, brick, tile, wallboard, paneling, metal scraps, drums, electrical conduits, and plastics. No burning took place at F-Area Rubble Pit (231-2F).

Initial Response

After being filled in 1978 (231-F and 231-1F) and in 1983 (231-2F), the pits were covered with compacted clay-rich native soil and vegetation established. Figure F-4 is an aerial photograph of the FBRP OU with vegetation established.

A characterization of the unit was performed from May to December 1993 as part of the RCRA Facility Investigation (RFI)/Remedial Investigation (RI) unit assessment. Twelve

soil borings were taken within the pits (four in each pit) and four deep soil borings (geohydrologic data) were completed. Seven temporary monitoring wells and six permanent monitoring wells were installed. Approximately 228 soil and water samples were taken for analyses.

Basis for Taking Action

The RFI/RI Report (WSRC 1996a) determined that most contaminants in the FBRP OU are in the interval from 1.2 m (4 ft) bgs to the bottom of Pits 231-F and 231-1F (3 m [10 ft] bgs). Detailed information regarding the development of constituents of potential concern, the fate and transport of contaminants, and the risk assessment can be found in the RFI/RI Report (WSRC 1996a) and the baseline risk assessment (BRA) (WSRC 1996b).

The final constituents of concern (COCs) for soil at Pits 231-F and 231-1F were arsenic, benzo(a)pyrene, heptachlorodibenzo-p-dioxin (HpCDD), cesium-137, and potassium-40 (Figure F-3). The risks for future residential land use were 2E-05 for soil ingestion and 3E-05 for direct radiation. For future industrial land use, the risks were 5E-06 for soil ingestion and 3E-06 for direct radiation.

The final COCs for soil at Pit 231-2F were Aroclor 1254, cesium-137, potassium-40, and strontium-90. The risks for future residential land use were 2E-05 for soil ingestion and 5E-06 for direct radiation. For future industrial land use, the risks were 4E-06 for soil ingestion and 2E-06 for direct radiation.

There were no final ecological COCs.

Groundwater Assessment

Contaminant transport modeling included in the BRA (WSRC 1996b) demonstrated that the soil contaminants constitute little or no risk to groundwater. However, groundwater contamination was present downgradient of the FBRP OU at a total risk (future resident) of 1E-04 and a hazard index of 3 for all exposure pathways and contaminants. A technical memorandum and summary for the groundwater (WSRC 1998b) demonstrated that the FBRP OU is not the source of the groundwater contamination that was detected both

upgradient and downgradient. Currently, the groundwater in this area is being addressed as part of the GSA Western Groundwater OU.

IV. Remedial Actions

Remedy Selection

The remedial action objectives (RAOs) for this unit are as follows:

- Protect human health (future residents) from exposure to Aroclor-1254, cesium-137, potassium-40, and strontium-90 in Pit 231-2F soil above the 1E-06 risk level and from exposure to Aroclor-1254 in Pit 231-2F soil above a hazard index of 1 (WSRC 1997);
- Protect human health (future residents) from exposure to arsenic, benzo(a)pyrene, HpCDD, cesium-137, and potassium-40 in Pits 231-F and 231-lF soil above the 1E-06 risk level (WSRC 1997); and
- Protect human health (future industrial worker) from exposure to arsenic, HpCDD, benzo(a)pyrene, cesium-137 and potassium-40 in Pits 231-F and 231-1F and from exposure to Aroclor-1254 in Pit 231-2F above the 1E-06 risk level (WSRC 1997).

The selected remedial action for the FBRP OU consists of:

- Institutional controls (i.e., LUCs) that will restrict the land to future industrial use (WSRC 1997).

Remedy Implementation

Following waste disposal activities, the pits were covered with soil to create a native soil cover. The final remedial action for FBRP OU was institutional controls consisting of:

- Establishing LUCs for 1.56 hectares (3.83 acres).
- Installing warning signs to indicate that this area was used to manage hazardous materials;
- Existing SRS access controls (SRS site security) 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 FBRP 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.

Discussions pertaining to these elements are provided in the Final Remediation Report for the FBRP OU (WSRC 1998a). Figures F-5 and F-6 are photographs of FBRP OU in 2018.

System Operations/Operations and Maintenance

There are no system operational requirements.

The following activities are ongoing:

- Annual site inspections for general site conditions and site maintenance; and
- Groundwater assessment based on data from the ongoing monitoring associated with the GSA Western Groundwater OU.

The Record of Decision (ROD) (WSRC 1997) estimated direct operating and maintenance (O&M) cost associated with the selected remedy for FBRP OU as $500 per year for 30 years and five-year remedy review cost of $3,000 every five years. Table F-2 compares the actual O&M cost over the last four years to the estimated cost from the ROD. The estimated direct O&M cost from fiscal year (FY) 2015 to FY2018 are $5,000 as compared to the total actual O&M cost of $41,390 for the same period. The actual cost is higher than the estimated cost because periodic inspections and site maintenance (e.g., mowing) were not included in the estimated cost. Additionally, repairs to the native soil cover were

conducted to fix damage from feral hogs rutting and active ant mounds on the native soil cover.

V. Progress Since Last Review

This is the sixth five-year review for the FBRP OU. The previous protectiveness statement concluded that because the remedial actions of institutional controls at FBRP OU are protective, the site is protective of human health and the environment.

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,
- Reviewed the groundwater monitoring data presented in Table F-4 to verify that FBRP OU is not the source of groundwater contamination;
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment F-1; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Groundwater data, as reported in the annual GSA Western Groundwater OU Scoping Summaries (SRNS 2015, SRNS 2016, SRNS 2017 and SRNS 2018), was reviewed. As shown in Figures F-7 and F-8, groundwater contaminants present at the FBRP OU are part of larger plumes that originate upgradient of this OU. Table F-4 provides a summary of groundwater data for the GSA Western Groundwater OU West Plume, which includes the FBRP OU. The data show the highest contaminant concentrations emanate from the F-Area facilities with the plumes moving through the subsurface below the FBRP OU. Though tetrachloroethylene and trichlorofluoromethane concentrations are highest in FBP series wells, these wells are located upgradient of the FBRP OU indicating these

constituents are emanating from the F-Area facilities. The data also indicate that concentrations are decreasing or remaining constant for all the constituents of interest.

Initially, radionuclides (including iodine-129, strontium-90, technetium-99, etc.) were analyzed for as part of the FBRP OU monitoring. However, sampling from 2002 through 2006 in the FBP wells indicated radionuclide results were non-detect, which demonstrated that the FBRP is not a source of these constituents. After five years of non-detects, analyses for specific radionuclide constituents were discontinued; analyses for gross alpha, nonvolatile beta, and tritium continues.

The ongoing monitoring associated with the GSA Western Groundwater OU provides data supporting the conclusion that the FBRP is not a source of groundwater contamination.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member and George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues were identified for the FBRP OU during these interviews. The FBRP OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on August 29, 2018. No issues were identified during this inspection.

The FBRP OU was inspected by SRNS EC&ACP and USDOE personnel on November 29, 2018. No issues were identified for the FBRP OU during the inspection.

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 March 19, 2019. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from FY2015 through FY2018 identified the presence of downed trees, overgrown vegetation near signs, evidence of hog rutting and ant mounds on the native soil covers, and a small area of subsidence. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy, institutional controls (i.e., LUCs), is effective in preventing human exposure to contaminants above the 1E-06 risk level and is functioning as intended.

The above remedial activities are meeting the remedial goals established for the FBRP OU, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Land Use Control Implementation Plan for FBRP OU is discussed in Section 2.0 of the Final Remediation Report and governs institutional controls (i.e., LUCs) implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 1998a). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restriction to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the FBRP OU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. All LUC objectives are being met.

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 the remedy selection are still valid. There have been no changes in standards or physical conditions of FBRP 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 FBRP 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 unit.

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 operation, conditions, or activities that currently prevent the remedy for the FBRP OU from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to or ingestion of contaminated soil. All threats to FBRP OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the FBRP OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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, 2015. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, September 2015, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2016. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, October 2016, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2017. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, October 2017, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2018. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, September 2018, 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

Various - Inspection Data Sheets – *Field Inspection Checklist, F-Area Burning/Rubble Pits 231-F, 231-1F, & 231-2F (U)*, ER-IDS-019-002, Inspection periods 2015 through 2018

WSRC, 1996a. *RCRA Facility Investigation/Remedial Investigation Report for the F-Area Burning/Rubble Pits (231-F, 231-1F, & 231-2F) (U)*, WSRC-RP-94-938, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996b. *Baseline Risk Assessment for the F-Area Burning/Rubble Pits and Rubble Pit* (U), WSRC-TR-94-108, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996c. *F-Area Burning/Rubble Pits 9231-F, 231-1F, & 231-2F) Corrective Measures Study/Feasibility Study (U)*, WSRC-RP-95-660, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997. *Record of Decision Remedial Alternative Selection for the F-Area Burning/Rubble Pits (231-F, 231-1F, 231-2F) (U)*, WSRC-RP-96-868, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998a. *Final Remediation Report for the F-Area Burning/Rubble Pits (231-F, 231-1F, 231-2F) (U)*, WSRC-RP-97-193, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998b. *Technical Memorandum and Summary Report for the F-Area Burning/Rubble Pits (231-F, 231-1F, 231-2F) (U)*, WSRC-RP-96-884, 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, August 1999, latest update, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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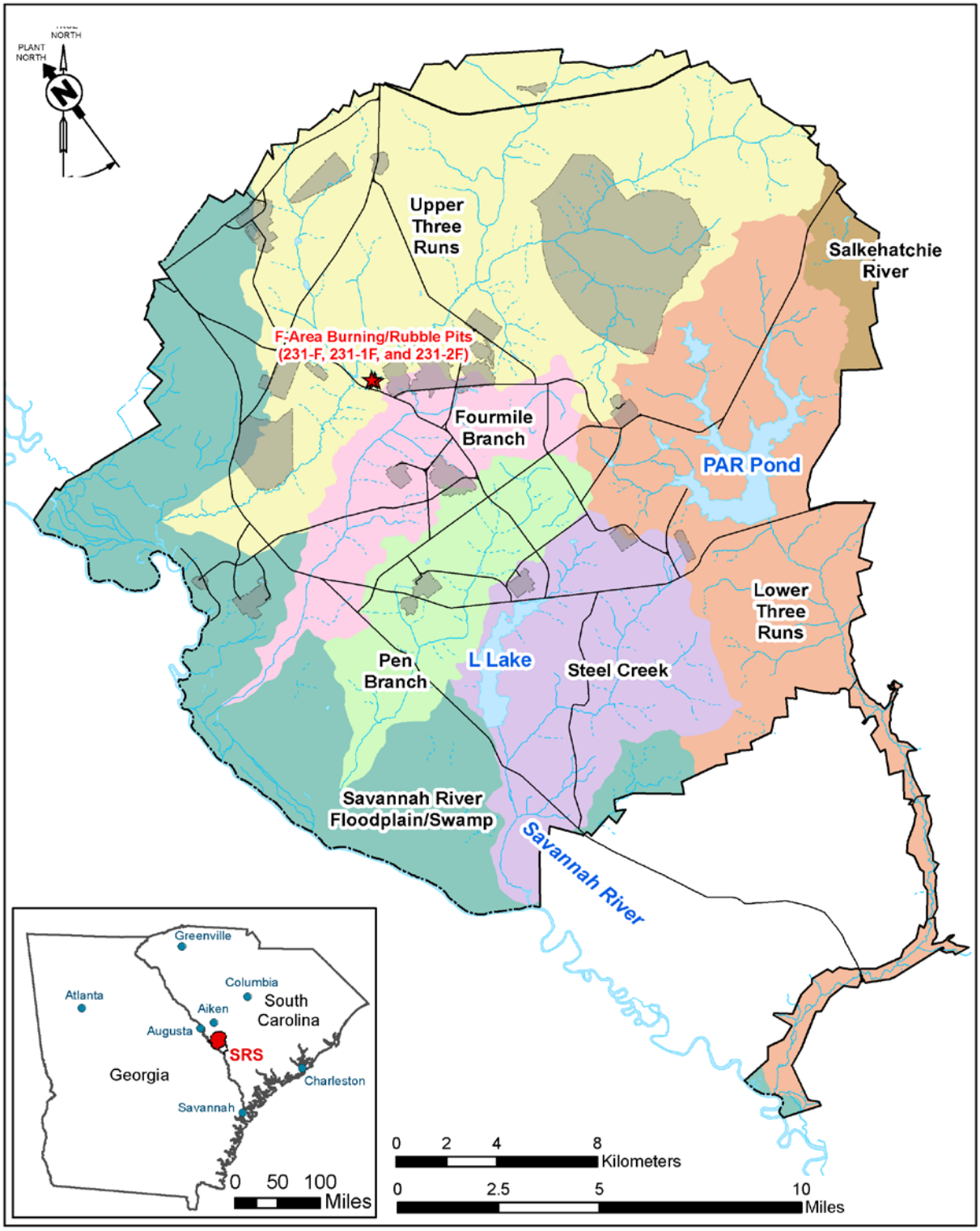


Figure F-1. Location of the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit at SRS

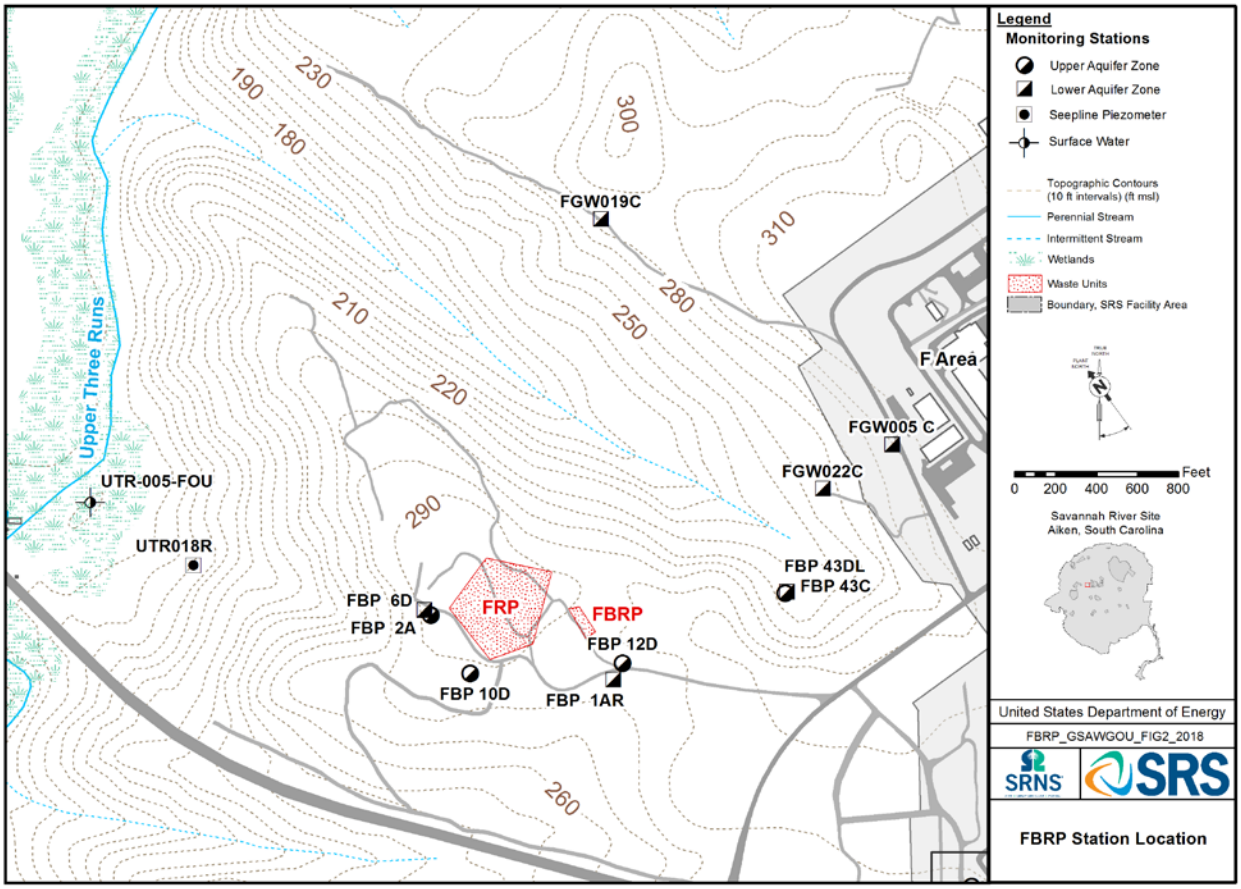


Figure F-2. **Location of the F-Area Burning/Rubble Pits (231-F and 231-1F) and F-Area Rubble Pit (231-2F) Operable Unit and Active Monitoring Stations**



Figure F-3. Photos of F-Area Burning/Rubble Pits during Operational Period
Top photo is an oblique aerial photograph looking east (exact date unknown). The FBRP is the non-forested area in the left foreground. The railroad tie pile is in the extreme left foreground. Bottom left photo is a trench in Pits 231-F and 231-1F (November 1989). Bottom right photo depicts wooden pallets and cardboard boxes disposed in Pits 231-F and 231-1F (approximately September 1973).



Figure F-4. **2010 Aerial Photograph of the F-Area Burning Rubble Pits – Post Operation**



Figure F-5. 2018 Photograph of the F-Area Burning Rubble Pits (231-F and 231-1F)



Figure F-6. 2018 Photograph of the F-Area Rubble Pit (231-2F)

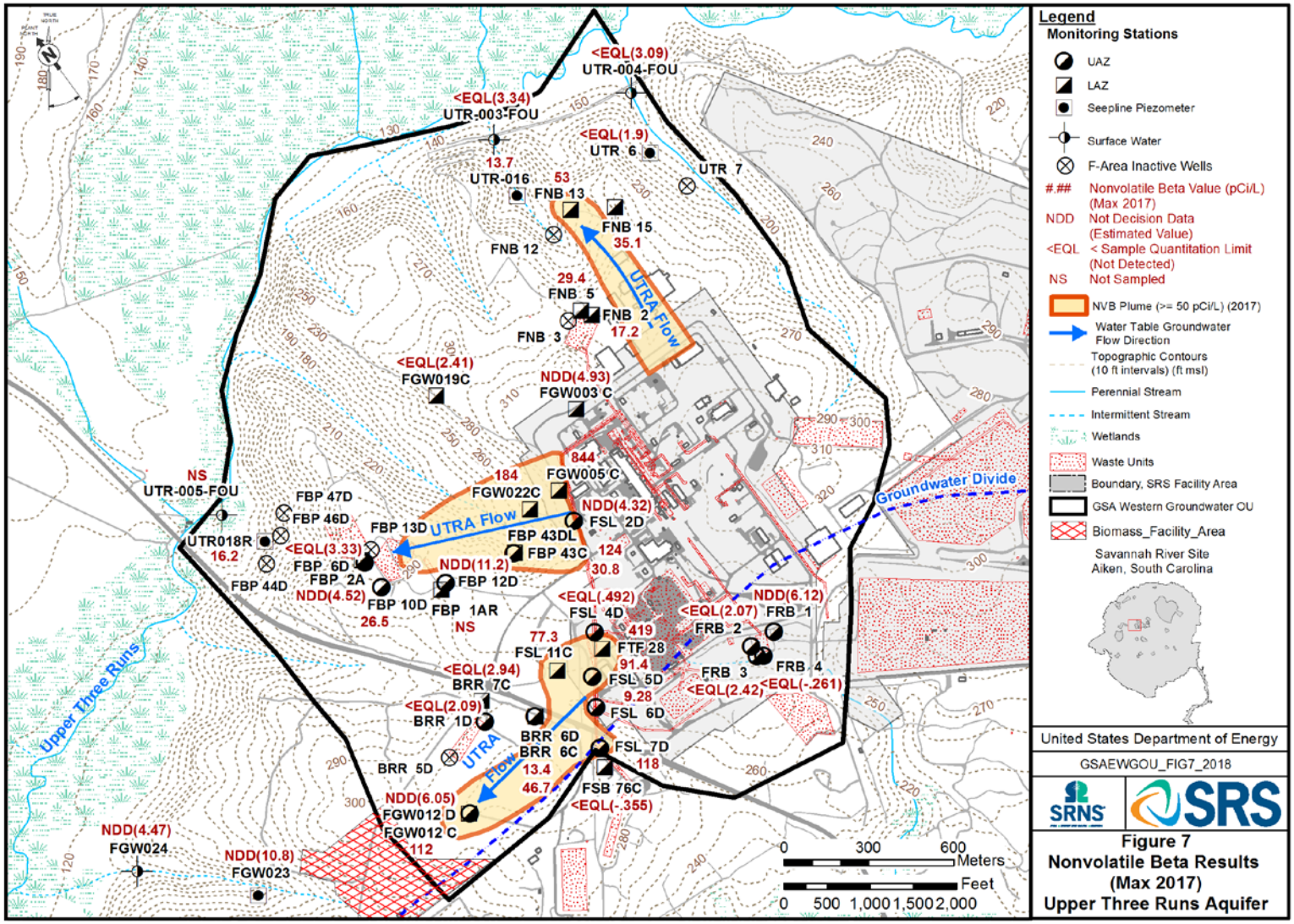


Figure F-7. Non-Volatile Beta Results from 2017 Groundwater Sampling (SRNS 2018)

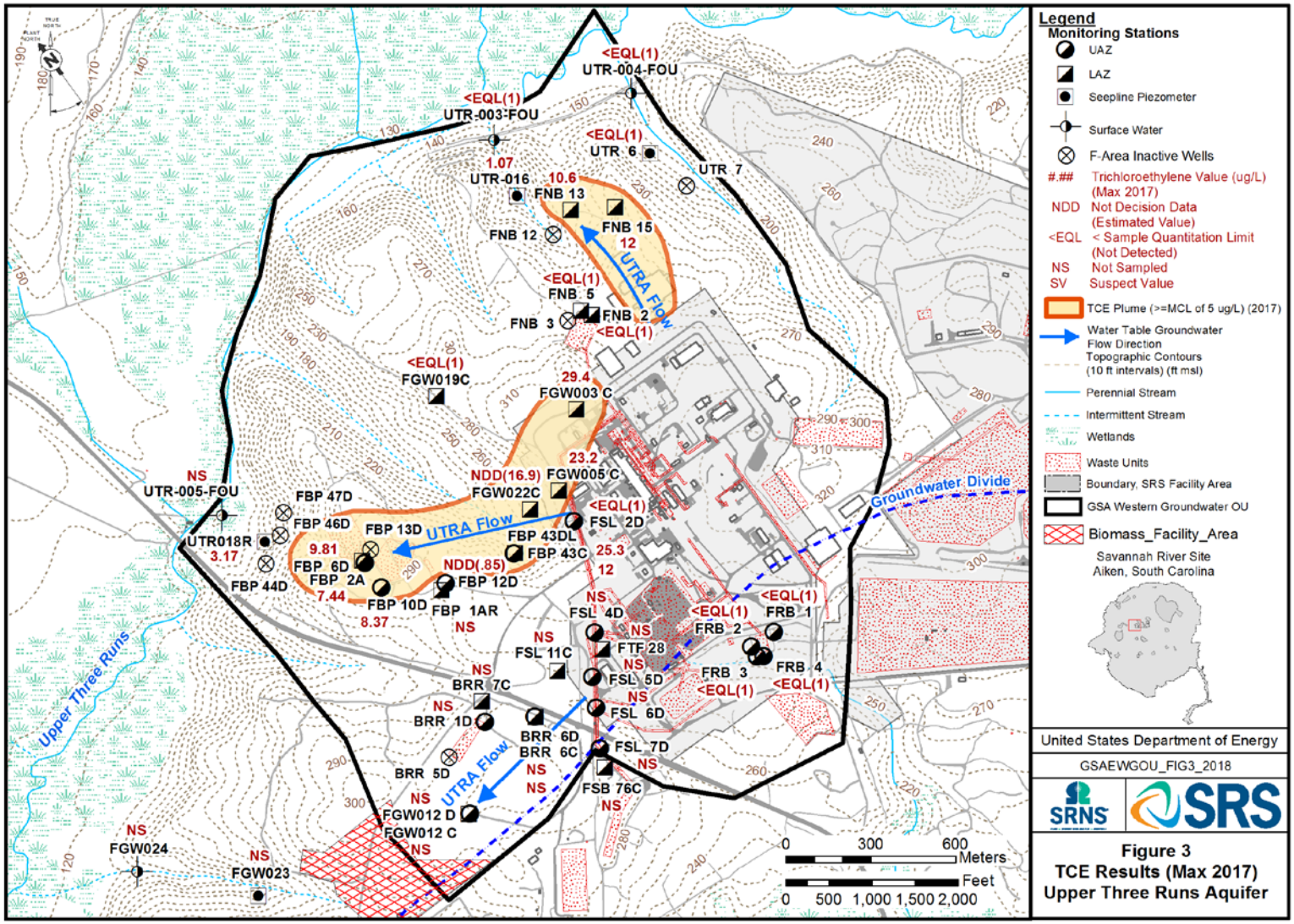


Figure F-8. TCE Results from 2017 Groundwater Sampling (SRNS 2018)

Table F-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	May 4, 1993 / April 25, 1996
ROD Issuance	July 3, 1997
Remedial Action Start/Complete	April 1,1998 / June 30, 1998
Final Remediation Report Approved	April 23, 1998
Previous Five-Year Reviews Issuance	August 27, 1997 / February 12, 2004 / January 28, 2009 / February 4, 2014 / November 30, 2015

Table F-2. FBRP OU Remedial Goals in Soil

Subunit	COC	Type of COC	RG	Basis
Pits 231-F amd 231-1F	Arsenic (mg/kg)	HH	8.02E-01	HH – Future Resident
	Benzo(a)pyrene (mg/kg)	HH	1.62E-01	HH – Future Resident
	Heptachlorodibenzo-p-dioxin (mg/kg)	HH	7.9E-04	HH – Future Resident
	Cesium-137 (pCi/g)	HH	2.79E-01	HH – Future Resident
	Potassium-40 (pCi/g)	HH	1.03E+00	HH – Future Resident
	Arsenic (mg/kg)	HH	3.71E+00	HH – Future Industrial Worker
	Heptachlorodibenzo-p-dioxin (mg/kg)	HH	3.74E-03	HH – Future Industrial Worker
	Cesium-137 (pCi/g)	HH	1.04E+00	HH – Future Industrial Worker
	Potassium-40 (pCi/g)	HH	3.85E+00	HH – Future Industrial Worker
Pits 231-2F	Aroclor 1254 (mg/kg)	HH	1.57E+00	HH – Future Resident
	Cesium-137 (pCi/g)	HH	2.79E-01	HH – Future Resident
	Potassium-40 (pCi/g)	HH	1.03E+00	HH – Future Resident
	Strontium-90 (pCi/g)	HH	5.13E-01	HH – Future Resident
	Aroclor 1254 (mg/kg)	HH	4.09E+01	HH – Future Industrial Worker
	Cesium-137 (pCi/g)	HH	1.04E+00	HH – Future Industrial Worker
	Potassium-40 (pCi/g)	HH	3.85E+01	HH – Future Industrial Worker

COC – constituent of concern
HH – human health

Add table

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

	FY2015	FY2016	FY2017	FY2018	4-Year Total
Actual O&M Costs	18,081	9,485	7,257	6,568	$41,390
Estimated Direct O&M Costs*	$500	$500	$3,500	$500	$5,000

* Source of Estimate: The estimated direct O&M costs shown in the ROD (WSRC 1997) are provided in more detail in the Feasibility Study (WSRC 1996c) and show the direct O&M cost as $500/year for 30 years. Remedy review costs were estimated at $3,000 every 5 years for 30 years, which were included with the annual maintenance cost in FY2017.

Table F-4. Summary Groundwater Data for the GSA Western Groundwater OU – West Plume as Compared to the FBRP OU Wells

Constituent	MCL	Units	2014		2015		2016		2017	
			Max Conc (well ID)	Max Conc (FBP well)	Max Conc (well ID)	Max Conc (FBP well)	Max Conc (well ID)	Max Conc (FBP well)	Max Conc (well ID)	Max Conc (FBP well)
Nitrates	10	mg/L	63 (FGW22C)	31 (FBP43DL)	56.5 (FGW005C)	34.5 (FBP43DL)	44.7 (FGW22C)	31.6 (FBP43DL)	39.3 (FGW005C)	31.1 (FBP43DL)
PCE	5.0	µg/L	17 (FBP13D)	17 (FBP13D)	6.48 (FBP6D)	6.48 (FBP6D)	7.14 (FBP6D)	7.14 (FBP6D)	5.72 (FBP6D)	5.72 (FBP6D)
TCE	5.0	µg/L	28 (FGW005C)	22 (FBP43DL)	29.6 (FBP 43DL)	29.6 (FBP43DL)	28.4 (FBP43DL)	28.4 (FBP43DL)	29.4 (FGW003C)	25.3 (FBP43DL)
TCFM	5.0	µg/L	35.9 (FBP43DL)	35.9 (FBP43DL)	36.1 (FBP43DL)	36.1 (FBP43DL)	32.9 (FBP43DL)	32.9 (FBP43DL)	28.2 (FBP43DL)	28.2 (FBP43DL)
Gross alpha	15	pCi/L	1400 (FGW005C)	6.28 J (FBP2A)	1460 (FGW005C)	5.74 J (FBP6D)	1240 (FGW005C)	3.07 J (FBP12D)	1160 (FGW005C)	2.77 J (FBP12D)
Nonvolatile beta	50	pCi/L	518 (FGW005C)	62.4 (FBP43C)	780 (FGW005C)	159 (FBP43DL)	874 (FGW005C)	161 (FBP43DL)	844 (FGW005C)	124 (FBP43DL)
Tritium	20	pCi/ml	35.8 (FGW003C)	3.29 (FBP43DL)	27 (FGW003C)	2.58 (FBP43DL)	24.3 (FGW003C)	3.25 (FBP43DL)	18.9 (FGW003C)	2.65 (FBP43DL)

J - Estimated value
ND not detected

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Attachment F-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit

I. SITE INFORMATION			
Site Name:	**F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit**	**Date of Inspection:**	**08/29/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #14**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**92°F and 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 _____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 10/16/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment F-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

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: Annual site inspections are performed per *Waste Unit Inspection and Maintenance*, ER-SOP-019, *Field Inspection Checklist for F-Area Burning Rubble Pit OU (*ER-IDS-019-002).

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 Site-Specific Health and Safety Plan under 29 CFR 1910.1201, *Hazardous Waste Operations*. A SSHASP is prepared if needed.

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 – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) 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.

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

Describe costs and reasons: N/A

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 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.

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 five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Phil Prater (Name) DOE Program Manager (Title) 11/29/18 (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 of decision document 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:

Attachment F-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
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:
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A
B. Other Site Conditions: Annual site inspections conducted from 2015 through 2018 identified the presence of down trees, overgrown vegetation near signs, evidence of hog rutting and ant mounds on the native soil covers, and a small area of subsidence. These findings were documented on the field inspection checklist and resolved soon after discovery.
Remarks: Site vegetation is mowed regularly.
VII. LANDFILL COVER/CONTAINMENT ☐ **Applicable** ☒ **N/A**
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
X. OTHER REMEDIES ☐ **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 remedial action for the FBRP OU is institutional controls (i.e., LUCs) to prevent exposure to contaminants in soil. 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. The O&M procedures consisting of annual (2015-2018) site inspections and site maintenance (verify no invasive activities have occurred 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 FBRP OU and the condition of its 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

End of Checklist

GUNSITE 012 (NBN) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the Gunsite 012 Operable Unit (OU). The review was conducted from July 2018 through November 2018. Contaminants have been left in place at the Gunsite 012 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 Gunsite 012 OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table G-1 lists the chronology of site events for the Gunsite 012 OU.

III. Background

The Gunsite 012 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 the Savannah River Site (SRS) (FFA 1993). The media associated with this OU is soil.

Physical Characteristics

The Gunsite 012 OU (Figure G-1) is located northeast of the geographical center of the SRS and about 4.8 km (3 mi) from the nearest site boundary. The Gunsite 012 OU is located within the Lower Three Runs watershed, approximately 270 m (300 yd) south of Pond B. The area is flat to gently rolling and approximately 84 m (280 ft) above mean sea level. A detailed discussion of the operational compliance history of Gunsite 012 OU was provided in the Record of Decision (ROD) (SRNS 2011a). Subsequent paragraphs and subsections in this document provide a summary of this information.

Gunsites were anti-aircraft gun emplacements that operated from 1955 to 1957 to provide physical protection for SRS against possible enemy attack. Gunsite 012 was one of five

central gunsites that featured 90-mm anti-aircraft guns as well as extensive administrative support facilities, including barracks, mess halls, office buildings, and motor pools. Figure G-2 provides an aerial photograph of Gunsite 012 during operation.

The Gunsite 012 OU contains three RCRA/CERCLA subunits:

- Gunsite 012 Rubble Pile (No Building Number [NBN]);
- Rubble Pile Across from Gunsite 012 (NBN); and
- Early Construction Operation Disposal Site (ECODS) G-3 (Adjacent to Gunsite 012) (NBN).

For RCRA/CERCLA investigation purposes, the Gunsite 012 OU was further partitioned into four soil subunits and one groundwater subunit. The Building Pad and the Parking Area Subunits are contained within the Gunsite 012 Rubble Pile subunit. The Gun Emplacement Area Subunit is in the Rubble Pile Across from Gunsite 012 subunit. The ECODS G-3 subunit is contained within the ECODS G-3 subunit. Although the groundwater is not a unit listed in the FFA, the groundwater underlying the Gunsite 012 OU was included as part of the RCRA/CERCLA investigation process and identified as the Groundwater Subunit. Figure G-3 provides an illustration of the surface subunits.

The Gunsite 012 Rubble Pile is approximately 3.7 hectares (9 acres). The Building Pad consists of concrete slab foundations of former buildings, sidewalks, and driveways, and a concrete pad of an abandoned drinking well. The Parking Area consists of a former gravel parking lot that had been sprayed with an asphalt emulsion to suppress dust.

The Rubble Pile Across from Gunsite 012 is approximately 1.6 hectare (4 acres). The Gun Emplacement Area consists of concrete slab foundation for the former four circular gun emplacements and a building.

The ECODS G-3 is approximately 0.3 hectares (0.75 acres). ECODS G-3 is 60 m (200 ft) southwest of the Gunsite Rubble Pile and apparently contains construction waste from Gunsite 012. It currently is a wooded area.

The Groundwater subunit includes the groundwater underlying the Gunsite 012 OU. The water table at the Gunsite 012 is approximately 10.5 m to 13.5 m (35 ft to 45 ft) below ground surface.

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River* (WSRC 1999) designates Gunsite 012 OU as being outside of a site industrial area. However, according to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for this OU is reasonably anticipated to be industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The buildings in the Building Pad subunit of the Gunsite 012 Rubble Pile were constructed in 1955 and dismantled in 1961. Asphalt floor tiles containing asbestos, adhesives and tar material were placed in a pile on the building pad. Floor tiles were also found in piles on the ground. An underground septic system consisted of vitrified piping and a 37,854-L (10,000-gal) septic tank that was abandoned in place. Seven 7,570-L (2,000-gal) underground fuel storage tanks were removed most likely before 1990. Soil characterization conducted in 2007 determined that polycyclic aromatic hydrocarbons (PAHs) existed in the 0-0.3 m (0-1 ft) soil interval. Primarily, benzo(a)pyrene, benzo(b) fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d)pyrene were identified with the Building Pad subunit. In addition to the PAH contamination, asbestos found in floor tiles was determined to pose a potential risk to human health. Results of the human health risk assessment (HHRA) identified a risk to the resident receptor of 2.7E-04 for exposure to PAHs. No risk was identified for the industrial worker.

A gravel parking lot was constructed in 1955 in the Parking Area subunit of the Gunsite 012 Rubble Pile. The lot was periodically sprayed with an asphalt emulsion to suppress dust. From 1992 to 1997, the parking lot was used as a storage area for creosote-treated railroad crossties and utility poles. The railroad crossties and utility poles were removed

in January 1997. Based on the 2007 characterization events, PAHs were found in the 0-0.3-m (0-1-ft) soil interval in the gravel parking lot. However, it was determined that the low levels of PAHs were similar to PAH levels expected in any parking lot and therefore, no remedial response was needed. Additionally, antimony was determined to exist in the top 1.2 m (4 ft) of soil in the nearby disposal trench. The existence of antimony in the ditch appears to have originated from the scraps of metal and/or cans and buckets deposited within the disposal trench from past uses. Results of the HHRA identified a hazard greater than 1 (i.e., hazard quotient [HQ] = 2.7) to the resident receptor for exposure to antimony. There were no adverse health impacts identified for the industrial worker. The Rubble Pile Across from the Gunsite 012 contains the Gun Emplacement Area subunit. After the gun emplacements and building were removed, the building pad may have been used for limited chemical storage. The generator building's underground storage tank, which stored generator fuel, was removed prior to 1990. The 2007 characterization activities identified one PAH and trace amounts of petroleum analytes. However, all results were below action levels for industrial or unrestricted use.

Construction waste from the construction of Gunsite 012 apparently was disposed of in the ECODS G-3. Trace amounts of PAHs, petroleum analytes, solvents, pesticides, polychlorinated biphenyls, and metals were identified in this subunit. All results were below action levels for industrial or unrestricted use. For the Groundwater subunit, twelve groundwater samples were collected in 2007 to support the conclusions of the contaminant migration analysis. No exceedances of the most likely contaminants were found, and no additional sampling of the groundwater was performed. The contaminant migration analysis did not identify any problems for transport of soil contaminants to groundwater.

Initial Response

At the Building Pad subunit, asbestos-containing asphalt floor tiles were determined to pose a potential risk to human health. A non-time critical removal (NTCR) action and a maintenance action were conducted during 2010. The NTCR action was specific for the removal of asbestos-containing floor tiles within the soil surrounding the building pads (SRNS 2009). Additionally, a maintenance action was performed to remove the remaining

floor tiles adhering to the building pads including the associated adhesive and tar material located on the building pads and expansion joints (SRNS 2010).

Following the NTCR action and the maintenance action, remedial action was required for the remaining PAHs in the surface soil at the Building Pad subunit and the antimony in the Parking Area subunit surface soil that remained at levels that did not allow for unrestricted use.

Basis for Taking Action

The results of the Gunsite 012 evaluations are documented in the ROD for Gunsite 012 (SRNS 2011a) and are summarized below to support the selected remedy:

- There are no ecological contaminants of concern (COCs), contaminant migration COCs, or principal threat source material for any of the Gunsite 012 OU subunits;
- No human health COCs were identified for the Gun Emplacement Area, ECODS G-3, or the Groundwater subunits; and
- Human health COCs were identified at the Building Pad (i.e., PAHs in surface soil) and the Parking Area (i.e., antimony in surface soil) at levels that do not allow for unrestricted use.

The selected remedy for the Gunsite 012 OU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions until the concentrations of hazardous substances in the soil are at levels that allow for unrestricted use and exposure. If land use controls (LUCs) are not implemented, actual or threatened releases of hazardous substances from the Building Pad and the Parking Area may present a current or potential threat to public health, welfare, or the environment.

Results of the groundwater sampling conducted in May 2007 as part of the RCRA/CERCLA investigation process determined that there were no exceedances in groundwater. In addition, a contaminant migration analysis of the soil subunits did not identify any problems associated with the transport of soil contaminants to groundwater.

IV. Remedial Actions

Remedy Selection

As detailed in the ROD (SRNS 2011a), the remedial action objectives (RAOs) for Gunsite 012 OU are as follows:

Building Pad Subunit

- Prevent future residents from exposure to PAHs in surface soil at concentrations exceeding 1E-06 risk.

Parking Area Subunit

- Prevent future residents from exposure to antimony in surface soil at concentrations exceeding HQ>1.

The remedial goals for the human health refined constituents of concern (RCOCs) for the Building Pad and the Parking Area are shown in Table G-2.

As stated in the ROD (SRNS 2011a), the selected remedial action for the ECODS G-3, the Gun Emplacement Area, and the Groundwater subunit is No Action. There is no waste to treat, no LUCs required, and no Applicable or Relevant and Appropriate Requirements for these RCRA/CERCLA subunits. Because there are no problems warranting action at these subunits, no action was taken. These subunits pose no risk to human health or the environment and warrant unrestricted land use.

As stated in the ROD (SRNS 2011a), the selected remedial action for the Building Pad and Parking Area is LUCs and include the following:

- Institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the SRS 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 prior to access being granted.
- Engineering controls including signage to prevent unauthorized entry and uses.

- Access controls to prevent exposure to trespassers, as described in the 2013 RCRA Permit Renewal Application, Volume I, Section F.l, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

Remedial Implementation

Implementation of the Gunsite 012 OU remedial action included the following activities:

- Establishing LUCs for 3.6 hectares (8.85 acres).
- Installing warning signs at the LUC boundaries of the Building Pad and Parking Area subunits in October 2011.
- Implementing access controls at the SRS boundary to control and restrict public and trespasser access to Gunsite 012 OU.

Figure G-4 presents current (2018) photographs of this OU.

System Operations/Operations and Maintenance

There are no system operational requirements. Maintenance activities consist of annual site inspections and site maintenance (i.e., warning signs and verification that no invasive activities have occurred).

The ROD estimated direct operation and maintenance (O&M) cost associated with the selected remedy as $2,500 each year for 30 years. The five-year remedy review cost is estimated at $15,000 every five years. Table G-3 compares the actual O&M cost over the last four years to the estimated cost from the ROD. The estimated direct O&M cost from fiscal year (FY) 2015 to FY2018 is $25,000 as compared to the actual O&M cost of $76,686 for the same period. The difference in estimated verses actual costs is attributed to the maintenance costs being underestimated. Based on inspections, maintenance activities completed on Gunsite 012 include addressing active ant mounds, trimming of vegetation within LUC boundary and access roads.

V. Progress Since Last Review

This is the third five-year review for the Gunsite 012 OU. The previous protectiveness statement concluded that because the remedial action of LUCs is protective, the Gunsite 012 OU are protective of human health and the environment.

There were no recommendations or follow-up action 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 G-1; 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 George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues were identified for the Gunsite 012 OU during these interviews. The Gunsite 012 OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on September 12, 2018. No issues were identified during this inspection.

The Gunsite 012 OU was inspected by SRNS EC&ACP and USDOE personnel on November 26, 2018. No issues were identified for the Gunsite 012 OU during these inspections.

A site inspection was conducted by South Carolina Department of Health and Environmental Control and U.S. Environmental Protection Agency (USEPA) personnel, accompanied by USDOE and SRNS personnel, on March 21, 2019 and April 25, 2019,

respectively. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from FY2015 through FY2018 identified the presence of overgrown vegetation and ant mounds. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy of LUCs for the Gunsite 012 OU is effective in preventing future residents from exposure to PAHs and antimony and is functioning as intended.

The above remedial activities are meeting the RGs established for the Gunsite 012 OU, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Land Use Control Implementation Plan for Gunsite 012 OU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (SRNS 2011b). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restriction to prevent unauthorized contact, removal or excavation of, and restrictions to prevent disturbance of the Gunsite 012 OU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. 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 the remedy selection are still valid. There have been no changes in standards or physical conditions of the Gunsite 012 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 Gunsite 012 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 unit.

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

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 Gunsite 012 OU.

X. Protectiveness Statement(s)

The remedy at the Gunsite 012 OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with LUCs to prevent exposure to or ingestion of contaminated soil. All threats the Gunsite 012 OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the Gunsite 012 OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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, 2009. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for Floor Tile Piles at Gunsite 012 Operable Unit (U),* SRNS-RP-2009-01026, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Removal Action Report for Asbestos Removal at Gunsite 012 OU (NBN) (U),* SRNS-RP-2010-01278, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011a. *Record of Decision Remedial Alternative Selection for the Gunsite 012 OU (NBN) (U),* SRNS-RP-2010-01232, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011b. *Land Use Control Implementation Plan for Gunsite 012 Operable Unit (NBN) (U),* SRNS-RP-2011-00293, Revision 1, 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

Various – *Inspection Data Sheets - Field Inspection Checklist for Gunsite 012*, ER-IDS-019-070, Inspection Period 2015 through 2018 (annually)

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

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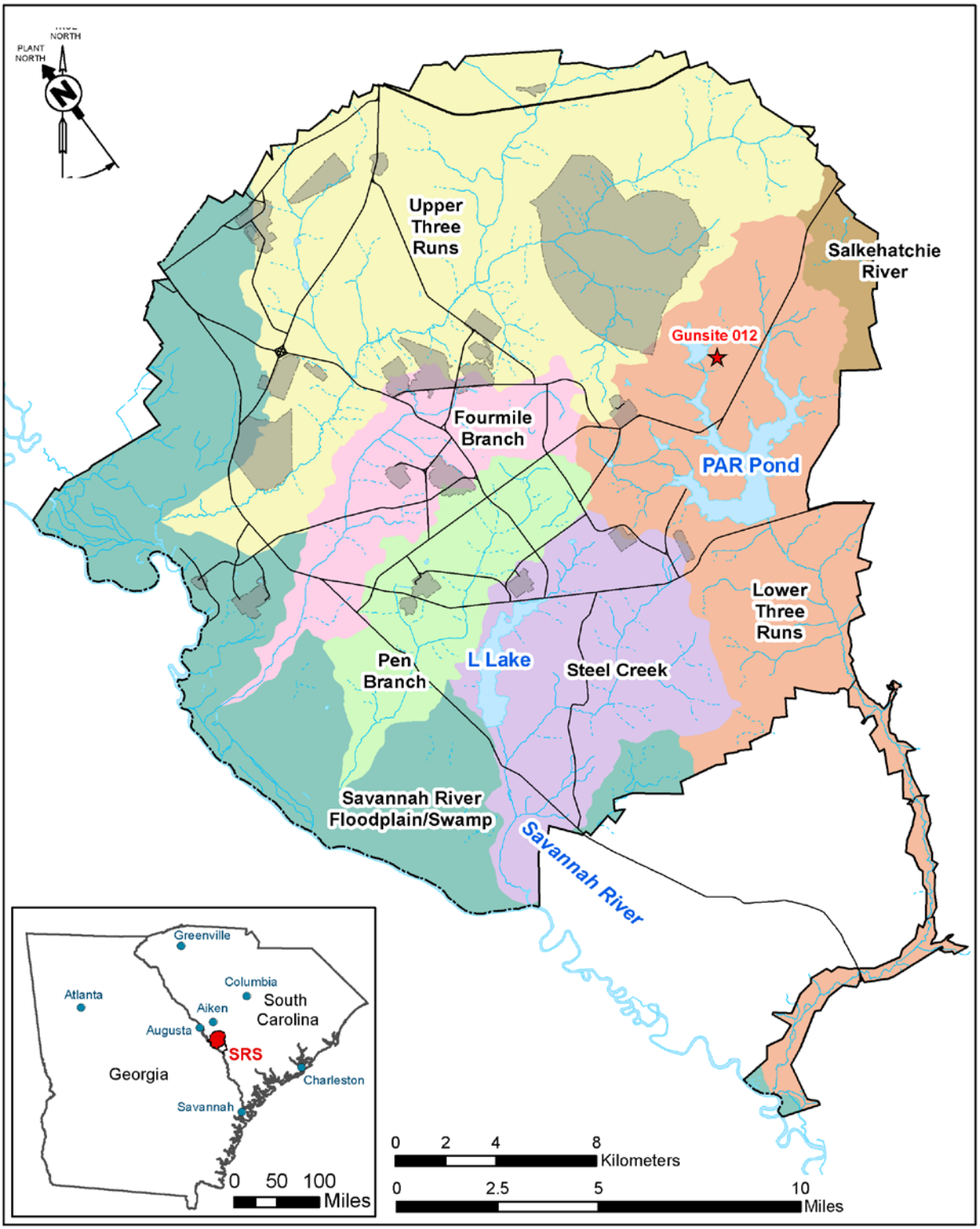


Figure G-1. Location of the Gunsite 012 OU at SRS



Figure G-2. Aerial Photograph of Gunsite 012 during Operation (approximately 1955 to 1957)

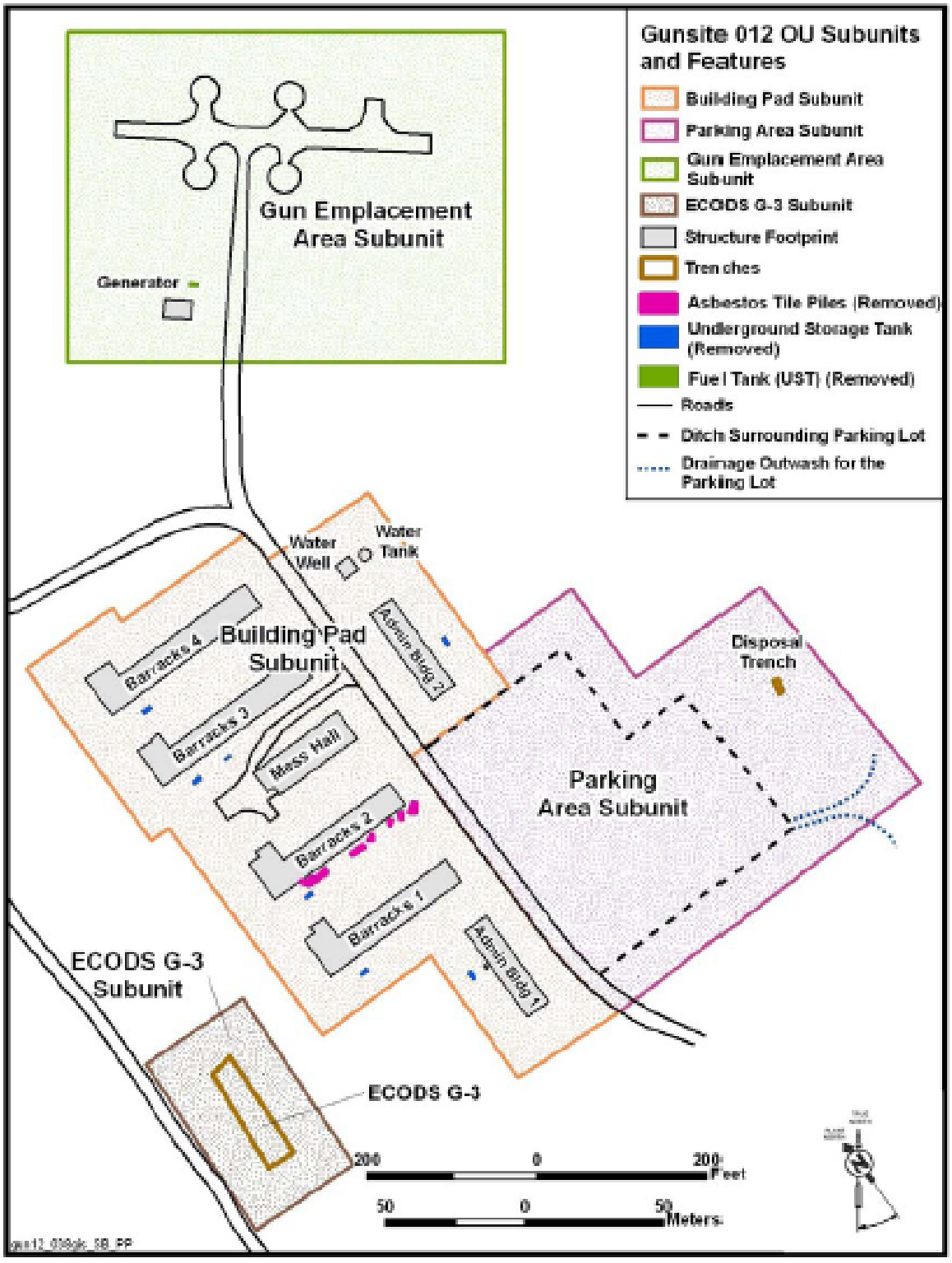


Figure G-3. Site Layout of Gunsite 012 Operable Unit





Figure G-4. Current Photos of Gunsite 012 Building Pad Subunit and Parking Area Subunit (2018)

Table G-1. Chronology of OU Events

Event	Date
RCRA Facility Investigation/Remedial Investigation Start/Complete	November 5, 2007 / August 20, 2009
Removal Action Start/Complete	June 16, 2010 / June 16, 2010
ROD Issuance	June 27, 2011
Remedial Action Start/Complete	October 5, 2011 / December 7, 2011
Previous Five-Year Review Issuance	February 4, 2014 / November 30, 2015

Table G-2. Remedial Goals for Gunsite 012 OU Soils

Subunit	Refined COCs	Type of COC	RG (mg/kg)	Basis
Building Pad	Benzo(a)anthracene	HH	1.5E-01	HH – future resident
	Benzo(a)pyrene	HH	1.5E-02	HH – future resident
	Benzo(b)fluoranthene	HH	1.5E-01	HH – future resident
	Benzo(k)fluoranthene	HH	1.5E+00	HH – future resident
	Dibenzo(a,h)anthracene	HH	1.5E-02	HH – future resident
	Indeno(1,2,3-c,d)pyrene	HH	1.5E-01	HH – future resident
Parking Area	Antimony	HH	3.1E+01	HH – future resident

Table G-3. Actual verses Estimated O&M

	FY2015	FY2016	FY2017	FY2018	4-Year Total
Actual O&M Costs	$27,184	$20,219	$15,646	$13,819	$76,868
Estimated Direct O&M Costs*	$2,500	$2,500	$17,500	$2,500	$25,000

* Source of Estimate: The ROD (SRNS 2011a) provides the annual direct O&M cost as $2,500/year. The estimated remedy review cost of $15,000 every five years was included with the annual maintenance cost in FY2017.

Attachment G-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN)

I. SITE INFORMATION			
Site Name:	**Gunsite 012 Operable Unit (NBN)**	**Date of Inspection:**	**09/12/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #78**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**80°F and 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 _____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 10/16/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment G-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

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: Annual site inspections are performed per SRS procedure *Waste Unit Inspection and Maintenance* (ER-SOP-019), *Field Inspection Checklist for Gunsite 012* (ER-IDS-019-070).

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, Hazardous Waste Operations. A SSHASP is prepared if needed.

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 G-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(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

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

Describe costs and reasons: N/A

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 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.

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.) Field Walkdown
Frequency: Once every five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Brian Hennessey (Name) Federal Project Manager (Title) 11/26/18 (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 of decision document 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:

Attachment G-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued/end)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
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:
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A
B. Other Site Conditions: Annual site inspections conducted from 2015 through 2018 identified the presence of overgrown vegetation and ant mounds. These findings were documented on the field inspection checklist and resolved soon after discovery.
Remarks: Site vegetation is mowed routinely.
VII. LANDFILL COVER/CONTAINMENT ☐ **Applicable** ☒ **N/A**
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
X. OTHER REMEDIES ☐ **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 Gunsite 012 OU consists of two subunits that warrant remediation. The remedy for the Building Pad and the Parking Area Subunits is LUCs. Warning signs have been posted at either end of the subunits and administrative controls have been put in place to prevent unauthorized invasive activities at the subunits. The remedy, LUCs, 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. The O&M procedures consisting of annual (2015-2018) site inspections and site maintenance (verify no invasive activities have occurred 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 Gunsite 012 and the condition of its 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

End of Checklist

HEAVY EQUIPMENT WASH BASIN (NBN) AND CENTRAL SHOPS BURNING/ RUBBLE PIT (631-5G) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the Heavy Equipment Wash Basin (HEWB) and Central Shops Burning/Rubble Pit (631-5G) (CSBRP-5G) Operable Unit (OU). The review was conducted from July 2018 through November 2018. Contaminants have been left in place at the HEWB/CSBRP-5G 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 HEWB/CSBRP-5G 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 HEWB/CSBRP-5G OU.

III. Background

The HEWB/CSBRP-5G 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 the Savannah River Site (SRS) (FFA 1993). The media addressed by the HEWB/CSBRP-5G OU Record of Decision (ROD) is soil (WSRC 2004). The groundwater beneath the HEWB/CSBRP-5G OU will be addressed as part of the Central Shops Groundwater OU.

The HEWB/CSBRP-5G OU consists of three soil subunits: 1) CSBRP-5G; 2) HEWB; and 3) HEWB Overflow Discharge Area. Figure H-1 shows the location of the HEWB/ CSBRP-5G OU at SRS. Figure H-2 shows the site layout for HEWB/CSBRP-5G OU.

Physical Characteristics

The HEWB/CSBRP-5G OU is in the central part of SRS, within the Fourmile Branch Watershed, approximately 9.6 km (6 mi) from the nearest (western) site boundary. The HEWB is roughly 9 to 18 m (30 to 60 ft) with an earthen berm 1.2-m to 1.5-m (4-ft to 5-ft) high and an area of 0.02 hectares (0.04 acres). It accommodates a volume capacity of 108 m^3 (3,800 ft^3) of standing water at full capacity (Figure H-3).

The CSBRP-5G was approximately 0.15 hectares (0.37 acres) and estimated to contain 3,409 m^3 (120,400 ft^3) of trash by volume. The CSBRP-5G was originally grouped with the other inactive neighboring burning/rubble pits (631-1G and 631-3G). However, in 1998 it was combined with HEWB to allow investigation of a suspected groundwater plume beneath the pit. The plume was thought to originate near the HEWB and to contain volatile organic compounds such as trichloroethylene. Waste disposal ceased in 1973 when the pit reached capacity and was covered with 0.6 m to 0.9 m (2 ft to 3 ft) of soil and brought to grade. Surface grade is approximately 84 m (276 ft) above mean sea level.

The HEWB Overflow Discharge Area is in relatively flat open woodland within the floodplain of an intermittent stream. The Overflow Discharge Area was installed under the berm at the northern end of the HEWB to receive discharges from the HEWB.

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 (LUCAP) for the SRS (WSRC 1999) designates the HEWB/CSBRP-5G OU as being within an industrial area. The future land use for the HEWB/CSBRP-5G OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

From 1950 until the early 1970s, the HEWB received Heavy Equipment Wash Area (HEWA) effluent wash water together with sanitary wastewater from Central Shops. HEWA was a facility set up in the maintenance area to clean equipment prior to maintenance. Historically, during day shifts the HEWB received approximately 37.85 L (10 gal) per minute of wastewater five days a week. The wastewater contained traces of oil, grease, and detergents, plus significant levels of solids that were allowed to settle in the basin. According to the wastewater permit, about one-half of the resulting wash water was lost through infiltration/evaporation. An aerial photo of the HEWB/CSBRP-5G OU in operation in 1951 is shown in Figure H-3. After construction of the Central Shops Sanitary Wastewater Treatment plant in the early 1970s, the wash water from the HEWA

was no longer directed to the HEWB. Since 1981, the HEWB has not received water from Central Shops and the associated facilities. The HEWB only collects stormwater now.

The HEWB Overflow Discharge Area historically received permitted discharges from the HEWB via a high overflow discharge culvert installed under the berm at the northern end of the HEWB. Portions of the releases either infiltrated the soil or traveled surficially to the intermittent stream. This same floodplain served as a conduit for occasional excess stormwater flow.

The CSBRP-5G pit received waste materials including asbestos, used batteries and empty paint cans along with ash, paper, and glass at various times from 1951 until 1973. Waste was also burned periodically at CSBRP-5G from 1951 until 1973 when a layer of soil was placed over the ashes. The pit continued to receive rubble such as paper, empty paint cans, lumber, and empty galvanized steel barrel until 1973.

Initial Response

After operations ceased, the HEWB and the HEWB Overflow Discharge Area were abandoned in place. When the CSBRP-5G reached capacity in 1973 waste disposal ceased and was covered with 0.6 m to 0.9 m (2 ft to 3 ft) of soil and brought to grade.

Basis for Taking Action

Characterization data was collected and evaluated in the RCRA Facility Investigation (RFI)/Remedial Investigation (RI) Report with Baseline Risk Assessment (WSRC 2003) to identify refined constituents of concern (RCOCs) which are constituents warranting remedial action. There were no RCOCs identified for the industrial worker scenario. There were no RCOCs identified for the CSBRP-5G or the Overflow Discharge Area based on unrestricted (residential) land use. There were six RCOCs identified for the HEWB based on unrestricted (residential) land use including benzo(a)pyrene, alpha chlordane, gamma chlordane, heptachlor epoxide, dichlorodiphenyldichloroethane (DDD), and dichloro-diphenyltrichloroethane (DDT). The contamination is isolated to the surface soil in the HEWB.

The hypothetical risk to the future resident for exposure to surface soil contamination in the HEWB was 2.7E-05. This presents a condition that warrants institutional controls

(i.e., land use controls [LUCs]) to prevent unrestricted land use as documented in the ROD for the HEWB/CSBRP-5G and consistent with the LUCAP for the SRS.

Based on the unit characterization data and risk assessment results, the risks associated with the CSBRP-5G and HEWB Overflow Discharge Areas subunits are negligible. No RCOCs for human health or ecological receptors were identified at the two subunits. No Action was the selected response for these two subunits and they remain in their present conditions with no restrictions or LUCs. The HEWB/CSBRP-5G OU does not contain contaminated soil that could act as a source of future contamination to the groundwater through leaching. Therefore, this OU is not a "source control" unit.

IV. Remedial Actions

Remedy Selection

Six RCOCs are present at concentrations representing a combined risk greater than 1E-06 at the HEWB subunit and residential exposure must be prevented. Therefore, the following remedial action objective (RAO) was identified for the HEWB subunit:

- Prevent residential exposure to contaminated soil at the HEWB subunit.

The human health RCOCs and remedial goals (RGs) for the HEWB subunit are listed in Table H-2.

Remedy Implementation

Following waste disposal activities, CSBRP-5G was covered with soil to create a native soil cover. The selected remedy for the HEWB/CSBRP-5G OU is institutional controls (i.e., LUCs) which include access controls (SRS site security), access control signs posted around the HEWB subunit, periodic inspections, and deed restrictions.

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

- Establishing LUCs for the HEWB subunit for 0.11 hectares (0.26 acres);
- Installing warning signs at the boundaries of the HEWB subunit (Figure H-5); and
- Implementing access controls at the SRS boundary to control and restrict public and trespasser access to HEWB subunit.

Discussions pertaining to these elements are provided in the Corrective Measures Implementation Report/Final Remediation Report for the HEWB/CSBRP-5G OU (WSRC 2005a).

System Operations/Operations and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (repair of access road and warning signs) for HEWB subunit only. No inspections or maintenance are required for CSBRP-5G or the Overflow Discharge Area.
- Site controls and land use restrictions via the SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the HEWB/CSBRP-5G OU. Institutional controls (i.e., LUCs) will be maintained until the identified RCOCs no longer pose a threat under the residential (unrestricted) land use scenario.

The operation and maintenance (O&M) cost associated with the selected remedy for the HEWB/CSBRP-5G OU includes the annual inspections and site maintenance, institutional controls (i.e., LUCs) and five-year remedy reviews. Table H-3 compares the actual O&M cost over the last four years to the estimated cost from the ROD. The ROD estimated direct O&M cost associated with the selected remedy as $2,000 each year for 30 years. The five-year remedy review cost is estimated at $15,000 every five years. The estimated direct O&M cost from fiscal year (FY) 2015 to FY2018 are $23,000 as compared to the actual O&M cost of $50,053 for the same period. The actual O&M costs (Table H-3) are slightly higher than expected due to underestimation of maintenance costs. Additional maintenance activities completed included cutting vegetation at signs.

V. Progress Since Last Review

This is the fourth five-year review for the HEWB/CSBRP-5G OU. The previous protectiveness statement concluded that because the remedial action of institutional

controls (i.e., LUCs) at HEWB/CSBRP-5G OU is protective, the site is protective of human health and the environment.

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 Reference XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Evaluated whether the RCOCs still pose a threat under the residential (unrestricted) land use scenario to determine if institutional controls (i.e., LUCs) are still required;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment H-1; 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 George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues were identified for the HEWB OU during these interviews. The HEWB OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on September 12, 2018. No issues were identified during this inspection.

The HEWB OU was inspected by SRNS EC&ACP and USDOE personnel on November 26, 2018. No issues were identified for the HEWB OU during this inspection.

A site inspection was conducted by South Carolina Department of Health and Environmental Control and U.S. Environmental Protection Agency (USEPA) personnel, accompanied by USDOE and SRNS personnel, on March 21, 2019 and April 25, 2019, respectively. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from 2015 through 2018 identified the presence of down trees, overgrown vegetation near signs, and a sign laying on the ground. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy of institutional controls (i.e., LUCs) for the HEWB/CSBRP-5G is effective in preventing residential exposure to RCOCs and is functioning as intended.

The above remedial activities are meeting the RGs established for the HEWB/CSBRP-5G, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Land Use Control Implementation Plan for HEWB/CSBRP-5G OU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2005b). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restrictions to prevent unauthorized contact, removal or excavation of soils, and restrictions to prevent disturbance of the HEWB/CSBRP-5G. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. All LUC objectives are being met.

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

The exposure assumptions, toxicity data, and cleanup levels, and RAOs used at the time of remedy selection are still valid. There have been no changes in standards or physical conditions of the HEWB/CSBRP-5G 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 RCOCs at the HEWB/CSBRP-5G 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 review for applicability to this site. None of the listed emerging contaminants were identified as applicable to this unit.

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

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 currently prevent the remedy for HEWB/CSBRP-5G OU 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 HEWB/CSBRP-5G OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to or ingestion of contaminated soil. All threats to contaminated soil at the HEWB/CSBRP-5G OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the HEWB/CSBRP-5G OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

XII. Document 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

Various – *Inspection Data Sheets - Field Inspection Checklist – Heavy Equipment Wash Basin (U)*, ER-IDS-019-034, Inspection period 2015 through 2017 (annually)

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

WSRC, 2003. *RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) Operable Unit (U)*, WSRC-RP-2002-4088, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Record of Decision Remedial Alternative Selection for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit Operable Unit (631-5G) (U)*, WSRC-RP-2003-4185, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005a. *Corrective Measures Implementation Report/Final Remediation Report for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit Operable Unit (631-5G) (U)*, WSRC-RP-2005-4006, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005b. *Land Use Control Implementation Plan for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit Operable Unit (631-5G) (U)*, WSRC-RP-2005-4015, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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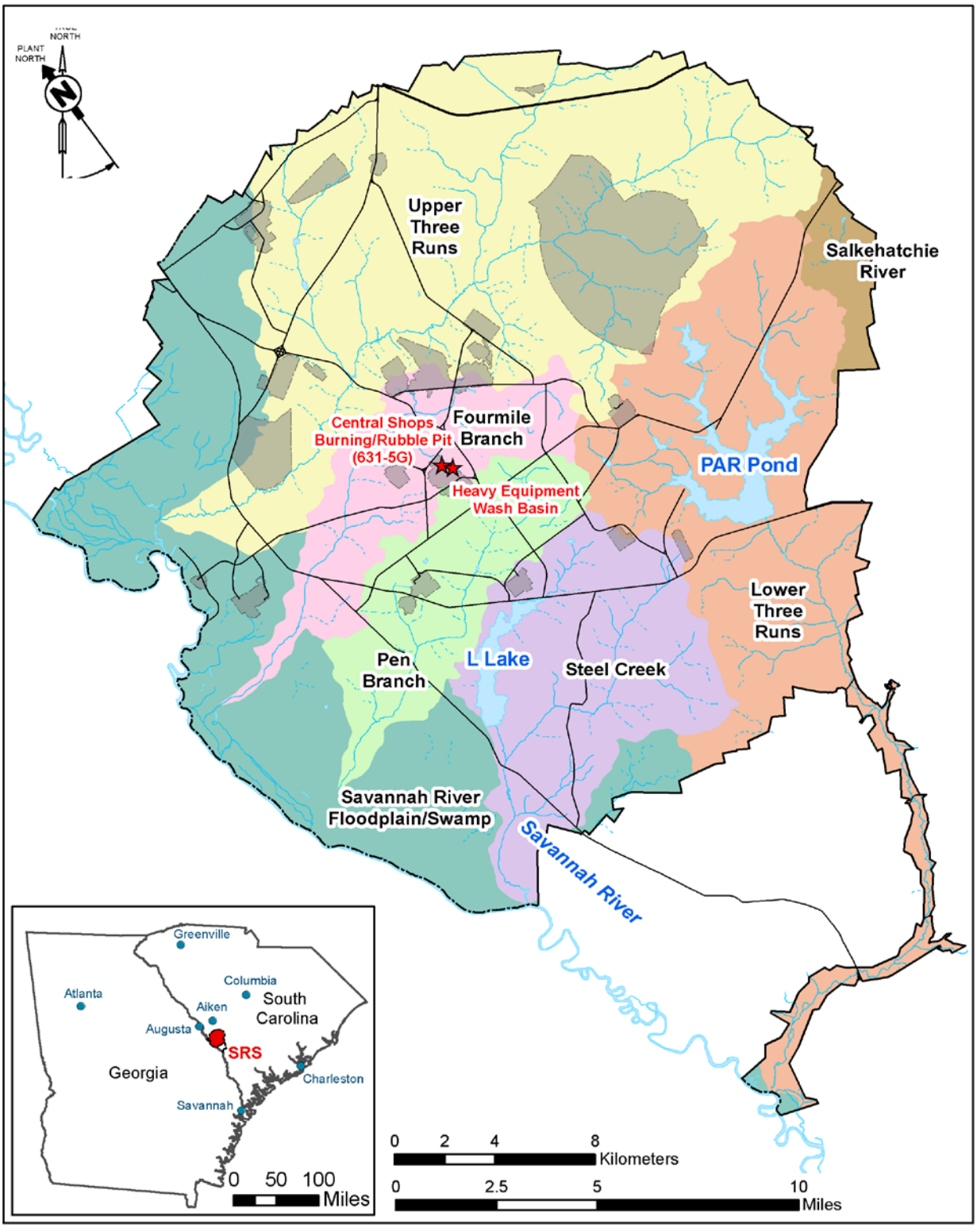


Figure H-1. Location of the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) Operable Unit

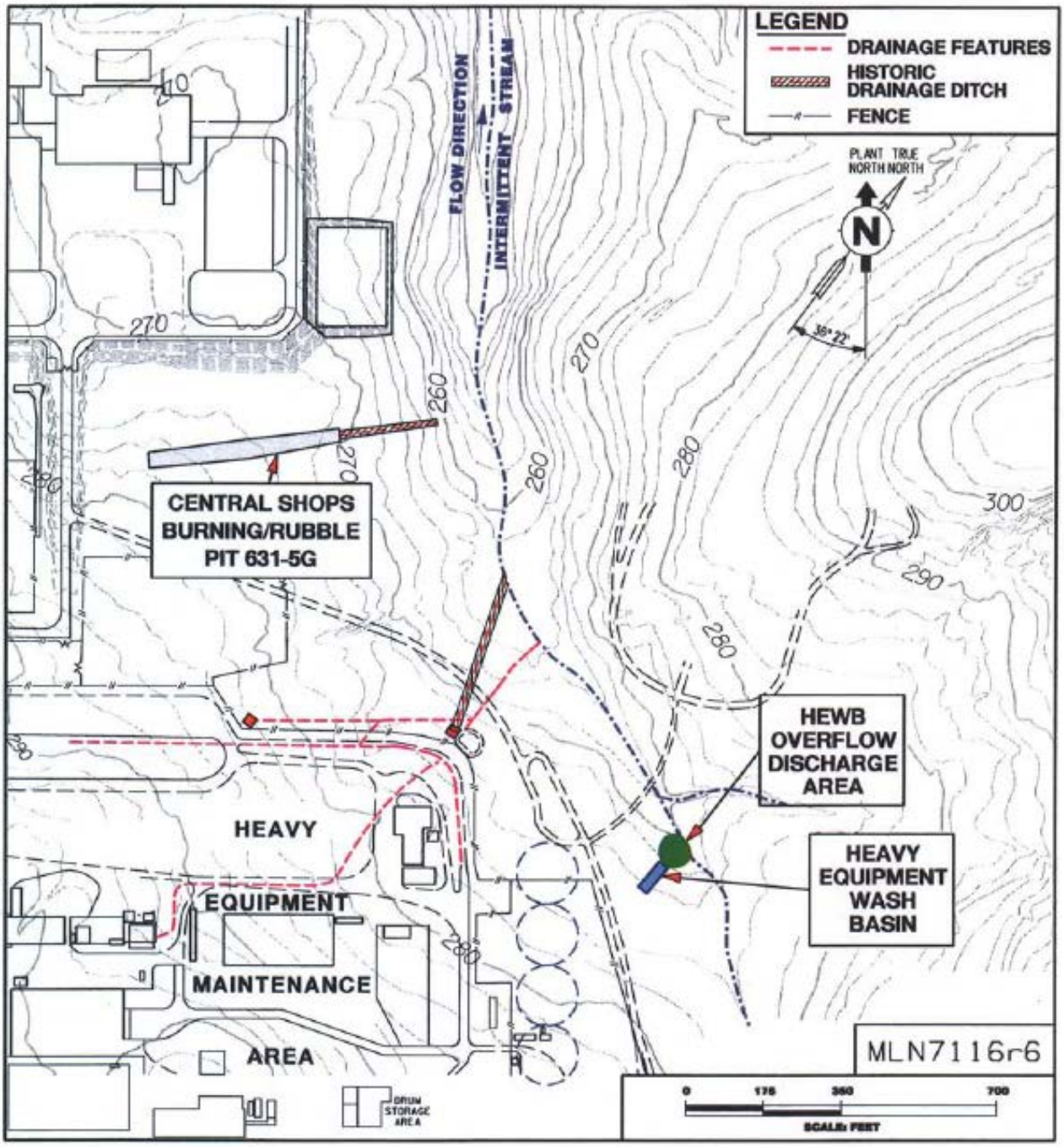


Figure H-2. Layout of the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) Operable Unit



Figure H-3. Aerial Photo of the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) in Operation in 1951



Figure H-4. Current Photo of the Central Shops Burning/Rubble Pit (631-5G) (2018)



Figure H-5. **Current Photos of the Heavy Equipment Wash Basin Boundary Sign (top) and Basin (bottom) (2018)**

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Table H-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	September 1998 / October 3, 2001
ROD Issuance	January 28, 2005
Remedial Action Start/Complete	February 22, 2005 / March 22, 2005
Previous Five-Year Review Issuance	January 28, 2009 / February 4, 2014 / November 30, 2015

Table H-2. Refined COCs and RGs for HEWB Subunit Soils

Subunit	RCOC	Type of COC	RG (mg/kg)	Basis
HEWB	Benzo(a)pyrene	HH	5.19E-02	HH – future resident
	alpha-Chlordane	HH	1.28E+00	HH – future resident
	gamma-Chlordane	HH	1.28E+00	HH – future resident
	Heptachlor epoxide	HH	5.42E-02	HH – future resident
	DDD	HH	2.04E+00	HH – future resident
	DDT	HH	1.44E+00	HH – future resident

COC = constituent of concern
HH = human health
RCOC = refined COC
DDD = dichlorodiphenyldichloroethane
DDT = dichlorodiphenyltrichloroethane

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

	FY2015	FY2016	FY2017	FY2018	5-Year Total
Actual O&M Costs	$21,097	$13,000	$9,889	$6,068	$50,053
Estimated Direct O&M Costs*	$2,000	$2,000	$17,000	$2000	$23,000

* Source of Estimate: The ROD (WSRC 2004) provides the annual direct O&M cost as $2,000/year. The estimated remedy review cost of $15,000 every five years was included with the annual maintenance cost in FY2017.

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Attachment H-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G)

I. SITE INFORMATION			
Site Name:	**Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G)**	**Date of Inspection:**	**09/12/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #53**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**89°F and 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 _____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 10/16/2018 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

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: N/A
   Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Attachment H-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

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: Annual site inspections are performed per SRS procedure *Waste Unit Inspection and Maintenance* (ER-SOP-019), *Field Inspection Checklist for the Heavy Equipment Wash Basin* (ER-IDS-019-034).

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, *Hazardous Waste Operations*. A SSHASP is prepared if needed.

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

Attachment H-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(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.

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

Describe costs and reasons: N/A

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 fencing was 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.

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 five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Brian Hennessey (Name) | Federal Project Director (Title) | 11/26/18 (Date) | 803-952-9365 (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 of decision document 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:

Attachment H-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued/end)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
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:
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A
B. Other Site Conditions: Annual site inspections conducted from 2015 through 2018 identified the presence of down trees, overgrown vegetation near signs, and a sign laying on the ground. These findings were documented on the field inspection checklist and resolved soon after discovery.
Remarks:
VII. LANDFILL COVER/CONTAINMENT ☐ **Applicable** ☒ **N/A**
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
X. OTHER REMEDIES ☐ **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) to prevent human exposure to contaminants in soil. The remedy is fully established and functioning as intended.
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 (2015-2018) site inspections and site maintenance (repair of erosion damage 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 HEWB and CSBRP-5G OU and the condition of its 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

End of Checklist

K-AREA BINGHAM PUMP OUTAGE PIT (643-1G) OPERABLE UNIT

I. Introduction

This report is the fifth five-year review for the K-Area Bingham Pump Outage Pit (643-1G) (KBPOP) Operable Unit (OU). The review was conducted from July 2018 through November 2018. Contaminants and waste have been left in place at the KBPOP 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 KBPOP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table I-1 lists the chronology of site events for the KBPOP OU.

III. Background

KBPOP OU is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media associated with the KBPOP OU is soil.

Physical Characteristics

The KBPOP (643-1G) OU is located near the K-Reactor Area in the west-central portion of SRS (Figures I-1 and I-2). It is approximately 6.4 km (4 mi) east of the SRS boundary. The pit was formed by excavating trenches to an average depth of 3.9 m (13 ft), disposing of 2.7 m (9 ft) of debris, and then returning the unit to grade. The unit is approximately 120 m (400 ft) in length and 18 m (60 ft) in width.

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 KBPOP OU as being within an industrial area. The future land use for the KBPOP OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The KBPOP was a burial pit that received waste debris generated by major modifications to primary and secondary reactor cooling systems in 1957 and 1958, including waste from the Bingham pumps primary system. The waste consisted of miscellaneous construction debris (pipes, cables, ladders, etc.). There were no pumps buried or liquid waste disposed of in the pit. Low-level radioactive debris (less than 25 mR/hr with no detected alpha activity), generated by the repairs, was buried in the pit.

Initial Response

After the pit was filled in 1958, the debris was covered by 1.2-m (4-ft) of backfill. The cover material was placed at a time preceding the preparation of the formal CERCLA documentation and investigation.

Basis for Taking Action

The potential for unrestricted excavation and human exposure to buried debris with fixed radioactive contamination is the basis for taking action at the KBPOP OU**.** Because of the data analysis and risk assessment presented in the Remedial Investigation (RI)/Baseline Risk Assessment (BRA) for the KBPOP OU, cesium-137 was the only constituent of concern (COC) for this OU. The maximum concentration detected in the surface soils at the KBPOP OU was 0.295 pCi/g. Because the cesium-137 concentrations were less than typical background concentrations due to global fallout, institutional controls (i.e., LUCs) were sufficient for remedial action.

Based on characterization and risk assessment information, the KBPOP OU does not impact the watershed. The results from the KBPOP OU sample analyses indicate that minor concentrations/activities of constituents in the soil have migrated from the pit into

the surrounding soil horizons; however, horizontal migration is limited to the boundaries of the pit, and vertical migration is limited to the upper clayey zones.

The geotechnical and geologic data indicate that a less permeable zone is present underneath the pit that will inhibit less mobile constituents from migrating vertically and potentially impacting the groundwater. Groundwater sampling results support that the KBPOP OU has not impacted the groundwater and that the metal constituents detected are naturally occurring.

A total of six groundwater samples were collected from the water table aquifer near the KBPOP in January 1995. These include two background samples (KH1 and KH4), an additional upgradient sample (KH3), and three down- or side-gradient samples (KH2, KH5, and KH6) (Figure I-2). Based on the conclusion of the KBPOP RI/BRA Report, there are no groundwater COCs and no soil contaminant migration COCs. Therefore, no groundwater remedial actions were required.

Table I-2 presents the refined COCs (RCOCs) and remedial goals (RGs) for the future industrial worker based on a risk of 1E-06.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 1998b), the remedial action objectives (RAOs) for the KBPOP OU soils are as follows:

- Reduce risks to human health via external exposure to radiological constituents (i.e., cesium-137) in the soil; and
- Achieve RGs established for unit soil.

There were no RAOs required for ecological receptors or contaminant migration COCs.

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

- Land Use Controls (LUCs) (access and deed restrictions/notifications) for soil; and
- No remedial action for groundwater was identified in the ROD because the RI/BRA concluded that KBPOP is not impacting groundwater.

Remedy Implementation

Following waste disposal activities, the pit was covered with backfill to create a native soil cover. The implementation of the selected remedy included the following:

- Establishment of LUCs for 0.24 hectares (0.59 acres);
- Posting of warning signs at appropriate locations in sufficient numbers to be seen from any approach; and

Figure I-3 is a current photo (2018) of the KBPOP OU.

Systems Operations/Operations and Maintenance

There are no system operation requirements for KBPOP OU.

The following maintenance activities are being performed to maintain the native soil cover as long as the waste remains a threat to human health or environment:

- Visual inspections are being performed annually for evidence of damage to the native soil cover due to erosion or intrusion by burrowing animals. The inspection also addresses upkeep of the vegetative cover and the warning signs.
- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.
- LUCs (i.e., institutional controls) are being enforced to preclude unauthorized access or intrusive activities through the SRS Site Use / Site Clearance program and SRS site security.

Cost associated with the selected remedy for the KBPOP OU includes operation and maintenance (O&M) cost of LUCs. Table I-3 compares the actual O&M cost over the last four years to the estimated cost from the ROD. The ROD estimated O&M cost associated with the selected remedy are $2,600 annually for maintenance activities and $3,036 every five years for remedy reviews. The estimated direct O&M cost for fiscal year (FY) 2015 to FY2018 is $13,436 as compared to the actual O&M cost of $36,237 for the same period. The actual O&M costs are higher than the estimated O&M costs due to five-year remedy review and maintenance costs being underestimated. Additional maintenance activities completed included cutting vegetation at OU perimeter.

V. Progress Since Last Review

This is the fifth five-year review for the KBPOP OU. The previous protectiveness statement concluded that because the remedial actions of LUCs are protective, the site is protective of human health and the environment.

There were no recommendations of 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 Checklists provided in Attachment I-1; 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 George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues

were identified for the KBPOP OU during these interviews. The KBPOP OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completions Projects (EC&ACP) on September 26, 2018. No issues were identified during these inspections.

The KBPOP OU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2018. No issues were identified for the KBPOP OU during this inspection.

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 March 19, 2019. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from 2015 through 2018 identified three signs that needed to be replaced. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy for the KBPOP OU of LUCs is effective in preventing human exposure to cesium-137 in the soil and is functioning as intended.

The Land Use Control Implementation Plan for KBPOP OU is discussed in Section 2.0 of the Final Remediation Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 1998a). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restrictions to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the KBPOP OU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. 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. There have been no changes in standards or physical conditions of the KBPOP 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 KBPOP 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 unit.

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

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 KBPOP OU.

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to or ingestion of contaminated soil. All threats to the KBPOP OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the KBPOP OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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

Various - *Inspection Data Sheets – Field Inspection Checklist K-Area Bingham Pump Outage Pit (643-1G) (U),* ER-IDS-019-004, Inspection periods 2015 through 2018

WSRC, 1997. *Feasibility Study for the K-Area Bingham Pump Outage Pit (653-1G) (U),* WSRC-RP-96-831, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998a. *Final Remediation Report for the K-Area Bingham Pump Outage Pit (643-1G) (U),* WSRC-RP-98-4003, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998b. *Record of Decision Remedial Alternative Selection for the K-Area Bingham Pump Outage Pit (643-1G) (U),* WSRC-RP-97-178, 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, August 1999, latest update, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

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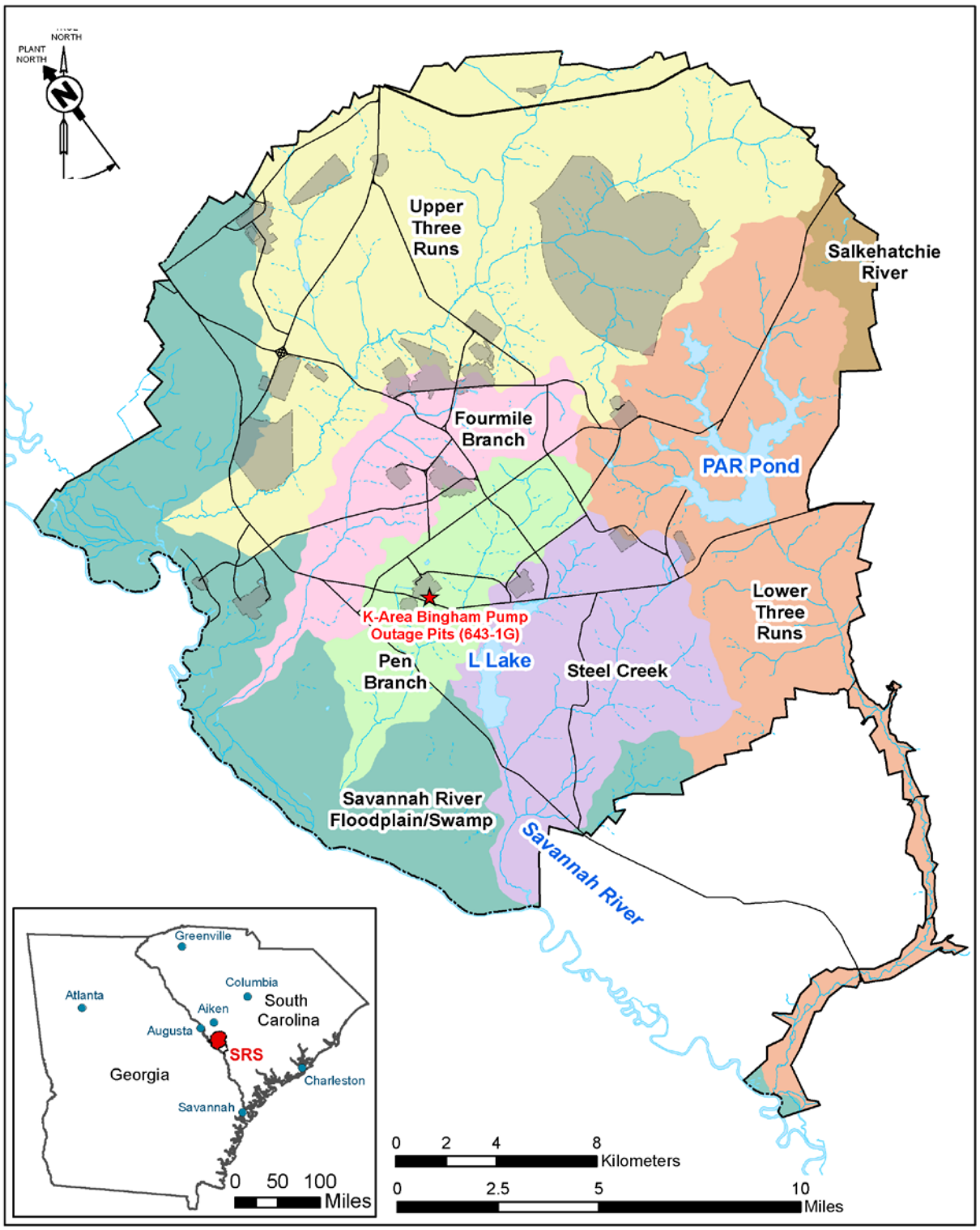


Figure I-1. Location of the K-Area Bingham Pump Outage Pit (643-1G) OU at SRS

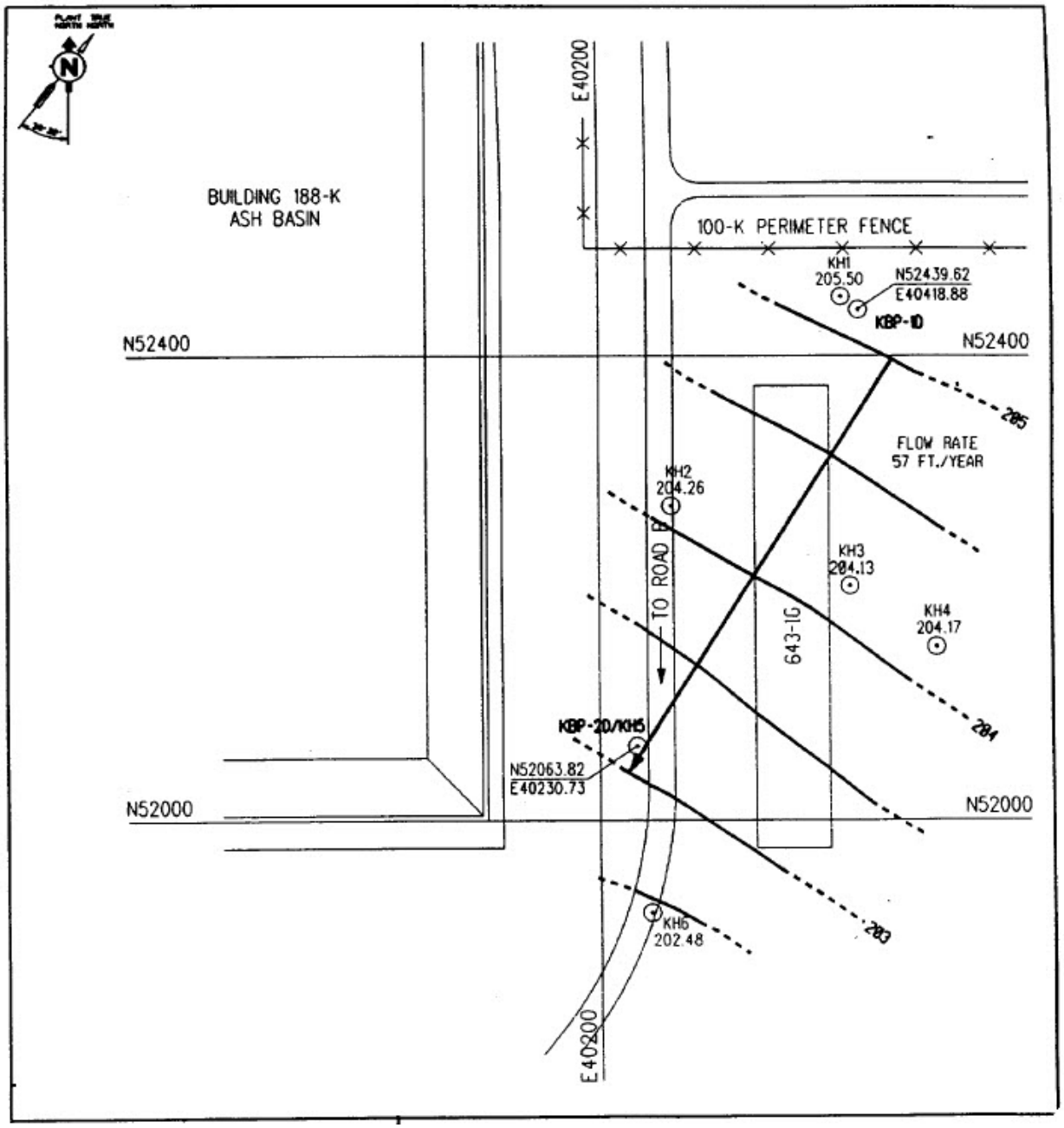


Figure I-2. Location of Groundwater Samples at K-Area Bingham Pump Outage Pit (643-1G) Operable Unit



Figure I-3. Photo of the K-Area Bingham Pump Outage Pit (643-1G) Operable Unit (2018)

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Table I-1. Chronology of OU Events

Event	Date
Removal Action (Disposal Operation)	1957 - 1958
RI Start / Complete	January 1995 / June 19, 1997
ROD Issuance	June 11, 1998
Previous Five-Year Reviews Issuance	February 12, 2004 / January 28, 2009 / February 4, 2014 / November 30, 2015

Table I-2. Remedial Goals for KBPOP in soils

Subunit	RCOC	Type of COC	RG (ρCi/g)	Basis
KBPOP	Cesium-137	HH	1.06E-01	HH – Future Industrial Worker
	Cesium-137	HH	2.08E-02	HH – Future Resident

COC – constituent of concern
HH – human health
RCOC – refined COC

Table I-3. Actual verses Estimated O&M Cost

	FY2015	FY2016	FY2017	FY2018	4-Year Total
Actual O&M Costs	$16,750	$7,916	$6,053	$5,519	$36,237
Estimated Direct O&M Costs*	$2,600	$2,600	$5,636	$2,600	$13,436

* Source of Estimate: The ROD (WSRC 1998b) provides a total present worth O&M cost of $40,000 for maintenance activities and $280,000 for five-year remedy reviews. To convert the values to yearly unit cost, the total present worth cost was divided by the present worth factor provided in the Feasibility Study (WSRC 1997) to reflect $2,600 annually for maintenance activities and $3,036 (i.e., $18,217 unit cost/6 reviews) every five years for 30 years for remedy reviews. The estimated remedy review cost was included with the annual maintenance cost in FY2017.

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Attachment I-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G)

I. SITE INFORMATION			
Site Name:	**K-Area Bingham Pump Outage Pits (643-1G)**	**Date of Inspection:**	**09/26/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #20**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**91°F and 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 _____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 10/16/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment I-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

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: Annual site inspections are performed per SRS procedure *Waste Unit Inspection and Maintenance* (ER-SOP-019), *Field Inspection Checklist for K-Area Bingham Pump Outage Pits* (ER-IDS-019-004).

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, *Hazardous Waste Operations*. A SSHASP is prepared if needed.

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 I-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(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.

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

Describe costs and reasons: N/A

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 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 at this site are in good condition.

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 five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Phil Prater (Name) DOE Program Manager (Title) 12/03/2018 (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 of decision document 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:

Attachment I-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued/end)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
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:
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A
B. Other Site Conditions: Annual site inspections conducted from 2015 through 2018 identified three signs that needed to be replaced. These findings were documented on the field inspection checklist and resolved soon after discovery.
Remarks:
VII. LANDFILL COVER/CONTAINMENT ☐ Applicable ☒ N/A
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
X. OTHER REMEDIES ☐ 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 remedial action for this unit is institutional controls (i.e., LUCs) to prevent human exposure to contaminants in soil. 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. The O&M procedures consisting of annual (2015-2018) site inspections and site maintenance (verify no invasive activities have occurred 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 KBPOP OU and the condition of its 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

End of Checklist

L-AREA BINGHAM PUMP OUTAGE PITS (643-2G AND 643-3G) (LBPOP) AND P-AREA BINGHAM PUMP OUTAGE PITS (643-4G) (PBPOP) OPERABLE UNIT

I. Introduction

This report is the fifth five-year review for the L-Area Bingham Pump Outage Pits (643-2G and 643-3G) (LBPOP) and P-Area Bingham Pump Outage Pit (643-4G) (PBPOP) Operable Unit (OU). The review was conducted from July 2018 through November 2018. Contaminants have been left in place at the LBPOP/PBPOP 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 LBPOP/PBPOP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table J-1 lists the chronology of site events for the LBPOP/PBPOP OU.

III. Background

The LBPOP/PBPOP OU is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media associated with the LBPOP/PBPOP OU is soil.

Physical Characteristics

The LBPOP/PBPOP are located near the L- and P-Reactor Complexes, respectively, at SRS (Figure J-1). The LBPOP consists of two pits (643-2G and 643-3G) aligned end-to-end with approximately 37.5 m (125 ft) between them; one pit is 82.5 m by 6.6 m (275 ft by 22 ft) and the other pit is 113 m by 6 m (377 ft by 20 ft) (Figure J-2). The PBPOP consists of one pit (643-4G) with dimensions of 141.6 m by 7.8 m (472 ft by 26 ft) (Figure J-3). The mean depth of each pit is approximately 3.9 m (13 ft). Figures J-4 and J-5 show current (2018) photographs of LBPOP and PBPOP, respectively.

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 the LBPOP/PBPOP OU as being within an industrial area. The future land use for the LBPOP/PBPOP OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The LBPOP/PBPOP were burial pits that received waste debris generated by major modifications to primary and secondary reactor cooling systems in 1957 and 1958, including waste from the Bingham pumps primary system. The waste consisted of miscellaneous construction materials such as pipes, cables, ladders, and concrete. No known pumps or liquid wastes were buried in the L- and PBPOPs. Radioactive contamination associated with the debris was less than 25 mR/hr with no detected alpha activity. The debris was classified as Low-Level Threat Waste.

Initial Response

The LBPOP/PBPOP were formed by excavating trenches to an average depth of 3.9 m (13 ft), disposing of 2.7 m (9 ft) of debris, and then returning the pits to grade by covering the debris with 1.2 m (4 ft) of backfill. This cover material was placed in 1958 at a time preceding the preparation of the formal CERCLA documentation and investigation.

Basis for Taking Action

The potential for unrestricted excavation and human exposure to buried debris with fixed radioactive contamination is the basis for taking action at the LBPOP/PBPOP. No human health refined constituents of concern (RCOCs) were identified in the soil at any depth at LBPOP for any land use/receptor scenario. No human health RCOCs were identified in the surface soil at PBPOP for any land use/receptor scenario. Polyaromatic hydrocarbons (PAHs) including: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and

dibenzo(a,h)anthracene, and polychlorinated biphenyls (PCBs) (i.e., Aroclor 1254 and Aroclor 1260) were retained as RCOCs in subsurface soil at PBPOP for the hypothetical on-unit resident scenario. Benzo(a)pyrene was identified as the only RCOC in the subsurface soil at PBPOP for the future industrial worker scenario and is confined to a small area around intra-pit boring P-46 with a maximum concentration of 1,430 µg/kg. No ecological RCOCs or contaminant migration (CM) COCs were identified for either LBPOPs or PBPOP.

Table J-2 presents the RCOCs and remedial goals (RGs) for the future industrial worker and residential adult receptors based on a risk of 1E-06.

Groundwater is included as a subunit for the LBPOP/PBPOP OU. However, no CMCOCs were identified as potential sources of groundwater contamination, and no COCs were identified in the groundwater. Therefore, groundwater monitoring and reporting is not required for the LBPOP/PBPOP OU.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 1999b), the remedial action objectives (RAOs) for the LBPOP/PBPOP OU soils are as follows:

- Reduce the potential for exposure to buried waste at each unit and exposure to PAHs and PCBs in subsurface soil at the PBPOP.

As stated in the ROD, the remedial action at the LBPOP/PBPOP OU is as follows:

- Land Use Controls (LUCs) (access and deed restrictions/notifications) for soil to prohibit residential use and unauthorized excavation of the waste; and
- No action for groundwater.

Remedy Implementation

Following waste disposal activities, the pits were covered with backfill to create native soil covers. The implementation of the selected remedy for the LBPOP/PBPOP included the following:

- Established LUCs for 0.3 hectares (0.73 acres) for LBPOPs and 0.17 hectares (0.41 acres) for PBPOP as documented in the survey plats provided in the Final Remediation Report (WSRC 2000);
- Posted warning signs at the units at appropriate locations in sufficient numbers to be seen from any approach to prohibit unauthorized excavation and disturbance of the cover system;
- Existing SRS access controls (including security gates and guards) prohibit residential use; and
- Existing SRS Site Use/Site Clearance Program controls work in the areas of the OUs and prevents unauthorized disturbance of the LBPOP/PBPOP while under ownership of the government.

Systems Operations/Operations and Maintenance

There are no system operational requirements.

The following maintenance activities are being performed to maintain the native soil cover as long as the waste remains a threat to human health or environment:

- Visual inspections are being performed annually for evidence of damage to the native soil cover due to erosion or intrusion by burrowing animals. The inspection also addresses upkeep of the vegetative cover and the warning signs.
- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.

- LUCs (i.e., institutional controls) 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 the LBPOP/PBPOP OU includes operation and maintenance (O&M) costs of LUCs. Table J-3 compares the actual O&M costs over the last four years to the estimated costs from the ROD. The ROD estimated O&M costs associated with the selected remedy is $2,700 annually for maintenance activities for L- and PBPOPs, and $16,667 every five years for remedy reviews. The estimated direct O&M cost from fiscal year (FY) 2015 to FY2018 is $27,467 as compared to the actual O&M cost of $59,270 for the same period. The actual O&M are higher than the estimated O&M costs because the five-year remedy review and maintenance costs were underestimated. Additional maintenance activities completed included addressing active ant mounds, removing dead trees, and repairing native soil cover damaged from feral hog rutting.

V. Progress Since Last Review

This is the fifth five-year review for the LBPOP/PBPOP. The previous protectiveness statement concluded that because the remedial action of LUCs is protective, the sites are protective of human health and the environment.

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 OUs, interviewed maintenance personnel, and documented the results on the Inspection Checklists provided in Attachment J-1; 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 George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues were identified for the LBPOP/PBPOP OU during these interviews. The LBPOP/PBPOP OU were inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on August 27, 2018. No issues were identified during these inspections.

The LBPOP/PBPOP were inspected by SRNS EC&ACP and USDOE personnel on December 3, 2018 and November 29, 2018, respectively. No issues were identified for the LBPOP/PBPOP OU during the 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 March 19, 2019. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from 2015 through 2018 identified the presence of fallen trees and new tree growth near cap, evidence of soil disturbance by feral hogs, and ant mounds on the native soil covers. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy of LUCs for the LBPOP/PBPOP is effective in preventing human exposure to contaminated media and is functioning as intended.

The above remedial activities are meeting the RGs established for the LBPOP/PBPOP, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Land Use Control Implementation Plan for LBPOP/PBPOP is discussed in Section 2.0 of the Final Remediation Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2000). The LUCs that are in place include access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restrictions to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the LBPOP/PBPOP OU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. 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. There have been no changes in standards or physical conditions of the LBPOP/PBPOP 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 PBPOP 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 these sites. None of the listed emerging contaminants were identified as applicable to these units.

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

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 that prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for LBPOP/PBPOP OU.

X. Protectiveness Statement(s)

The remedy at the LBPOP/PBPOP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to or ingestion of contaminated soil. All threats to the LBPOP/PBPOP OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the LBPOP/PBPOP OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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

Various - *Inspection Data Sheets – Field Inspection Checklist L-Area Bingham Pump Outage Pits (Bldg. 643-2G & 643-3G) (U)*, ER-IDS-019-005, Inspection period 2015 through 2018

Various - *Inspection Data Sheets – Field Inspection Checklist P-Area Bingham Pump Outage Pit (Bldg. 643-4G) (U)*, ER-IDS-019-006, Inspection period 2015 through 2018

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

WSRC, 1999b. *Record of Decision Remedial Alternative Selection for the L- and P- Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)*, WSRC-RP-98-4105, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000. *Final Remediation Report for the L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)*, WSRC-RP-2000-4030, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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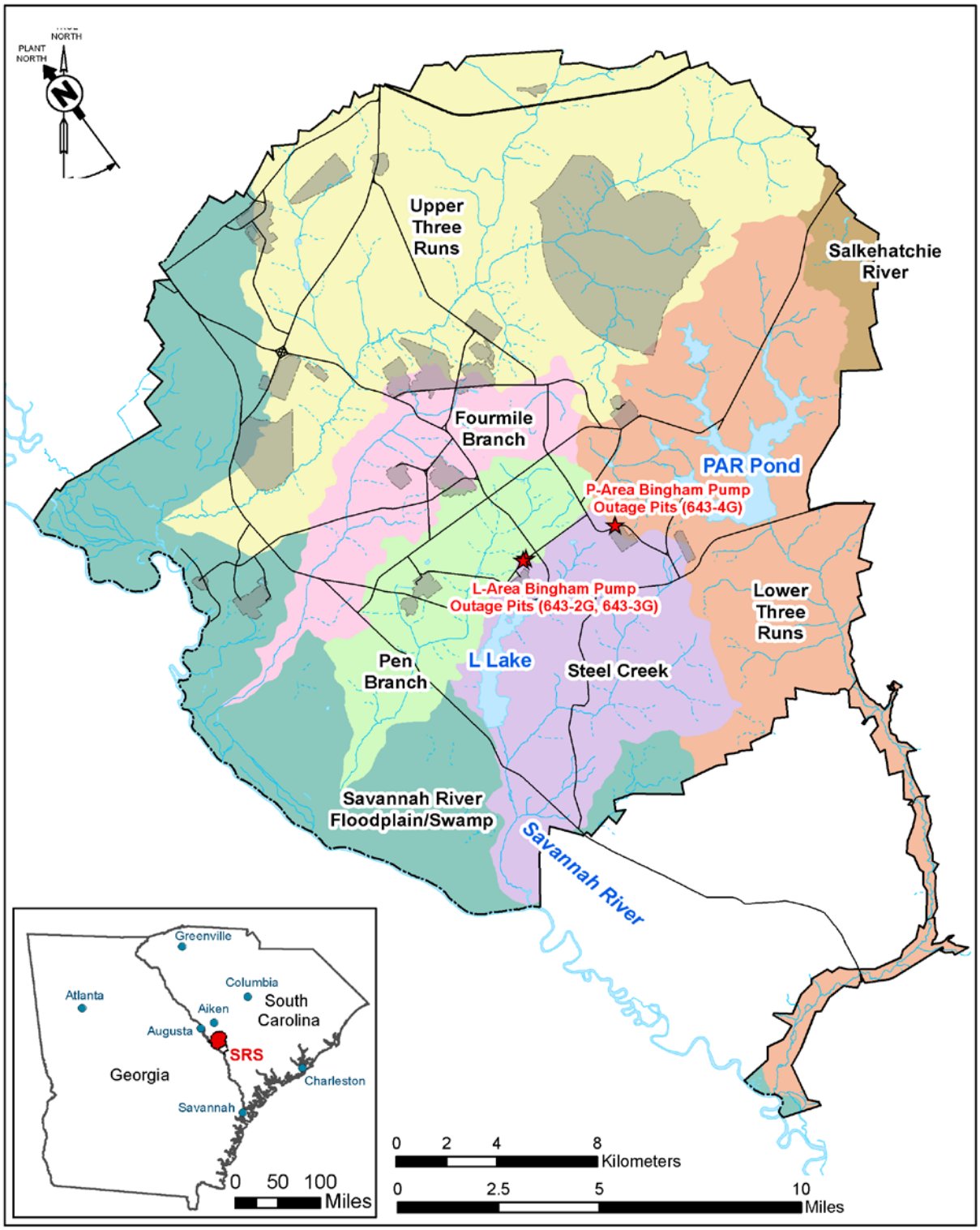


Figure J-1. Location of the L-Area Bingham Pump Outage Pits (643-2G and 643-3G) and P-Area Bingham Pump Outage Pit (643-4G) at SRS

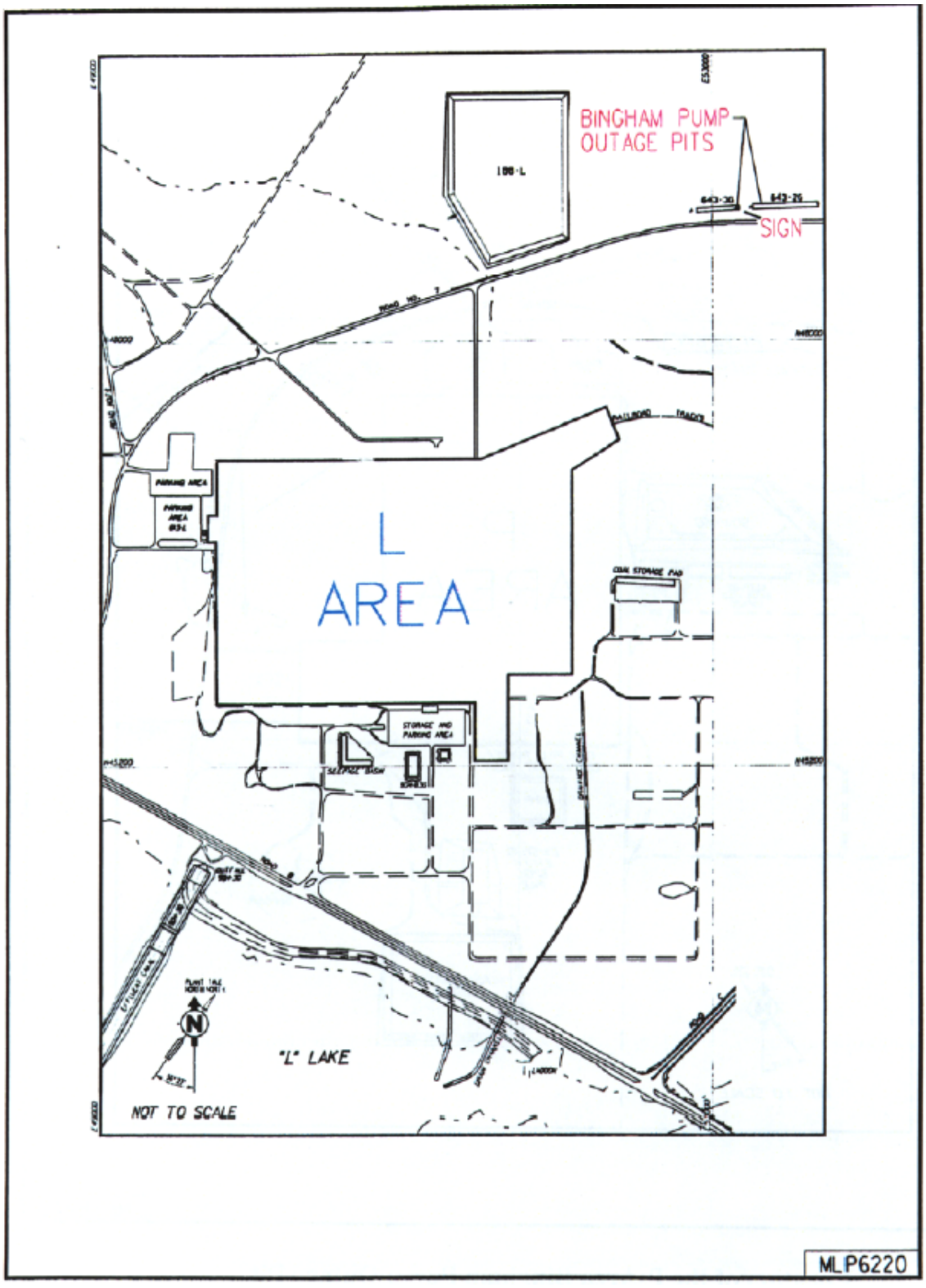


Figure J-2. Layout of L-Area Bingham Pump Outage Pits

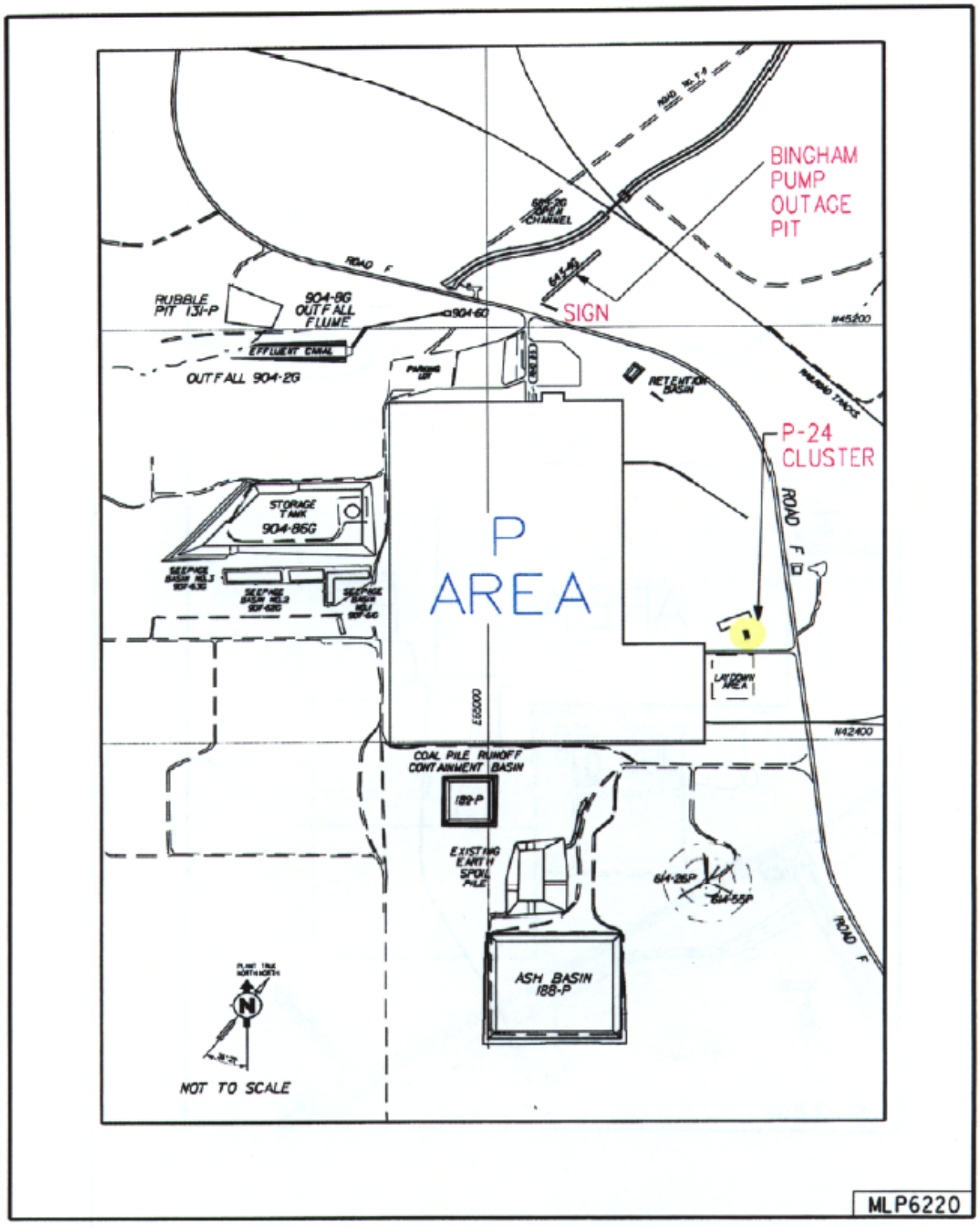


Figure J-3. Layout of the P-Area Bingham Pump Outage Pit

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Figure J-4. Photo of L-Area Bingham Pump Outage Pits (643-2G and 643-3G) (2018)



Figure J-5. Photo of P-Area Bingham Pump Outage (643-4G) (2018)

Table J-1. Chronology of OU Events

Event	Date
Remedial Investigation Field Start / Complete	March 3, 1997 / May 27, 1999
ROD Issuance	October 18, 2000
Remedial Action Start / Complete	September 11, 2000 / September 11, 2000
Previous Five-Year Review Issuance	February 12, 2004 / January 28, 2009 / February 4, 2014 / November 15, 2015

Table J-2. Remedial Goals for LBPOP/PBPOP in Subsurface Soil*

Subunit	COC	Type of COC	RG (mg/kg)	Basis
PBPOP	Aroclor 1254	HH	2.6E-01	HH – Future Resident
	Aroclor 1260	HH	2.6E-01	HH – Future Resident
	Benzo(a)anthracene	HH	5.19E-01	HH – Future Resident
	Benzo(a)pyrene	HH	5.2E-02	HH – Future Resident
	Benzo(b)fluoranthene	HH	5.19E-01	HH – Future Resident
	Dibenzo(a,h)anthracene	HH	5.2E-02	HH – Future Resident
	Benzo(a)pyrene	HH	2.56E-01	HH – Future Industrial Worker

* RGOs are selected based on the anticipated future land use of the unit (limited use with restrictions similar to an industrial use zone) with exposure to surface soil. Because there were no final COCs for surface soil, no RGs are listed.

Table J-3. Comparison of Actual vs. Estimated O&M

	FY2015	FY2016	FY2017	FY2018	4-Year Total
Actual O&M Costs	$24,137	$16,585	$12,702	$5,846	$59,270
Estimated Direct O&M Costs *	$2,700	$2,700	$19,367	$2,700	$27,467

* Source of Estimate: The ROD (WSRC 1999b) provides the unit cost of $2700 for maintenance activities for LBPOP/P BPOP, and a total present worth cost of $50,000 for six five-year remedy reviews over 30 years for each BPOP. The estimated remedy review cost was included with the annual maintenance cost in FY2017. Costs are shown for the combined LBPOP/PBPOP.

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Attachment J-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) and P-Area Bingham Pump Outage Pits (643-4G)

I. SITE INFORMATION			
Site Name:	**L-Area Bingham Pump Outage Pits (643-2G and 643-3G) and P-Area Bingham Pump Outage Pits (643-4G)**	**Date of Inspection:**	**08/27/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #26**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**92°F and 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 _____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 10/16/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment J-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) and P-Area Bingham Pump Outage Pits (643-4G) *(continued)*

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: Annual site inspections are performed per SRS procedure *Waste Unit Inspection and Maintenance* (ER-SOP-019), *Field Inspection Checklist for the LBPOPs* (ER-IDS-019-005) and *Field Inspection Checklist for the PBPOP* (ER-IDS-019-006).

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, *Hazardous Waste Operations*. A SSHASP is prepared if needed.

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 – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) and P-Area Bingham Pump Outage Pits (643-4G) *(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

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: N/A

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 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.

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 five years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | DOE Program Manager (Title) | 11/29/18 (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 of decision document 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:

Attachment J-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) and P-Area Bingham Pump Outage Pits (643-4G) *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

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:

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: Scheduled annual site inspections conducted from 2015 through 2018 identified the presence of fallen trees and new tree growth near cap, evidence of soil disturbance by feral hogs, and ant mounds on the native soil covers. These findings were documented on the field inspection checklist and resolved soon after discovery.

Remarks: Site vegetation is mowed routinely.

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

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

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

X. OTHER REMEDIES ☐ **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 LUCs with a no action for groundwater. This 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.

The O&M procedures consisting of annual (2015-2018) site inspections and site maintenance (repair of erosion damage, 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 L- and PBPOP OU and the condition of 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

End of Checklist

PAR POND (685-G) (INCLUDING THE PRE-COOLER PONDS AND CANALS) AND LOWER THREE RUNS INTEGRATOR OPERABLE UNIT TAIL PORTION (MIDDLE AND LOWER SUBUNITS)

I. Introduction

This report is the sixth five-year review for the PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals), hereafter referred to as PAR Pond. This is the third review for the Lower Three Runs (LTR) Integrator Operable Unit (IOU) Tail Portion (Middle and Lower Subunits), which was added to the PAR Pond Interim Record of Decision (IROD) via an Explanation of Significant Differences (ESD). The review was conducted from July 2018 through November 2018. Contaminants have been left in place at the PAR Pond and in the LTR IOU Tail Portion (Middle and Lower Subunits) 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 PAR Pond and the LTR IOU Tail Portion (Middle and Lower Subunits) is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table K-1 lists the chronology of site events for the PAR Pond.

III. Background

The PAR Pond and LTR IOU are listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) units in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media associated with the PAR Pond and the LTR IOU Tail Portion are sediment and soil. PAR Pond is part of the LTR IOU.

Physical Characteristics

PAR Pond is a 1,072-hectares (2,640-acres) man-made reservoir located southeast of R Area and east of P Area (Figure K-1). The easternmost shore is approximately 1.6 km (1 mi) from the eastern SRS boundary. The PAR Pond consists of the PAR Pond reservoir, the series of pre-cooler ponds and canals, and the Lower Three Runs Creek (Figure K-2).

The portion of the Lower Three Runs Creek that is bounded by a narrowed SRS boundary and the wetlands associated with that portion of the LTR IOU are sometimes referred to as the tail portion of the LTR IOU (Figure K-1).

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River* (WSRC 1999) designates PAR Pond as being outside of a designated site industrial area. However, according to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for the PAR Pond is reasonably anticipated to be industrial (i.e., non-residential) with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

PAR Pond was built in 1958 to create a reservoir for augmenting the cooling water requirements of both R- and P-Reactors, which began operations in 1953 and 1954, respectively. It served as a heat exchange/cooling reservoir for P Reactor until 1988. Releases in the form of process leaks, purges, and makeup cooling water have contaminated PAR Pond with cesium-137 and other radioactive and nonradioactive (i.e., mercury) contaminants. Between 1954 and 1964, approximately 222 Ci of cesium-137 were released from R-Reactor into PAR Pond or Lower Three Runs Creek (before the creation of the reservoir in 1958). All radioactive isotope releases ceased following the shutdown of R-Reactor in 1964. No measurable cesium-137 was released into PAR Pond from P-Reactor. Since most of the radionuclide releases to PAR Pond (direct or indirect) occurred during the 1950 to 1960 era, and the half-life of cesium-137 is approximately 30 years, more than half of this radionuclide has decayed. The estimated inventory of cesium-137 associated with all sediments within the PAR Pond reservoir in 1993 was approximately 43 Ci, of which 9 Ci were present in the 544 hectares (1,340 acres) of sediments that were exposed when PAR Pond was drawn down in 1991 to repair the PAR Pond Dam. The remaining 68 Ci of cesium-137 inventory in the PAR Pond system was in the sediments of the pre-cooler canal/pond system and Lower Three Runs Creek (WSRC 1995).

Initial Response

During an inspection of the PAR Pond Dam in March 1991, a small surface depression was noted on the downstream face. Based on the inspection report, the USDOE ordered a detailed structural investigation into the cause of the depression and simultaneously initiated a precautionary drawdown of the reservoir. From June through September 1991, the level of PAR Pond was lowered from 60 m to 54.3 m (200 ft to 181 ft) mean sea level (msl). The 54.3-m (181-ft) level was chosen to reduce the risk and consequences of potential flooding in downstream communities in the unlikely event of a dam failure. Lowering the surface water level elevation of PAR Pond resulted in a reduction of the reservoir's surface area and volume by approximately 50 and 65 percent, respectively. However, the drawdown resulted in the exposure of 544 hectares (1,340 acres) of sediments contaminated with cesium-137 and mercury.

A CERCLA IROD was issued in early 1995 that selected an interim remedy to maintain the PAR Pond reservoir level to the original 60 m (200 ft) level following repair of the PAR Pond Dam (WSRC 1995).

In 1995, USDOE prepared an Environmental Assessment for the proposed natural fluctuation of water level in PAR Pond and reduced water flow in Steel Creek below L-Lake at the Savannah River Site (USDOE 1995). Based on the analysis in the Environmental Assessment, USDOE determined that the proposed natural fluctuations of water levels in PAR Pond and reduced water flow in Steel Creek below L-Lake did not constitute a Federal action significantly affecting the quality of the human environment. Therefore, an Environmental Impact Statement (EIS) was not required and USDOE issued a Finding of No Significant Impact (FONSI) on August 29, 1995 (USDOE 2009).

Basis for Taking Action

PAR Pond Reservoir

A limited evaluation of human health and environmental risks was conducted for potential exposure to the contaminated sediments in the PAR Pond reservoir that were exposed when the water level was lowered to 54.3 m (181 ft) msl (from full level of 60 m [200 ft] msl) (WSRC 1995). Sixteen nonradioactive constituents and four radionuclides were identified

in the sediments. Based on the qualitative risk assessment, carcinogenic risks for the current land use scenario (i.e., on-unit worker) associated with external exposure to cesium-137 contaminated sediment to the on-unit worker was 4E-05, exceeding the target risk of 1E-06. The carcinogenic risk to the hypothetical future resident was calculated to be above 1E-04. No non-carcinogenic human health effects were identified.

Because ecological effects are not immediately manifested with system changes, the ecological evaluation was based on the conditions at the time of the evaluation, which was representative of the full-pool scenario. Selected terrestrial and aquatic animal species with the potential to experience ecological effects from exposure to cesium-137 and mercury were identified. Results of the limited risk assessment indicated that cesium-137 and mercury levels in the exposed sediments could potentially threaten the ecological receptors that inhabit the PAR Pond shoreline with maintenance of the reservoir at the 54.3-m (181-ft) msl water level. However, little or no effects to either terrestrial or aquatic vegetation were expected to occur. If enhanced mercury loading into PAR Pond were to occur, there is the potential threat to selected aquatic receptor species and the PAR Pond ecosystem.

LTR IOU Tail Portion (Middle and Lower Subunits)

Data from characterization efforts conducted during the period from 2006 through early 2014 identified an unacceptable risk to human health for the adolescent trespasser receptor from external exposure to cesium-137 in the tail portion of the LTR Creek (i.e., LTR IOU) (WSRC 2007 and SRNS 2012b). Historically, there has been evidence of trespasser activity along the lower subunit of LTR IOU, as the U.S. government-controlled land along this section of the creek is less than 0.4 km (0.25 mi) wide at some points along an approximately 20.8 m (13 mi) stretch and is crossed by several public access points (i.e., bridges, railroads, utility rights of way) and bounded by private property. Prior activities have included installation of fencing and signage to deter trespassing. While this appeared to be effective as no recent signs of trespassing were noted during the 2009 and 2010 characterization efforts, USDOE initiated a time critical removal action (TCRA) to remove selected cesium-137 contaminated sediment along three transects (Figures K-3 and K-4). Following the removal action, residual cesium-137 contamination remained at levels

that did not allow unrestricted land use and additional land use controls (LUCs) were needed in the LTR IOU Tail Portion (Middle and Lower Subunits) to control and restrict public and trespasser access. An ESD (SRNS 2012a) to the IROD (WSRC 1995) incorporated additional LUCs in the form of added signage and fencing for the lower and middle sections of the LTR IOU Tail Portion.

IV. Remedial Actions

Remedy Selection

PAR Pond Reservoir

An IROD for PAR Pond (WSRC 1995) was issued in 1995 to address potential exposure to contaminated sediments that were exposed following water level drawdown of the PAR Pond reservoir as needed for repair of the PAR Pond dam. The interim remedial action objective (RAO) for the PAR Pond reservoir identified in the IROD (WSRC 1995) is as follows:

- Prevent exposure of the on-unit worker and ecological receptors to approximately 544 hectares (1,340 acres) of contaminated sediments that were exposed because of reservoir drawdown in the PAR Pond reservoir.

The selected interim remedy in the IROD was to refill and maintain the PAR Pond reservoir level to the original 60 m (200 ft) level following repair of the PAR Pond Dam. The following controls were identified in the IROD as part of that remedy:

- Engineering Controls – Controlled pumping to and discharge from PAR Pond to maintain the water level; and

- Institutional Controls – Existing SRS access controls.

This interim remedy was to prevent exposure of contaminated shoreline sediments until a National Environmental Protection Act evaluation could be conducted that would assess the environmental impacts from reduced flow to the Lower Three Runs Creek, fluctuating reservoir water levels, and the discontinuance of pumping river water into the reservoir (WSRC 1995). The EIS for the *Shutdown of the River Water System at the Savannah River*

Site (USDOE 1997) culminated in the selection of the No Action alternative. The EIS (USDOE 1997), issued in 1998, documented continued operation of the river water system using a 5,000 gallon per minute (gpm) pump allowing PAR Pond reservoir water levels to continue to fluctuate naturally between 58.5 and 60 m (195 and 200 ft) msl. Under severe drought conditions, and if necessary, the River Water System could be used to maintain PAR Pond water levels (USDOE 1998).

LTR IOU Tail Portion (Middle and Lower Subunits)

An ESD to the PAR Pond IROD was issued in 2012 to address potential exposure to cesium-137 contaminated sediments in middle and lower tail portions of the LTR IOU below the PAR Pond Dam (SRNS 2012a). The ESD did not alter the existing interim remedial action decision for the PAR Pond reservoir but provided additional LUCs to prevent exposure to contaminated sediments that had migrated to the Lower Three Runs Creek below the PAR Pond Dam. The RAO for the middle and lower tail portions of the LTR IOU is as follows:

- Prevent exposure of the adolescent trespasser to contaminated sediment/soil in the middle and lower tail portions of the LTR IOU (SRNS 2012a).

Remedial goals (RGs) for the onsite worker for sediment/soil media and recreational fisherman for fish tissue media are identified in Table K-2 (SRNS 2017). The most likely RGs presented are the starting point for developing remedial alternatives. Final RGs will be agreed upon by the Core Team concurrent with selection of a remedial action and will be documented in the Record of Decision (ROD).

Remedy Implementation

PAR Pond Reservoir

The selected interim remedy met the RAO for the PAR Pond reservoir by covering 544 hectares (1,340 acres) of exposed sediments with water by refilling the PAR Pond reservoir through:

- Forced refilling (i.e., pumping water) of PAR Pond. Pumping started on February 1, 1995 and ranged from 60,000 to 160,000 gpm as described in the IROD (WSRC 1995).

During the refill, 90 to 95% of the refilling occurred through the PAR Pond pump house and only 5 to 10% of the total water added went through the P Canal. Flow through the canal did not exceed 50,000 gpm. Resuspension of sediments was minimized. A minimum flow of 10 ft^3/s was maintained to Lower Three Runs Creek during the refill. During the refill, the 0.6-m (2-ft) per week level increase was maintained for dam stability and testing purposes. PAR Pond overflowed the spillway on March 15, 1995, indicating the water level had reached full pool. The refilling was considered complete with the topping of the spillway.

- Reconfiguring the PAR Pond pump house to its normal operating configuration following the refill of the PAR Pond reservoir to full pool.
- Establishing a pool level-monitoring program to maintain surface water elevation at a prescribed level, following the refill of the PAR Pond reservoir to full pool.
- Existing SRS site access controls, which are in already place, to prevent unauthorized entry to SRS and PAR Pond.

LTR IOU Tail Portion (Middle and Lower Subunits)

The selected interim remedy met the RAO for the LTR IOU Tail Portion (Middle and Lower Subunits) by implementing a TCRA for cesium-137 contaminated sediments in the middle and lower tail portions of the LTR IOU, which was initiated in June 2012, as described in the ESD (SRNS 2012a) (Figure K-5). This action consisted of:

- Excavating cesium-137 contaminated sediment/soil in the middle and lower subunits of the Lower Three Runs Creek and floodplain that exceed the 1E-04 risk (23.7 pCi/g) for the adolescent trespasser. Three transect areas were identified for excavation. Approximately 0.4 hectares (1 acres) of sediment/soil was excavated to a minimum of 0.3 m (1 ft) depth at each transect, which resulted in 1,613 yd^3 of sediment/soil transported to an approved disposal facility.
- Implementing LUCs upon completion of the TCRA to include approximately 11.2 km (7 mi) of additional fencing and warning signs at approximately 1,000 locations along the tail perimeter of the lower LTR IOU. This is to prevent inadvertent and unauthorized access to areas within this IOU where residual contamination remains.

System Operation and Maintenance

The following system operational requirements are ongoing:

- Pumping, when required, to maintain the PAR Pond reservoir at a minimum 58.5 +/- 0.3 m (195 +/- 1-ft) msl level. The specified water level is required for as long as the contaminated sediments pose an unacceptable risk to human health or the environment.

The following maintenance activities are ongoing:

- Monitoring water level in the PAR Pond reservoir to verify the level is within the range of 58.5 and 60 m (195 and 200 ft) msl;

- Annual inspection and maintenance of signs and fences in lower LTR IOU subunit at the four public road crossings started in fiscal year (FY) 2014. Every fifth year, inspections and maintenance of all other signs and fences will be performed in either the year preceding or the year of the Five-Year Remedy Review Report per the Early Action Land Use Control Implementation Plan (SRNS 2013); and

- LUCs are being enforced through the SRS Site Use/Site Clearance program and SRS site security to preclude unauthorized access.

The annual operation and maintenance (O&M) estimated cost associated with maintaining the water level in the PAR Pond reservoir was estimated in the IROD (WSRC 1995) to be $360,000. This O&M cost is not included with the estimated cost in Table K-3 because inspections and maintenance for the Site Cooling Water Distribution System that maintains water to PAR Pond and L Lake is absorbed by Site Infrastructure and not reported separately. The IROD estimated five-year review cost for PAR Pond is $3,036 every five years.

After the TCRA was completed for the middle and lower tail portions of the LTR IOU, annual O&M costs associated with the LUCs began in FY2013. The annual O&M costs for maintenance activities for access controls, clearing of vegetation, and inspection and maintenance of signs in the LTR IOU middle and tail portions are estimated to be

approximately $20,500. Every fifth year, the O&M costs for maintenance activities is $128,536 when the entire LTR Tail Portion is inspected and maintained. Table K-3 compares the actual O&M cost over the last four years to the estimated cost from the IROD. The estimated direct O&M cost from fiscal year (FY) 2015 to FY2018 is $190,036 as compared to the actual O&M cost of $62, 136 for the same period. The costs for maintaining the water level in PAR Pond was included in the estimated direct O&M costs. However, the actual costs do not include maintaining the water level in PAR Pond as this activity is conducted as part of Site Infrastructure maintenance.

V. Progress Since Last Review

This is the sixth five-year review for the PAR Pond. This is the third five-year review for the LTR IOU Tail Portion. The previous protectiveness statement concluded that because the remedial actions at PAR Pond and LTR IOU Tail Portions are protective, the site is protective of human health and the environment.

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 Review;
- Confirmed implementation of the TCRA;
- Inspected the LTR IOU Tail Portion signs and fences;
- Reviewed PAR Pond reservoir data;
- Inspected PAR Pond, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment K-1; and
- Reviewed changes in standard and to-be-considered guidance

Data Review

The interim action remedy of refilling and maintaining the PAR Pond reservoir level at a minimum of 58.5 m (195 ft) msl is effective at preventing exposure to contaminated

shoreline sediments. The periodic monitoring of pool levels indicate that the minimum pool level has not dropped below the minimum level required by the *Shutdown of the River Water System at the Savannah River Site* ROD (USDOE 1998). Water levels are measured twice weekly. A review of the data from January 2014 through October 1, 2018 indicates a pool level minimum of 60.6 m (198.74 ft) msl on August 17, 2015 and a pool level high of 61.1 m (200.32 ft) msl on January 23, 2017 (Figure K-6).

The TCRA and implementation of LUCs (i.e., signage and fencing) in the middle and lower tail portions of the LTR IOU was completed in August 2012. Inspections are conducted as discussed under System O&M (Section IV).

Summary of Inspections and Interviews

Interviews were conducted with James Wood, O&M staff member, on October 3, 2018 at the PAR Pond OU, and Richard Swygart, O&M Site Manager, on October 4, 2018 by phone. No issues were identified for the PAR Pond OU during these interviews. The LTR IOU Tail Portion was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on March 29, 2018. No issues were identified during this inspection.

The PAR Pond OU was inspected by SRNS EC&ACP and USDOE personnel on November 26, 2018. No issues were identified for the PAR Pond OU, including the LTR IOU Tail Portion (Middle and Lower Subunits), during the inspections and interviews.

A site inspection was conducted by South Carolina Department of Health and Environmental Control and U.S. Environmental Protection Agency (USEPA) personnel, accompanied by USDOE and SRNS personnel, on March 19, 2019 and April 25, 2019, respectively. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from 2015 through 2018 identified the presence of downed trees, overgrown vegetation near signs, and ant mounds. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy functioning as Intended by the Decision Document?

The selected remedies of refilling and maintaining the PAR Pond reservoir to a minimum water level of 58.5 m (195 ft) msl and LUCs for the LTR IOU Tail Portions are effective in preventing human health exposure to contaminated media and is functioning as intended.

The above remedial activities are meeting the RGs established for PAR Pond and the LTR IOU Tail Portions, as discussed in Section IV, by eliminating or controlling all routes of exposure potentially affecting human health.

The Land Use Control Implementation Plan for the LTR IOU Tail Portion governs implementation, maintenance, monitoring, reporting, and enforcement of LUCs (SRNS 2013). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restrictions to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the LTR IOU Tail Portions. Warning signs are in good condition, and no evidence of activities that would have violated the LUCs was observed. All LUC objectives are being met.

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. There have been no changes in standards or physical conditions of the PAR Pond unit 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 LTR IOU Tail Portions 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 these sites. None of the listed emerging contaminants were identified as applicable to these units.

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

While there are no issues related to current site conditions or activities that currently prevent the remedy from being protective, it should be recognized the actions at this unit are interim (PAR Pond) and include early removal actions (LTR IOU).

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The remedy at PAR Pond including the LTR IOU Tail Portion (Middle and Lower subunits) is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by maintaining a minimum water level in PAR Pond to cover contaminated sediments and by LUCs to prevent exposure to, or ingestion of, contaminated media. All threats to PAR Pond are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain PAR Pond for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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, 2012a. *Explanation of Significant Differences (ESD) for the Revision 0 Interim Action Record of Decision Remedial Alternative Selection: PAR Pond Unit(U) – Lower Three Runs Integrator Operable Unit Trail Portion (Middle and Lower Subunits) (U),* SRNS-RP-2012-00121, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012b. *Periodic Report 4 for the Lower Three Runs Integrator Operable Unit (U),* SRNS-RP-2011-01535, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2013. *Early Action Land Use Control Implementation Plan for the Lower Three Runs Integrator Operable Unit Tail Portion (U),* SRNS-RP-2013-00046, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2017. *Remedial Investigation/Baseline Risk Assessment for the Lower Three Runs Integrator Operable Unit (U),* SRNS-RP-2017-00139, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

USDOE, 1995. *Environmental Assessment for the Natural Fluctuation of Water Level in PAR Pond and Reduced Water Flow in Steel Creek below L-Lake at the Savannah River Site*, DOE/EA-1070, U.S. Department of Energy, Savannah River Operations Office, 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, 1997. *Final Environmental Impact Statement, Shutdown of the River Water System at the Savannah River Site, Aiken, South Carolina*, DOE/EIS-0268, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 1998. *Record of Decision, Shutdown of the River Water System at the Savannah River Site, Savannah River Operations Office, Aiken, South Carolina*, DOE/EIS-0268

(January 1998) 63 FR 4236, Filed 1-27-98, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 2009. *Revised Finding of No Significant Impact for the Natural Fluctuation of Water Level in Par Pond and Reduced Water Flow in Steel Creek below L Lake at the Savannah River Site*, January 2009, Department of Energy, Savannah River Operations Office, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist LTR Bridge Inspection (U)*, ER-IDS-019-040, Inspection periods 2015 through 2018

Various - *Inspection Data Sheets – Field Inspection Checklist LTR Tail Walkdown & Recon (U)*, ER-IDS-019-047, Inspection periods 2015 through 2018

WSRC, 1995. *Interim Action Record of Decision Remedial Alternative Selection for the PAR Pond Unit (685-G) (U)*, WSRC-RP-93-1549, 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, August 1999, latest update, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2007. *Lower Three Runs IOU Early Action Fact Sheet*, WSRC-RP-2007-4043, Washington Savannah River Company, Savannah River Site, Aiken, SC.

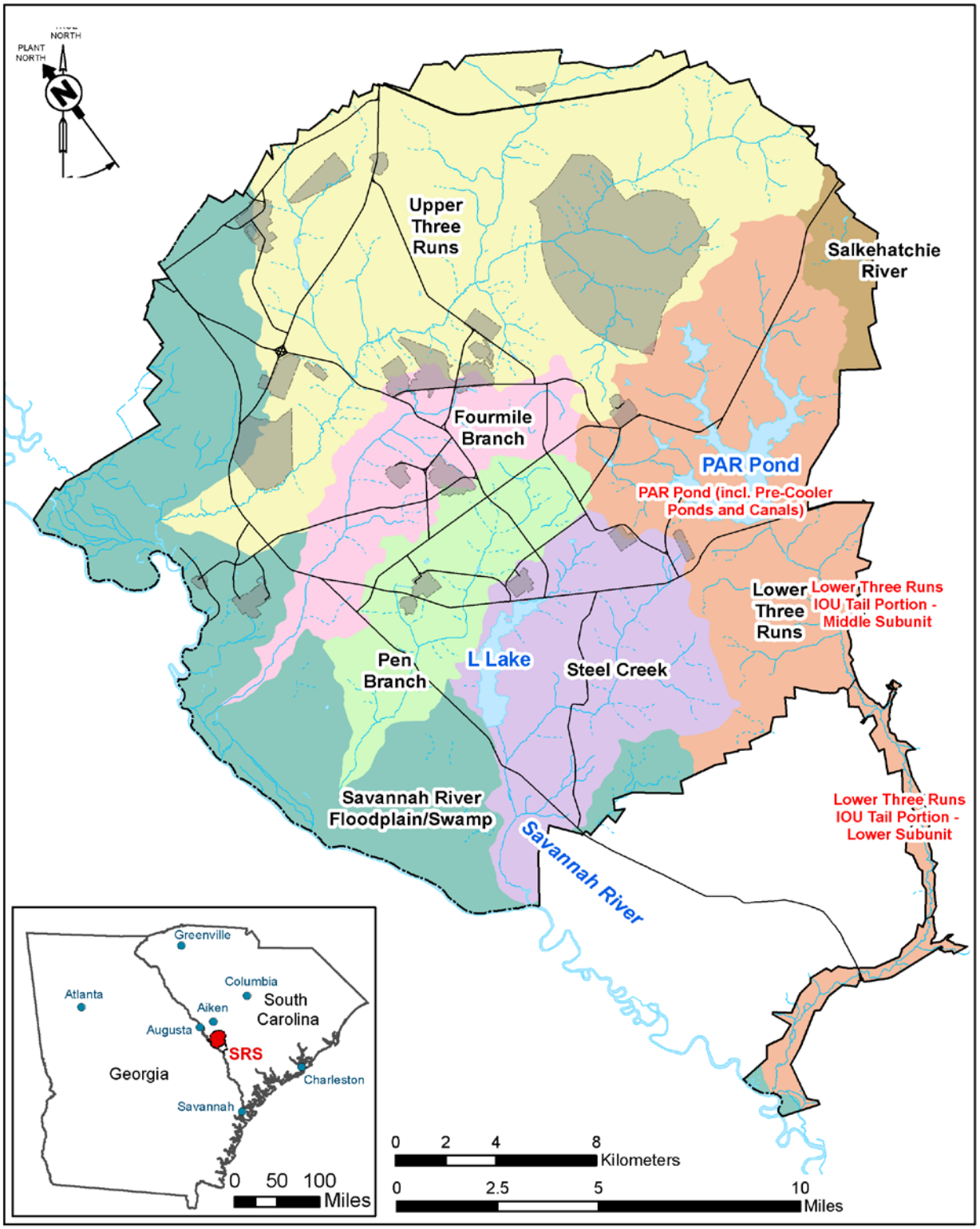


Figure K-1. Location of PAR Pond and Lower Three Runs IOU Tail Portion (Middle and Lower Subunits) at SRS

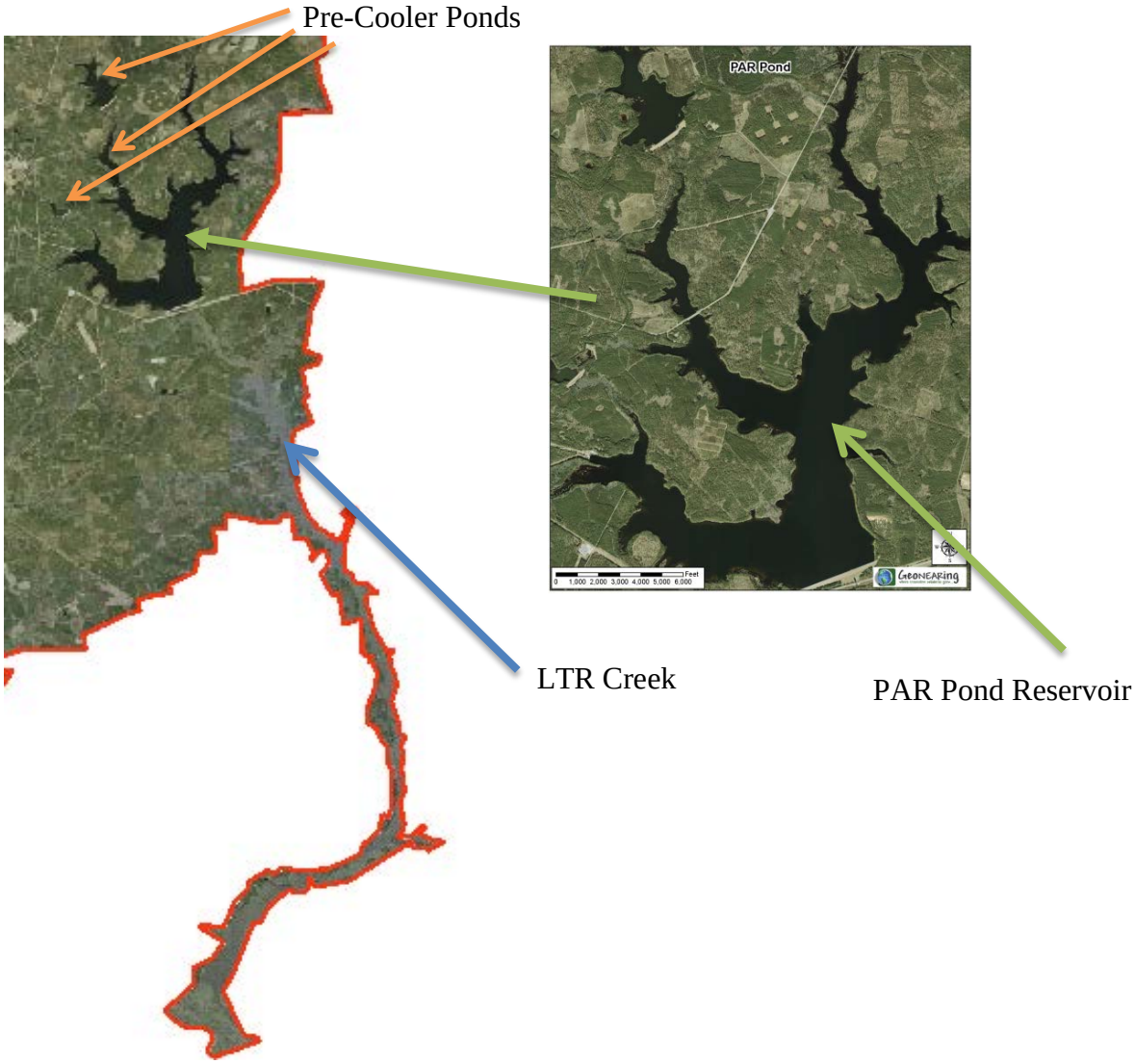


Figure K-2. Aerial Photos of the Lower Three Runs IOU (left) and of PAR Pond (right) (photos 2010)

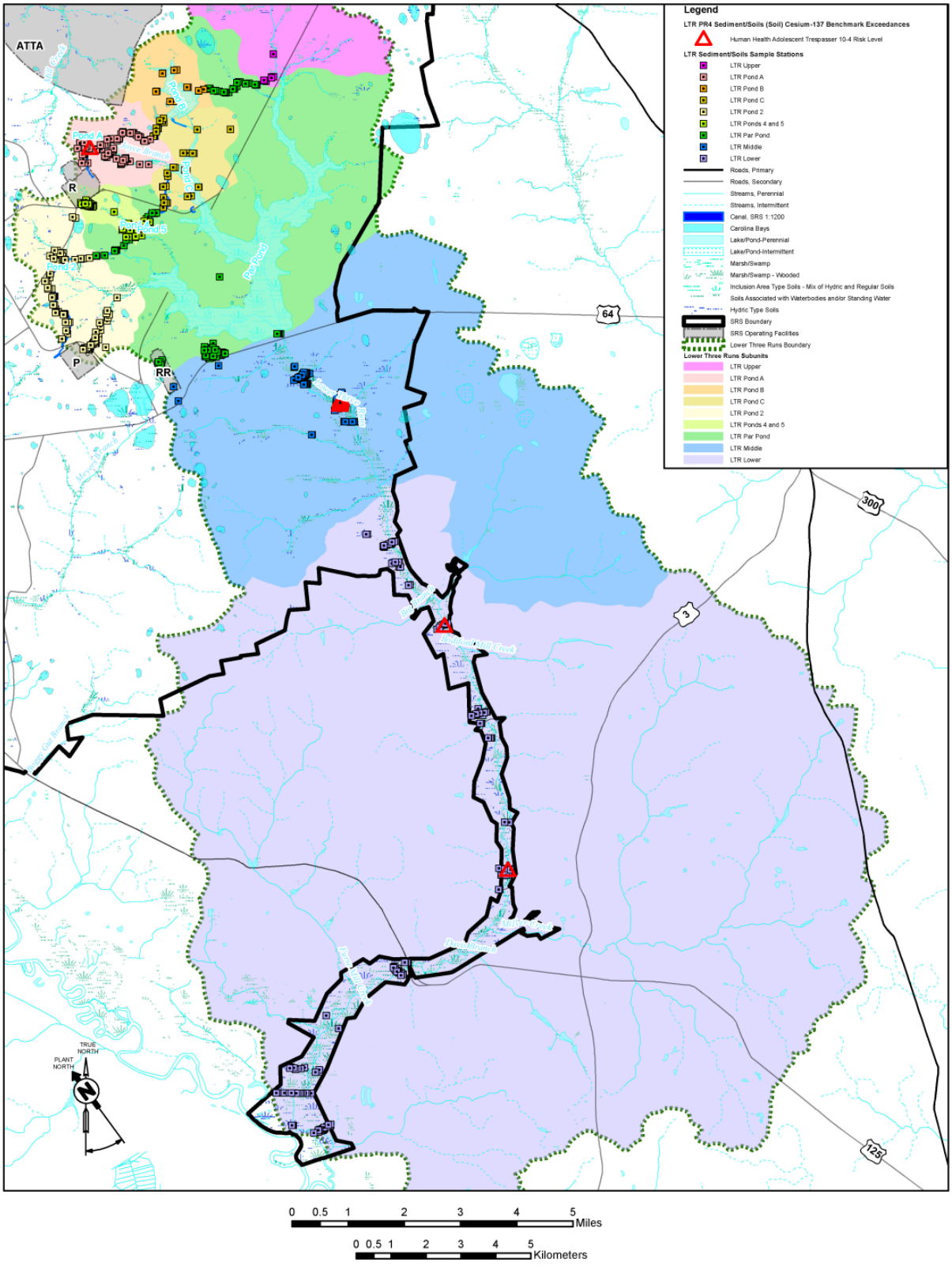


Figure K-3. Human Health Risk Exceedances (>1E-04) for Adolescent Trespasser for the LTR IOU Tail Portion

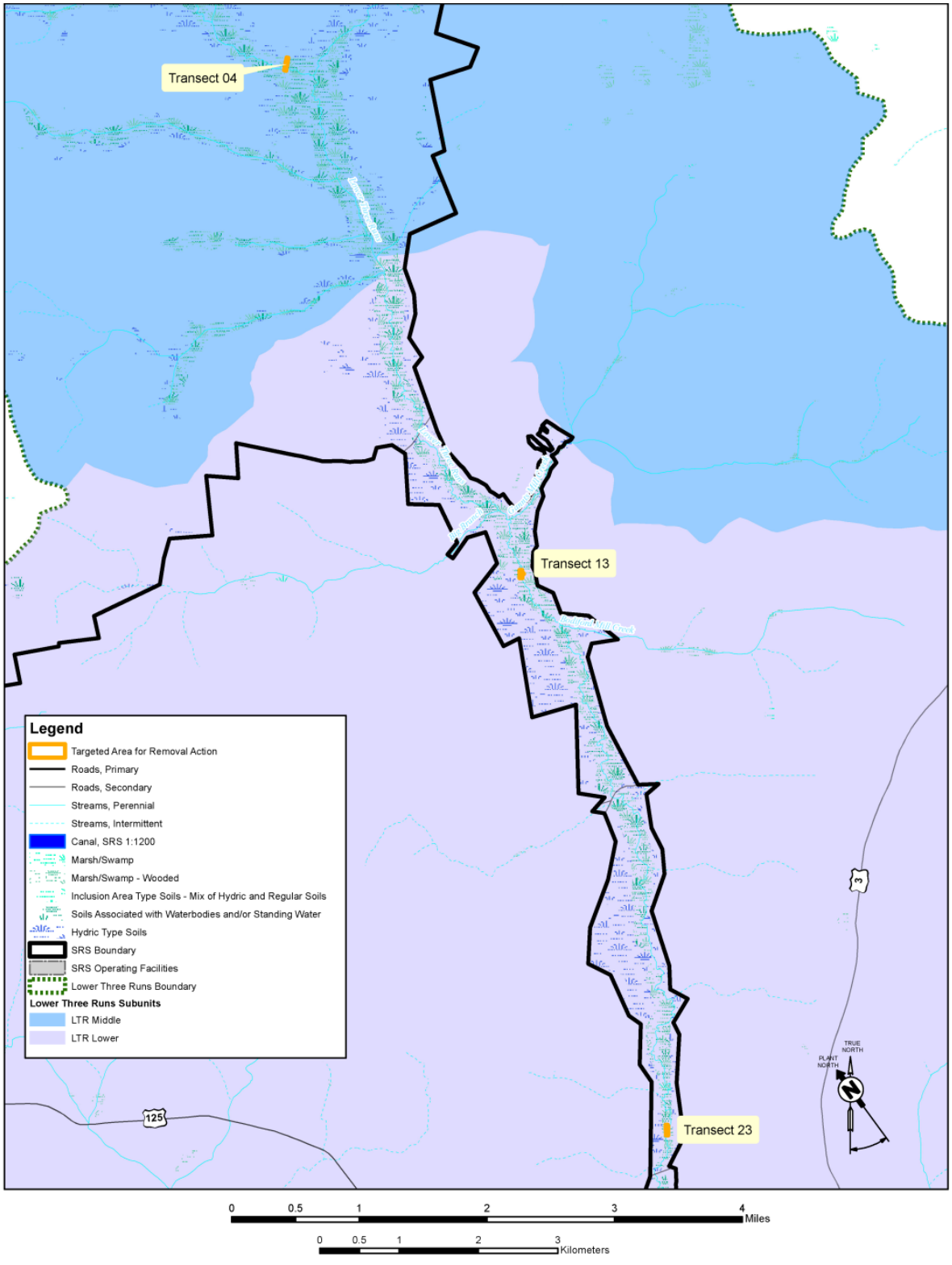


Figure K-4. **Targeted Areas for Time Critical Removal Action based on Adolescent Trespasser Scenario for Cesium-137 at the Lower Three Runs IOU Tail Portion**



Figure K-5. Photographs from the 2012 Time Critical Removal Action in Lower Three Runs IOU Tail Portion

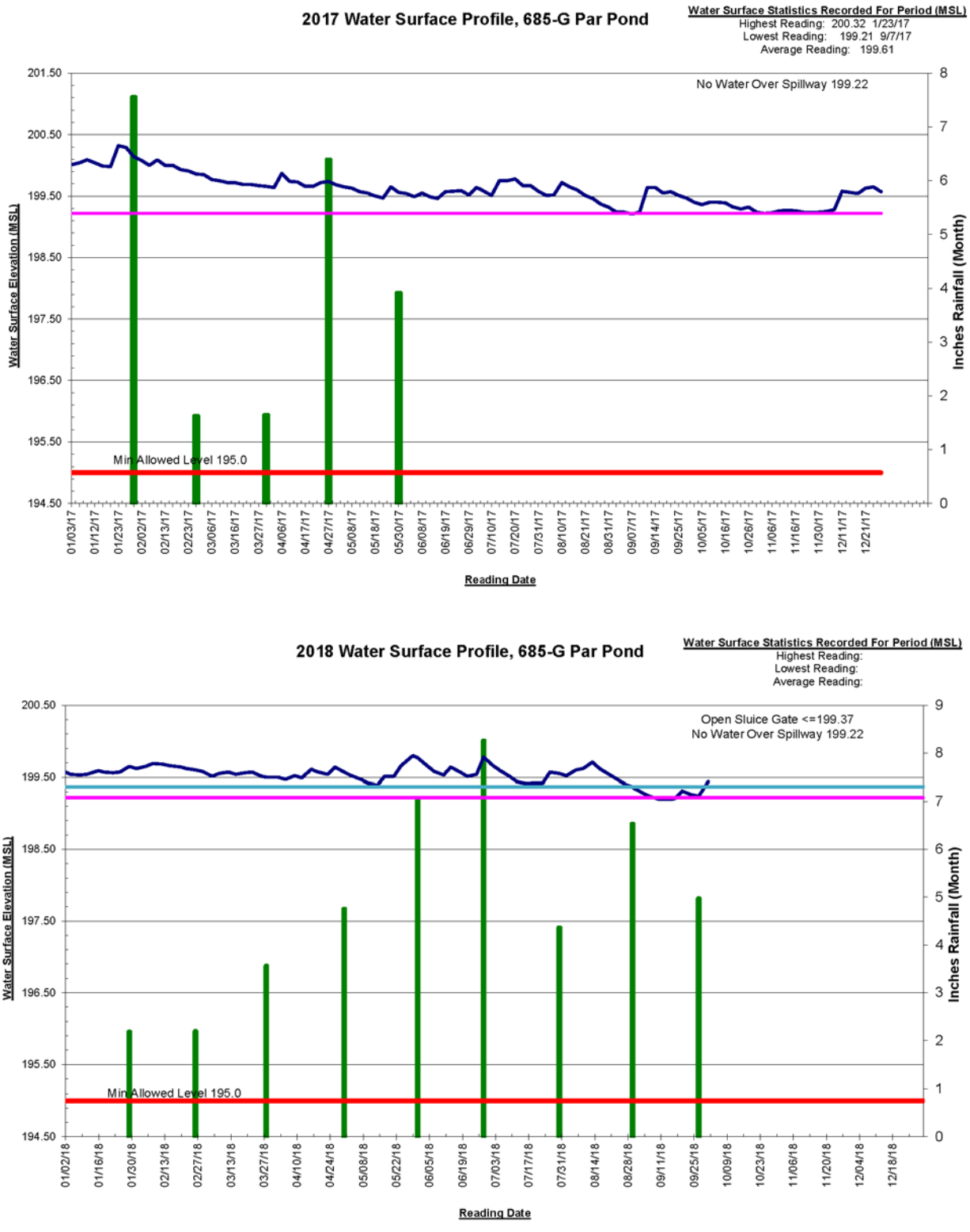


Figure K-6. PAR Pond Water Surface Profiles

Table K-1. Chronology of PAR Pond Unit Events

Event	Date
Interim ROD (IROD)- PAR Pond Issuance	February 16, 1995
Interim Remedial Action Start/Complete	February 1,1995 – March 15, 2001
ROD - Shutdown of River Water System	January 1998
Revised FONSI – PAR Pond	January 2009
ESD for Rev. 0 IROD PAR Pond	September 13, 2012
Previous Five-Year Reviews Issuance	August 27, 1997 / February 12, 2004 / January 28, 2009 / February 4, 2014 / November 30, 2015

Table K-2. Remedial Goals for Lower Three Runs*

Subunit	Refined COCs	Type of COC	RG	Basis
Sediment/Soil	Cesium-137 +D (ρCi/g)	HH	6.8E-01	HH – Onsite Worker
	Cobalt-60 (ρCi/g)	HH	8.32E-02	HH–Onsite Worker
Fish Tissue	Cesium-137 +D (ρCi/g)	HH	5.44E-02	HH – Recreational Fisherman
	Mercury (mg/kg)	HH	1.54E-01	HH – Recreational Fisherman

* RGs were not developed for PAR Pond (WSRC 1995). For LTR IOU, the most likely RGs were developed as the starting point for developing remedial alternatives. Final RGs will be agreed upon by the Core Team concurrent with selection of a remedial action and will be documented in the ROD (SRNS 2017).

Table K-3. O&M Costs – Actual versus Estimated

	FY2015	FY2016	FY2017	FY2018	4-Yr Total
Actual O&M Costs	$16,804	$7,987	$6,724	$30,621	$62,136
Estimated Direct O&M Costs*	$20,500	$20,500	$128,536	$20,500	$90,036

* Source of Estimate: The PAR Pond IROD (WSRC 1995) provides the present worth cost of $280,000 for five-year remedy reviews. To convert the value to yearly unit cost, the total present worth cost was divided by the present worth factor to reflect $3,036 ($18,217 unit cost/6 reviews) every five years for 30 years for remedy reviews. The value shown for FY2017 is for the remedy review and direct O&M costs. Note that O&M costs for maintaining the water level in PAR Pond are not shown in FY2015-FY2018 because this cost is absorbed by Site Infrastructure for maintenance of the Site Cooling Water Distribution System and not reported separately. In FY2015–FY2018, direct O&M costs of $20,500 for maintenance activities in the LTR IOU middle and tail portion were included.

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Attachment K-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and LTR IOU Tail Portion (Middle and Lower Subunits)

I. SITE INFORMATION			
Site Name:	**PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and LTR IOU Tail Portion (Middle and Lower Subunits)**	**Date of Inspection:**	**03/29/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #35**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**69°F and 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 Fill pond to maintain water level at 195 feet msl.

Attachments: ☐ Inspection team roster attached ☐ Sit e map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: Richard Swygart (Name) Infrastructure & Maintenance Engineer (Title) 10/04/2018 (Date)

Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-557-4695

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: James Wood (Name) Infrastructure & Maintenance Staff (Title) 10/03/2018 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-557-4615

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment K-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and LTR IOU Tail Portion (Middle and Lower Subunits) *(continued)*

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: Annual site inspections are performed per SRS procedure *Waste Unit Inspection and Maintenance* (ER-SOP-019), *Field Inspection Checklist for Integrator Operable Units, Inspection of LTR (4) Public Road Crossing* (ER-IDS-019-040), and *Field Inspection Checklist for Integrator Operable Units, Inspection of Tail Portion of LTR* (ER-IDS-019-047). Water-level measurements are taken twice a week and recorded. These are up to date and readily available.

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, *Hazardous Waste Operations*. A SSHASP is prepared if needed.

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 – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and LTR IOU Tail Portion (Middle and Lower Subunits) *(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.

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

Describe costs and reasons: N/A

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

A. Fencing

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

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A
Remarks: Signs at this site are in good condition.

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.) Field Walkdown
Frequency: Once in five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Brian Hennessey (Name) FFA Project Manager (Title) 11/26/18 (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 of decision document have been met: ☒ Yes ☐ No ☐ N/A
Violations have been reported: ☐ Yes ☐ No ☒ N/A
Problems/Suggestions: ☐ Report Attached

PAR Pond is in an Interim ROD and LUCs for PAR Pond are not currently applicable. The ESD for the removal action at the LTR IOU Tail Portion (Middle and Lower Subunits) did incorporate LUCs for the LTR IOU Tail Portion. The removal action implementation/construction was completed August 2012. The warning and no trespassing signs were installed in the LTR IOU Tail Portion as part of the action.

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks: PAR Pond: Survey wooden stakes were located. LTR IOU Tail: Signage is in good condition.

Attachment K-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and LTR IOU Tail Portion (Middle and Lower Subunits) *(continued/end)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

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:

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

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

B. Other Site Conditions: Scheduled annual site inspections conducted from 2015 through 2018 identified the presence of downed trees, overgrown vegetation near signs, and ant mounds. These findings were documented on the field inspection checklist and resolved soon after discovery.

Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

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

X. OTHER REMEDIES ☐ 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 PAR Pond is controlled pumping to and discharge from PAR Pond to maintain the water level at a minimum of 195 ft msl and institutional controls to prevent exposure to contaminants in sediments. The remedy for the LTR Tail Portion (Middle and Lower Subunits) is LUCs for the LTR IOU Tail Portion. 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.

The O&M procedures consisting of maintaining PAR Pond level at a minimum 195 ft msl and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities) have been implemented. The O&M procedures are adequately maintaining the pool level and the condition of the warning signs is good. The O&M procedures for inspection/maintenance of signs and access controls are adequately maintaining the LTR IOU Tail Portion 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

End of Checklist

R-AREA BINGHAM PUMP OUTAGE PITS (643-8G, 643-9G, AND 643-10G) AND R-AREA UNKNOWN PITS #1, #2, AND #3 OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOPs) and R-Area Unknown Pits #1, #2, #3 (RUNKs) Operable Unit (OU). The review was conducted from July 2018 through November 2018. Contaminants and waste have been left in place at the RBPOPs and RUNKs 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 RBPOPs and RUNKs 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 RBPOP and RUNK OU.

III. Background

The RBPOP and RUNK OU is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media associated with the RBPOPs and RUNKs OU is buried debris and associated contaminated soil. The U.S. Department of Energy (USDOE), U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) agreed in the Record of Decision (ROD) for the RBPOPs and RUNKs that groundwater at the OU will be evaluated separately in association with the R-Area Groundwater OU (WSRC 2002).

Physical Characteristics

The RBPOPs and RUNKs OU is located on the northeast side of R Area (Figure L-1). The OU consists of three pits referred to as the RBPOPs (643-8G, 643-9G, and 643-10G) and three pits with unknown or incomplete histories identified as the RUNKs (RUNK-1, RUNK-2, and RUNK-3) (Figure L-2). The pits were formed by excavating trenches to an

average depth of 3.9 m (13 ft), disposing of 2.7 m (9 ft) of debris, and then returning the unit to grade by covering the debris with 1.2 m (4 ft) of backfill. Pits 643-8G and 643-9G are approximately 75 m (250 ft) long, 4.8 m (16 ft) and 6 m (20 ft) wide, respectively, and up to 3.9 m (13 ft) deep. Pit 643-10G is approximately 156.6 m (522 ft) long, 5.7 m (19 ft) wide, and 4.2 m (14 ft) deep. RUNK-1 and RUNK-3 are approximately 31.5 m (105 ft) and 40.5 m (135 ft) long, respectively, 7.5 m (25 ft) wide, and up to 2.4 m (8 ft) deep. RUNK-2 is approximately 133.5 m (445 ft) long, 9 m (30 ft) wide, and up to 3.6 m (12 ft) deep. The sum of the areas for each pit is 0.37 hectares (0.9 acres); the area of a polygon around all the pits, including the areas between the pits, is 0.71 hectares (1.75 acres). The combined volume of the six pits is 10,710 m^3 (14,000 yd^3) (WSRC 2002).

Historical aerial photographs indicate RUNK-2 predates the RBPOPs. RUNK-2 was in existence as early as 1953 and closed in 1956. The RBPOPs were constructed during 1957 and 1958 when major modifications were made to primary and secondary SRS reactor cooling water systems. The outages of the cooling water systems that occurred because of these modifications became known as Bingham Pump Outages (WSRC 2002).

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* designates the RBPOPs and RUNKs OU as being within an industrial area (WSRC 1999). The future land use for the RBPOPs and RUNKs OU is reasonably anticipated to remain industrial with the USDOE maintaining control of the land.

History of Contamination

The RBPOPs were burial pits that received waste debris generated by major modifications to primary and secondary reactor cooling systems in 1957 and 1958. The waste consisted of miscellaneous construction materials such as pipes, cables, ladders, concrete, and miscellaneous hardware. Wastes were segregated based on levels of radioactivity. Lower

activity waste was buried in the RBPOPs and higher activity waste was sent to the SRS Burial Ground Complex in E Area.

RUNK-2 received construction debris based upon a magnetic survey, ground penetrating radar (GPR) surveys, and soil sampling in the pit. No debris has been identified in RUNK-1 and RUNK-3. It is possible that no debris was ever placed in these two RUNKs. A historical photograph indicates that liquid wastes were also introduced into RUNK-2, but no containerized liquids were discovered during characterization.

Initial Response

After the pits were filled in 1958, the debris was covered by 1.2 m (4 ft) of backfill as shown in Figure L-3 (WSRC 2003). The cover material was placed at a time preceding the preparation of the formal CERCLA documentation and investigation.

Investigations began at this OU in 1987 with a radiological survey of vegetation and continued in 1991 (radiological screening of surface soils), 1992 (soil gas survey), 1993 (GPR survey to delineate vertical boundaries of the pits) and 1995 (magnetic survey to identify magnetic debris) (WSRC 2001). Characterization of RBPOPs and RUNKs was performed starting in 1996 through a series of sampling events.

Basis for Taking Action

The unit investigation confirmed that miscellaneous debris remains buried in the unit. Soil contaminants, identified as refined constituents of concern (RCOCs) for the residential receptor, include polycyclic aromatic hydrocarbons (benzo[a]anthracene, benzo[b]fluor-anthene, benzo[a]pyrene, dibenzo[a,h]anthracene, and indeno[1,2,3-c,d]pyrene) and radionuclides (cobalt-60 and cesium-137). These contaminants are primarily in the RBPOPs and RUNK-2. Benzo(a)pyrene, benzo(a)anthracene, cobalt-60, and cesium-137 were RCOCs for the future industrial worker.

Table L-2 presents the soil RCOCs and remedial goals (RGs) for the future industrial worker based on a risk of 1E-06.

The RCOCs pose a carcinogenic risk of 5.24E-06 for the future industrial worker. The amount of unit-related contamination in the perimeter soils, if any, was minimal and not readily discernible from ambient background levels. There is no Resource Conservation and Recovery Act (RCRA) listed or characteristic wastes at the unit. The combined volume of the six pits, from land surface to the base of the pits, is 10,710 m^3 (14,000 yd^3) (WSRC 2002). There is no principal threat source material at the RBPOP and RUNK OU; the waste is categorized as a low-level threat.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 2002), the remedial action objective (RAO) for the RBPOPs and RUNKs OU is as follows:

- Prevent exposure of future industrial workers to benzo(a)pyrene, dibenzo(a,h)anthracene, cesium-137, and cobalt-60 at concentrations that exceed RGs.

As stated in the ROD, the selected remedial action for the RBPOPs and RUNKs OU is institutional controls (i.e., land use controls [LUCs]).

Remedy Implementation

Following waste disposal activities, the pits were covered with backfill to create native soil covers. The implementation of the selected remedy included the following:

- Establishing LUCs for 1.24 hectares (3.05 acres) including: 1) posting warning signs at appropriate locations in sufficient numbers to be seen from any approach; 2) requiring a SRS Site Use and Site Clearance Permit for any proposed use of land within the OU area, which is applicable to all activities and personnel on site; 3) maintaining the site access controls (24-hour surveillance system, artificial and natural barriers, control entry systems, and warning signs) in place at the SRS boundary to comply with the security requirements for a RCRA-permitted facility; and 4) in the long-term, if the property ever is transferred to non-federal ownership, the US

Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site (WSRC 2003).

Figure L-4 is a current photo (2018) of the RBPOP OU.

Systems Operations/Operations and Maintenance

There are no system operation requirements.

The following maintenance activities are ongoing as long as the waste remains a threat to human health or environment:

- Visual inspections are being performed annually for evidence of damage to the native soil cover due to erosion or intrusion by burrowing animals. The inspection also addresses upkeep of the vegetative cover and the warning signs.

- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.

- Institutional controls (i.e., LUCs) are being enforced to preclude unauthorized access or intrusive activities through the SRS Site Use and Site Clearance program and SRS site security (WSRC 2003).

Costs associated with the selected remedy for the RBPOPs and RUNKs OU includes operation and maintenance (O&M) costs of the site maintenance and institutional controls (i.e., LUCs). Table L-3 compares the actual O&M costs over the last four years to the estimated costs from the ROD. The ROD estimated direct O&M cost associated with the selected remedy is $3,500 each year and $15,000 for five-year remedy reviews every five years. The estimated direct O&M cost from fiscal year (FY) 2015 to FY2018 is $29,000 as compared to the actual O&M cost of $35,032 for the same period. The actual O&M costs over the last four years (Table L-3) are slightly higher than estimated costs primarily due to maintenance costs being underestimated. Additional maintenance activities

completed include addressing active ant mounds on the native soil cover and removing overgrown vegetation near the road and dead trees.

V. Progress Since Last Review

This is the fourth five-year remedy review for the RBPOPs and RUNKs OU. The previous protectiveness statement concluded that because the remedial action of LUCs is protective, the site is protective of human health and the environment.

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 the remedial action remains in place;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment L-1; 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 George Joyner, O&M Site Manager, on October 26, 2018 at the O&M organization offices. No issues were identified during these interviews. The RBPOPs and RUNKs OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Closure Projects (EC&ACP) on August 27, 2018. No issues were identified during this inspection.

The RBPOPs and RUNKs OU was inspected by SRNS EC&ACP and USDOE personnel on November 29, 2018. No issues were identified for the RBPOPs and RUNKs OU during the inspection.

A site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, on March 19, 2019. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from 2015 through 2018 identified the presence of dead trees near the native soil covers, overgrown vegetation near the road, and active ant mounds on the native soil covers. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy of LUCs for the RBPOPs and RUNKs OU is effective in preventing exposure of the future industrial workers to soil contaminants and is functioning as intended.

The above remedial activities are meeting the RGs established for the RBPOPs and RUNKs OU, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Land Use Control Implementation Plan for the RBPOPs and RUNKs OU is included as Appendix B of the Final Remediation Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2003). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restrictions to prevent unauthorized contact, removal or excavation of soils, and restrictions to prevent disturbance of the RBPOPs and RUNKs OU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. 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. There have been no changes in standards or physical

conditions of the RBPOPs and RUNKs 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 RCOCs at the RBOPs and RUNKs 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 these sites. None of the listed emerging contaminants were identified as applicable to these units.

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 at the RBPOPs and RUNKs OU from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to, or ingestion of, contaminated soil. All threats to the RBPOPs and RUNKs OU are being addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative

controls that maintain the RBPOPs and RUNKs OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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

Various - *Field Inspection Checklist: R-Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits 1, 2, & 3) (U)*, ER-IDS-019-026, Inspection Period 2015 through 2018 (annually)

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

WSRC, 2000. *Remedial Investigation Report with Baseline Risk Assessment for the R-Area Bingham Pump Outage Pits and the R-Area Unknowns (U)*, WSRC-RP-98-4106, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001. *Proposed Plan for the R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) and R-Area Unknown Pits #1, #2, #3 (RUNK-1, -2, -3) (U)*, WSRC-RP-2001-4128, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Record of Decision Remedial Alternative Selection for the R-Area Bingham Pump Outage Pits (643-8G, -9G, -10G) and R-Area Unknown Pits #1, #2, #3 (RUNK-1, -*

2, -3) (U), WSRC-RP-2001-4129, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Final Remediation Report (FRR) for the R-Area Bingham Pump Outage Pits (643-8G, -9G, -10G) and R-Area Unknown Pits #1, #2, #3 (RUNK 1, -2, -3) (U)*, WSRC-RP-2003-4061, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

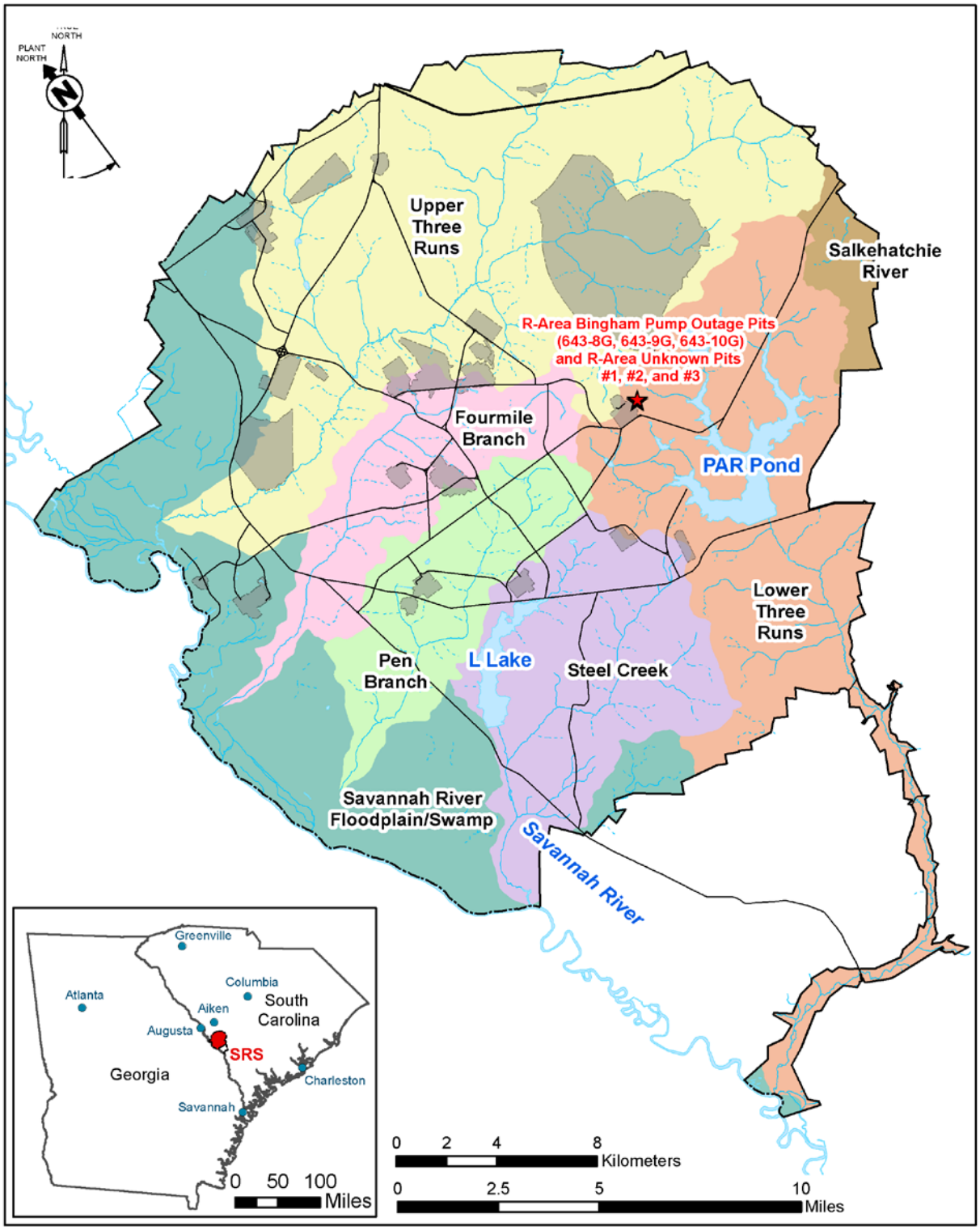


Figure L-1. Location of the RBPOPs and RUNKs Operable Unit at SRS

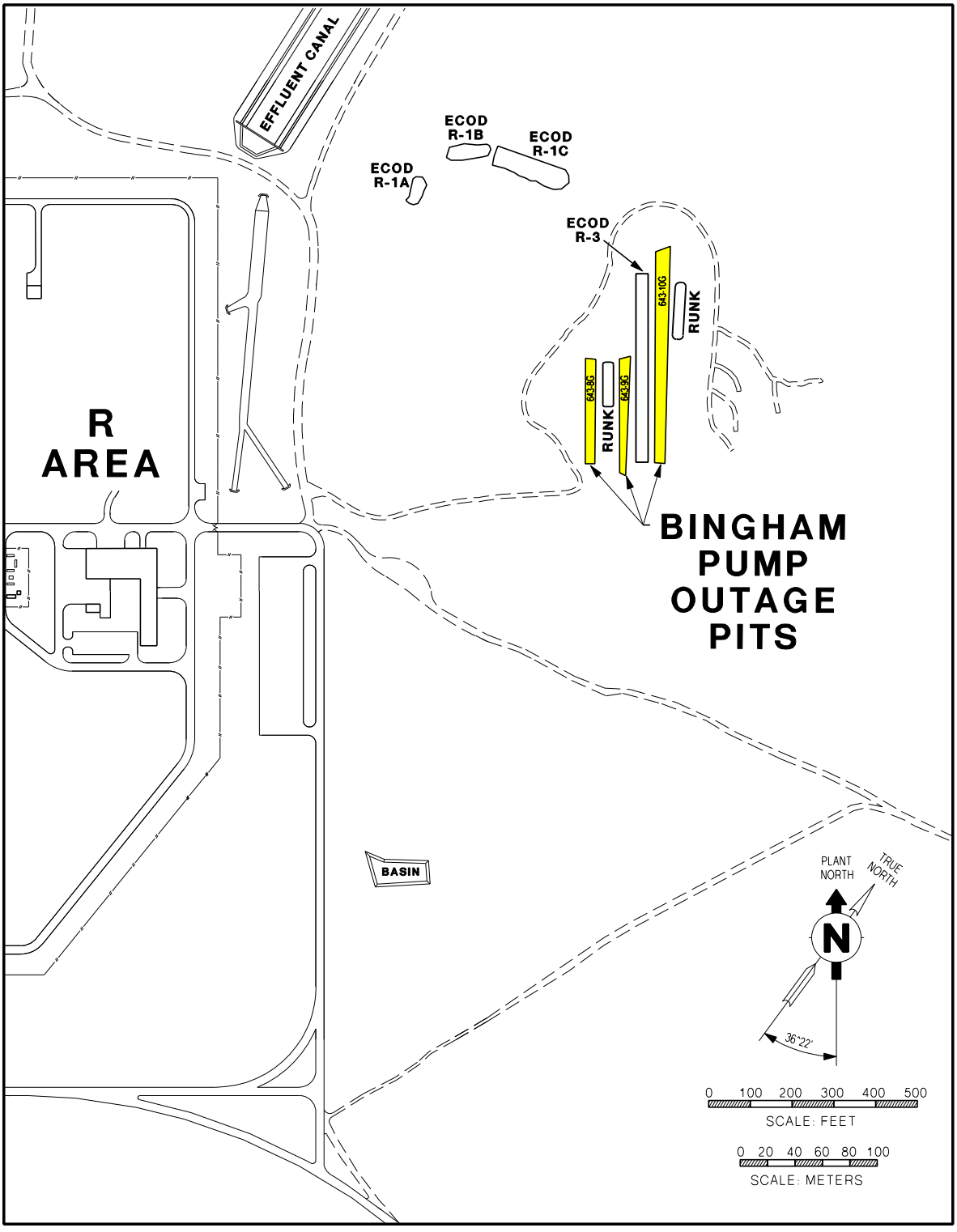


Figure L-2. Site Layout for RBPOPs and RUNKs Operable Unit



All six pits of the OU are in the center of the open grassy area behind the signs. The pits were backfilled to grade in the late 1950s and are not evident at the surface.

Figure L-3. Ground Level Photograph of the RBPOPs and RUNKs OU (approximately 2000)



Figure L-4. Photos of the RBPOPs and RUNKs OU (2018)

Table L-1. Chronology of OU Events

Event	Date
Remedial Investigation Start / Complete	June 26, 1996 / February 28, 2001
ROD Issuance	April 28, 2003
Remedial Action Start / Complete	April 16, 2003 / August 25, 2003
Previous Five-Year Review Issuance	January 28, 2009 / February 4, 2014 / November 30, 2015

Table L-2. RCOCs and RGs for RBPOP and RUNKS OU Soil

Subunit	RCOC	Type of COC	RGs	Basis
RBPOPs and RUNKs	*Polycyclic aromatic hydrocarbons (mg/kg)*			
	Benzo(a)pyrene	HH	2.56E-01	HH – Future Industrial Worker
	Dibenzo(a,h)anthracene	HH	2.56E-01	HH – Future Industrial Worker
	Radionuclides (ρCi/g)			
	Cesium-137	HH	1.12E-01	HH – Future Industrial Worker
	Cobalt-60	HH	2.24E-02	HH – Future Industrial Worker

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

	FY2015	FY2016	FY2017	FY2018	5-Year Total
Total Actual O&M Costs	$16,450	$7,562	$5,752	$5,268	$35,032
Total ROD Estimated Direct O&M Costs*	$3,500	$3,500	$18,500	$3,500	$29,000

* Source of Estimate: The ROD (WSRC 2002) provides the annual direct O&M cost as $3,500/year. The estimated remedy review cost of $15,000 every five years was included with the annual maintenance cost in FY2017.

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Attachment L-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G) (RBPOPs) and R-Area Unknown Pits #1, #2, and #3 (RUNKs) OU

I. SITE INFORMATION			
Site Name:	**R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G) (RBPOPs) and R-Area Unknown Pits #1, #2, and #3 (RUNKs) OU**	**Date of Inspection:**	**08/27/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #38**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**91°F and 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 _____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 10/26/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/26/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment L-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G) (RBPOPs) and R-Area Unknown Pits #1, #2, and #3 (RUNKs) OU *(continued)*

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: Annual site inspections are performed per SRS procedure, *Waste Unit Inspection and Maintenance* (ER-SOP-019), *Field Inspection Checklist for RBPOPs and RUNKs OU* (ER-IDS-019-026).

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, *Hazardous Waste Operations*. A SSHASP is prepared if needed.

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 – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G) (RBPOPs) and R-Area Unknown Pits #1, #2, and #3 (RUNKs) 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.

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

Describe costs and reasons: N/A

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 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.

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 five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Phil Prater (Name) DOE Program Manager (Title) 11/29/18 (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 of decision document 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:

Attachment L-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G) (RBPOPs) and R-Area Unknown Pits #1, #2, and #3 (RUNKs) OU *(continued/end)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
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:
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A
B. Other Site Conditions: Annual site inspections conducted from 2015 through 2018 identified the presence of dead trees near the native soil covers, overgrown vegetation near the road, and active ant mounds on the native soil covers. These findings were documented on the field inspection checklist and resolved soon after discovery.
Remarks: Site vegetation is mowed routinely.
VII. LANDFILL COVER/CONTAINMENT ☐ **Applicable** ☒ **N/A**
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
X. OTHER REMEDIES ☐ **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 remedial action for this OU is institutional controls (i.e., LUCs) to prevent human exposure to contaminants in soil. 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. The O&M procedures consisting of annual (2015-2018) site inspections (repair of 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 RBPOPs and RUNKs OU and the condition of 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

End of Checklist

SILVERTON ROAD WASTE UNIT (731-3A) OPERABLE UNIT

I. Introduction

This report is the sixth five-year review for the Silverton Road Waste Unit (731-3A) (SRWU) Operable Unit (OU). The review was conducted from July 2018 through November 2018. Contaminants have been left in place at the SRWU 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 SRWU OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table M-1 lists the chronology of site events for the SRWU OU.

III. Background

SRWU 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 the Savannah River Site (SRS) (FFA 1993). The media associated with the SRWU OU is soil.

Physical Characteristics

The SRWU OU is in the northwestern part of the SRS in Aiken County, approximately 2.4 km (1.5 mi) southwest of A/M Area (Figures M-1 and M-2). The SRWU OU is not located in or near an environmentally sensitive area and is unpopulated. The SRWU area is an irregular quadrilateral, which contains an unlined earthen depression dug into surficial soils. The area of waste disposal is within the orange ball markers and covers an area of approximately 180 m by 120 m (600 ft by 400 ft) with waste being buried to a maximum depth of approximately 4.8 m (16 ft) below ground surface (bgs). Therefore, the SRWU planar area is assumed to be 225 m by 180 m (750 ft by 600 ft). Using an average estimated depth of 1.8 m (6 ft) for the excavated area, the approximate waste volume of the SRWU is 76,500 m^3 (100,000 yd^3).

The SRWU is located on the southwestern flank of an inter-stream divide between Upper Three Runs Creek and the floodplain of the Savannah River. The ground surface elevation at the unit averages 105 m (350 ft) above mean sea level. The water table at the SRWU ranges from about 12 m (40 ft) bgs to the southwest to about 39 m (130 ft) bgs to the northeast.

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. Although the *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the SRWU OU as being outside of an industrial area, the future land use for the SRWU OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The SRWU was first used before the construction of SRS. Although there is no written record of when disposal began at the SRWU, or what materials were accepted, it is believed that the SRWU was originally a borrow pit used as an "open dump" by the local municipalities, including Old Ellenton, before the land was acquired by the federal government. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. The waste material at the dump was probably burned periodically, as was the practice at that time, for volume reduction. This practice would have eliminated many of the combustible organic materials while creating combustion byproducts.

After procurement by the federal government, the SRWU land continued to be used as an open dump (a legal practice at the time) by SRS. Historical and aerial photographs, presented in Figure M-3, show large piles of metal shavings (possibly aluminum), 55-gallon drums, cardboard drums, tires, lumber, wooden pallets, cardboard, construction debris, tanks, possibly asbestos, and other unidentified metal and wood objects. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased. The estimated volume of waste is 76,500 m^3 (100,000 yd^3) (WSRC 1997).

Initial Response

After operations ceased, the area was bulldozed, graded, covered with native soil, and planted with grasses. The cover material was placed prior to the CERCLA investigation and preparation of the formal CERCLA documentation.

SRWU OU was designated as an excavated area (filled). Soil borings were conducted in 1993 to identify the extent of waste buried beyond the excavated area. Since characterization data indicated contamination of the surface soils, the entire area within the orange balls is included in the SRWU OU.

Basis for Taking Action

Nonradiological contaminants and cesium-137 were present in soil that exceeded a 1E-06 risk for future human receptors. Low levels of contaminants were detected in the M-Area groundwater aquifer, which minimally and infrequently exceeded maximum contaminant levels (MCLs). SRWU OU was probably not the source of contamination in the M-Area groundwater aquifer. The basis for taking a remedial action at the SRWU OU was due to potential exposure of future occupational workers and residents to contaminants in groundwater exceeding MCLs, and contaminants in soils above 1E-06 risk levels (WSRC 1996a and WSRC 1996b). The presence of contamination in surface soil prohibits this waste unit for residential use (i.e., unrestricted land use) (WSRC 1997).

The constituents of concern (COCs) and remedial goals (RGs) for future receptors were identified in the SRWU OU Record of Decision (ROD) (WSRC 1997). The RG values based on a 1E-06 risk to future occupational workers are shown in Table M-2. Although RGs for groundwater were presented in the ROD, the groundwater in the lower aquifers is addressed separately as part of the RCRA Permit Renewal for the M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities Western Sector Corrective Action Program.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 1997), the remedial action objectives (RAOs) developed for the SRWU OU are as follows:

- For the future on-unit resident (adult/child and child): Prevent ingestion of soil and produce, and dermal contact with soil from arsenic, benzo(a)pyrene, dibenzo(a,h) anthracene, and benzo(b)fluoranthene; and
- For the future on-unit resident (adult/child and child) and occupational worker: Prevent ingestion, dermal contact, and inhalation of groundwater from constituents with concentrations that minimally and infrequently exceed MCLs.

The preferred alternative for the SRWU OU consisted of institutional controls (i.e., land use controls [LUCs]) with groundwater monitoring (WSRC 1997). The confirmatory groundwater monitoring program was established in 1998 to ensure that chosen remedy was appropriate for this OU. Sampling was conducted semiannually. The groundwater monitoring program was discontinued in 2003 after no COCs were detected above MCLs between 2000 and 2003. Per the Explanation of Significant Difference (ESD) (WSRC 2005), the groundwater monitoring program was discontinued in 2003.

A 2018 photograph of the SRWU OU is provided in Figure M-4.

Remedy Implementation

Following waste disposal activities, the pit was covered with native soil and graded to create a native soil cover. Implementation of the SRWU OU remedial action included:

- Installation of two new and one replacement groundwater monitoring wells;
- Posting of four warning signs; and
- Establishment of LUCs for 2.2 hectares (5.5 acres) to include: 1) use of existing SRS access controls to maintain the use of this site for industrial use only; 2) in the long-term if the property ever is transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner, which would include information

needed for compliance with Section 120(h) of CERCLA, and would prepare, certify, and record a survey plat of the area.

System Operations/Operations & Maintenance

There are no system operational requirements.

The following maintenance activity has been discontinued:

- Confirmatory groundwater-monitoring program.

The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (repair of erosion damage, maintenance of native soil cover, mowing, and warning signs); and
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU).

The operation and maintenance (O&M) costs associated with the selected remedy for the SRWU OU includes the annual inspections and institutional controls (i.e., LUCs). Table M-3 compares the actual O&M costs over the last four years to the estimated costs for the SRWU OU. The ROD estimated O&M cost associated with the selected remedy are $500 annually for maintenance and inspections and $3,000 every five years for remedy reviews. The estimated direct O&M cost from fiscal year (FY) 2015 to FY2018 is $5,000 as compared to the actual O&M cost of $55,764 for the same period. The actual O&M costs (Table M-3) over the last four years are higher than the estimated O&M costs because five-year remedy reviews, inspection, and maintenance costs were underestimated.

V. Progress Since Last Review

This is the sixth five-year review for the SRWU OU. The previous protectiveness statement concluded that because the remedial action of LUCs is protective, the site is protective of the human health and the environment.

The original remedy has been modified through an ESD (WSRC 2005) to discontinue the confirmatory groundwater monitoring program. An evaluation of the groundwater monitoring program has indicated that the monitoring is no longer required as the RGs for

groundwater have been reached. Per the ESD, the groundwater portion of the OU will not be included in the five-year review (WSRC 2005). The institutional controls (i.e., LUCs), included in the original remedy, will still be required for the SRWU OU soils.

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 implemented remedial action is being maintained;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment M-1; 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 George Joyner, O&M Site Manager, on October 16, 2018 at the O&M organization offices. No issues were identified for the SRWU OU during these interviews. The SRWU OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on August 22, 2018. No issues were identified during this inspection.

The SRWU OU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2018. No issues were identified for the SRWU OU during the inspection.

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 March 19, 2019. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from 2015 through 2018 identified the presence of dead trees near the native soil cover, overgrown vegetation, and active ant

mounds on the native soil covers. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy of institutional controls (i.e., LUCs) is effective in preventing ingestion, inhalation and dermal contact with contaminants and is functioning as intended.

The above remedial activities are meeting the RGs established for the SRWU OU, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Land Use Control Implementation Plan for SRWU OU is discussed in Section 2.0 of the Final Remediation Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 1998). The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), use restrictions to prevent unauthorized contact, removal or excavation of soils, and restrictions to prevent disturbance of the SRWU OU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs 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 standards or physical conditions of the SRWU 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 the COCs at the SRWU 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 these sites. None of the listed emerging contaminants were identified as applicable to these units.

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 currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by the institutional controls (i.e., LUCs). All threats at the SRWU OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the SRWU OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, the next five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for January 2025.

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

Various – Inspection Data Sheets - *Field Inspection Checklists for the Silverton Road Waste Unit (731-3A)*, ER-IDS-019-001, Inspection Period 2015 through 2018

WSRC, 1996a. *Final Baseline Risk Assessment for the Silverton Road Waste Unit (U*), WSRC-RP-95-215, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996b. *Final RFI/RI Report for the Silverton Road Waste Unit (U)*, WSRC-RP-95-214, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996c. *Corrective Measures Study/Feasibility Study for the Silverton Road Waste Unit (U)*, WSRC-RP-96-100, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997. *Record of Decision Remedial Alternative Selection for the Silverton Road Waste Unit (731-3A) (U)*, WSRC-RP-96-171, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998. *Final Remediation Report for the Silverton Road Waste Unit (731-3A) (U)*, WSRC-RP-97-153, 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, August 1999, latest update, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2005. *Explanation of Significant Difference (ESD) to the Revision 1 Record of Decision Remedial Alternative Selection for the Silverton Road Waste Unit (731-3A) (U)*, WSRC-RP-2004-4092, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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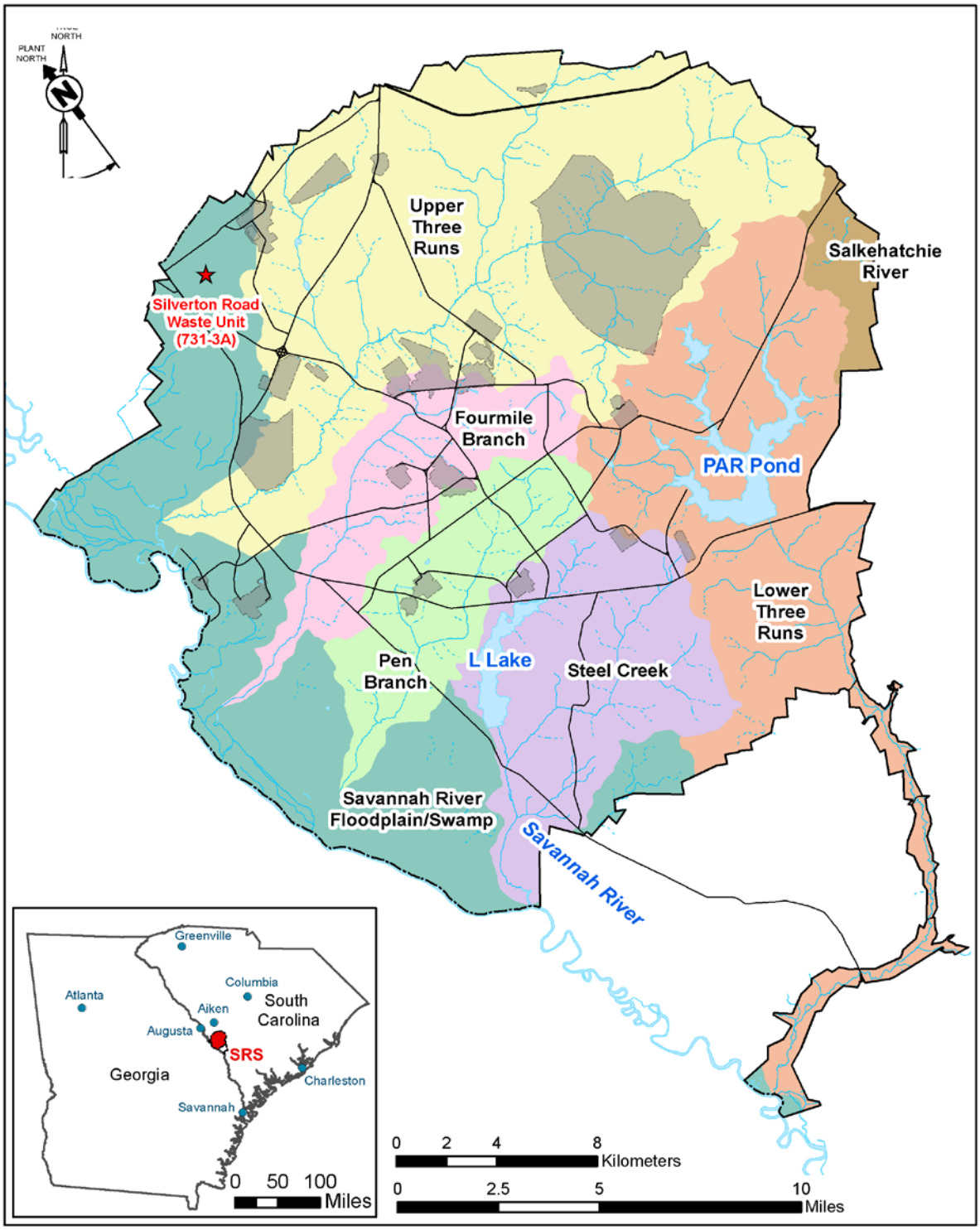


Figure M-1. Location of the Silverton Road Waste Unit OU at SRS

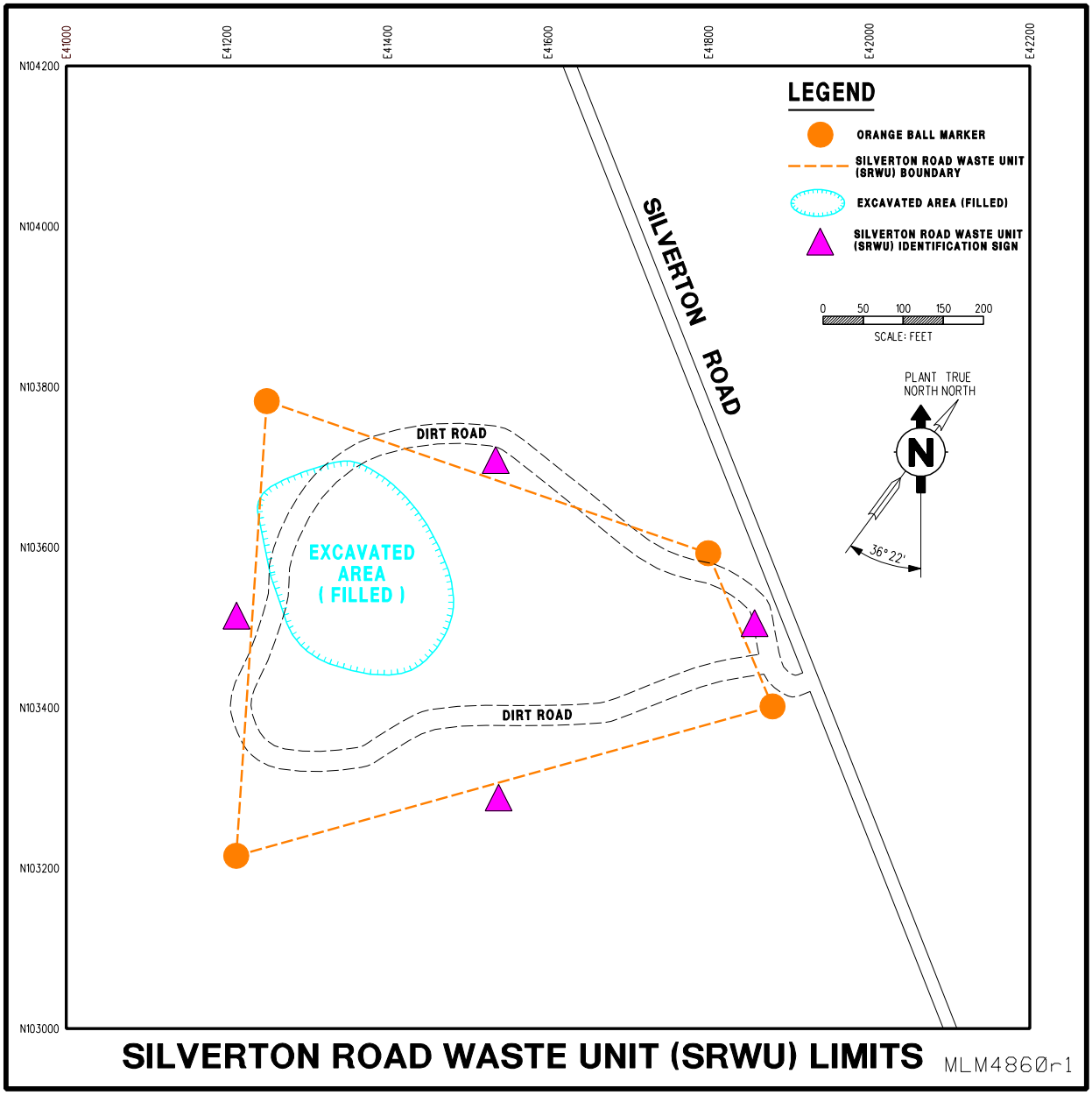


Figure M-2. Layout of the Silverton Road Waste Unit OU



Figure M-3. Silverton Road Waste Unit OU Aerial Photos before Remediation (Left Photo is Western Sector and Right Photo is Eastern Sector) (Approximately 1995)



Figure M-4. Photo of the Silverton Road Waste Unit OU (2018)

Table M-1. Chronology of OU Events

Event	Date
RCRA Facility Investigation/Remedial Investigation Field Start / Complete	1993 / August 21, 1996
ROD Issuance	July 3, 1997
Remedial Action Start/Complete	July 7, 1998/ September 9, 1998
Approval to Shutdown Groundwater Monitoring received	June 17, 2003
ESD to the ROD Issuance	June 16, 2005
Previous Five-Year Review Issuance	August 27, 1997 / February 12, 2004 / January 28, 2009 / February 4, 2014 / November 30, 2015

Table M-2. RCOCs for Silverton Road Waste Unit OU

Subunit	RCOC	Type of COC	RG	Units
Soil	Arsenic (mg/kg)	HH	3.8E+00	HH – Future Industrial Worker
	Benzo(a)pyrene (mg/kg)	HH	7.8E-01	HH – Future Industrial Worker
	Dibenzo(a,h)anthracene (mg/kg)	HH	7.8E-01	HH – Future Industrial Worker
	Cesium-137 (ρCi/g)	HH	8.3E-02	HH – Future Industrial Worker

COC – constituent of concern
HH – human health
RCOC – refined COC
RG – remedial goal

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

	FY2015	FY2016	FY2017	FY2018	5-Year Total
Actual O&M Csts	$22,108	$14,234	$10,973	$8,449	$55,764
Estimated Direct O&M Costs*	$500	$500	$3,500	$500	$5,000

* Source of Estimate: The ROD (WSRC 1997) provides a total present worth O&M cost for the selected remedy as $18,060. The Corrective Measures Study/Feasibility Study (WSRC 1996c) provided the details of the unit cost as $500/year for inspections and maintenance and $3,000 every 5 years for remedy reviews. The estimated remedy review cost was included with the annual maintenance cost in FY2017.

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Attachment M-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit

I. SITE INFORMATION			
Site Name:	**Silverton Road Waste Unit (731-3A) Operable Unit**	**Date of Inspection:**	**08/22/2018**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #13**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**80°F and 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 _____

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 10/16/2018 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/16/2018 (Date)

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

Problems/Suggestions: ☐ Report Attached _____

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: N/A

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

Attachment M-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit

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: Annual site inspections are performed per SRS procedures *Waste Unit Inspection and Maintenance* (ER-SOP-019), *Field Inspection Checklist for Silverton Road (731-3A)* (ER-IDS-019-001).

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 Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, *Hazardous Waste Operations*. A SSHASP is prepared if needed.

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: Groundwater monitoring ceased in 2003.

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 M-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) 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.

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

Describe costs and reasons: N/A

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 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.

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 five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Karen Adams (Name) | Federal Project Director (Title) | 12/03/2018 (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 of decision document 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:

Attachment M-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
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:
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A
B. Other Site Conditions: Annual site inspections conducted from 2015 through 2018 identified the presence of dead trees near the native soil cover, overgrown vegetation, and active ant mounds on the native soil covers. These findings were documented on the field inspection checklist and resolved soon after discovery.
Remarks: Site vegetation is mowed routinely.
VII. LANDFILL COVER/CONTAINMENT ☐ **Applicable** ☒ **N/A**
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
X. OTHER REMEDIES ☐ **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 (ceased in 2003) to prevent human exposure to contaminated media. 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. The O&M procedures consisting of annual (2015-2018) site inspections (repair of 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 SRWU OU and the condition of 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

End of Checklist