

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

**Aiken, South Carolina**

**SEMS Number: 00**

**SRNS-RP-2023-00715**

**Revision 01 Redline**

**~~December 2023~~ June 2024**

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**Printed in the United States of America**

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

Seventh Five-Year Remedy Review Report for SRS OUs  
with Native Soils Covers and/or LUCs (U)  
Savannah River Site  
~~December 2023~~June 2024

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ARF-024588  
SRNS-RP-2023-00715  
Rev. 01 Redline

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LIST OF ACRONYMS AND ABBREVIATIONS (*continued*)

LLWF	Low-Level Waste Facility
LRSB	L-Area Reactor Seepage Basin
LTR IOU	Lower Three Runs Integrator Operable Unit
LUC	land use control
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan
m	meter
m <sup>3</sup>	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 <sup>2</sup>	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
<u>MNR</u>	<u>monitored natural recovery</u>
mR/hr	milliRoentgen-equivalent-man (REM) per hour
MWMF	Mixed Waste Management Facility
MZ	mixing zone
N/A	not applicable
NARA	North Ash Remediation Area (Wetland Area at Dunbarton Bay)
NBN	no building number
NC	not calculated
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
<u>NDMA</u>	<u>N-nitroso-dimethylamine</u>
<u>NEPA</u>	<u>National Environmental Protection Act</u>
NPL	National Priorities List
NRDC	National Resource Defense Council
NTCR	non-time critical removal
NTSB	New TNX Seepage Basin (904-102G)
O&M	operation and maintenance
OFASB	Old F-Area Seepage Basin
OU	operable unit
PAB	P-Area Ash Basin (181-P)
PAH	polycyclic aromatic hydrocarbon
PAOU	P-Area Operable Unit
PAR Pond	P-Area and R-Area Pond (685-G)
PBDE	Polybrominated diphenyl ethers

LIST OF ACRONYMS AND ABBREVIATIONS (*continued*)

PBPOP	P-Area Bingham Pump Outage Pit (643-4G)
PBRP	P-Area Burning/Rubble Pit
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
ρCi/g	picoCuries per gram
ρCi/mL	picoCuries per milliliter
ρCi/L	picoCuries per liter
<u>PDBE</u>	<u>polybrominated diphenyl ethers</u>
PFOS	<u>Polyfluoroalkyl substances</u> perfluorooctane sulfonic acid
<u>PFAS</u>	<u>Per- and Polyfluoroalkyl substances</u>
p,p'-DDD	p,p'- dichlorodiphenyldichloroethane
p,p'-DDT	p,p'- dichlorodiphenyltrichloroethane
PRG	Preliminary Remediation Goal
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
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RFI	RCRA Facility Investigation
RG	remedial goal
RI	Remedial Investigation
ROD	Record of Decision
RRSB	R-Area Reactor Seepage Basins
RSL	regional screening level
RUNK	R-Area Unknown Pits
<u>RWS</u>	<u>River Water System</u>
S/S	stabilization/solidification
SARA	South Ash Remediation Area (Wetland Area at Dunbarton Bay)
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHEC	South Carolina Department of Health and Environmental Control
<u>SCDES</u>	<u>South Carolina Department of Environmental Services</u>
SE	secular equilibrium
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

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

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
<u>TCP</u>	<u>1,2,3-trichloropropane</u>
TCR	total cumulative risk
TCRA	time critical removal action
TNT	2,4,6-Trinitrotoluene
TNX GW	TNX Groundwater
UU/UE	unlimited use and unrestricted exposure
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
USFS-SR	U.S. Department of Agriculture Forest Service – Savannah River
VOC	volatile organic compound
WADB	Wetlands Area at Dunbarton Bay
WSRC	Washington Savannah River Company
WSRC	Westinghouse Savannah River Company
yd <sup>3</sup>	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 residual 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 residual 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 seventh 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)<sup>1</sup>, and the USDOE recognized that remedial

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<sup>1</sup> Effective July 1, 2024, the South Carolina Department of Health and Environmental Control (SCDHEC) became known as the South Carolina Department of Environmental Services.

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 Sixth Five-Remedy Review was issued in December 2023 (SRNS 2019, SRNS 2020b, SRNS 2021, SRNS 2022b, SRNS 2023).

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

- (1) Native Soil Covers and/or 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 the Seventh Five-Year Remedy Review Report is due no later than ~~January 21, 2029~~ December 31, 2028. A more detailed discussion of the phased reviews and transition schedule are provided in Appendix A.

This report documents the Seventh Five-Year Remedy Review for the first OU grouping, OUs with native soil covers and/or LUCs selected as the final remedy and includes a review of remedy decision documents for fourteen 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 July 2023 through December 2023.

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 N.

### **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 N).

## **Background**

The SRS was constructed during the 1950s to produce 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,

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 cleanup levels 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. The environmental database is not available to the public directly. However, the information retained in the database is provided in regulatory documents that are submitted to USEPA and SCDHEC for review and approval and are available to the public in the SRS Administrative Record File. 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.

### **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.

Based on remedial investigations and technical evaluations, the OUs addressed in this remedy review have hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. They are reviewed every five years to ensure protection of human health and the environment. The specific contaminants and remedial actions for each OU are described in greater detail in the OU-specific appendices (Appendix C through Appendix N).

## Remedial Actions

Remedial actions may target source areas, soil, vadose zone, and/or groundwater. Cleanup levels, formerly referred to as remedial goals in SRS decision documents, 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)/cleanup levels.
- Prevent or minimize the discharge of contaminated groundwater to surface water at levels that exceed MCLs/cleanup levels.

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.
- Maintain the integrity of the cover systems.

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

- Published an announcement on November 2, 2023 that the USDOE is conducting the Seventh 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, which is updated in July, 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 and documentation (i.e., 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 N;
- 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 N;
- 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 V (Technical Assessment), Section VI (Issues/Recommendations) of the OU-specific appendices; and

- Submitted a draft Fact Sheet to USEPA and SCDHEC for review with Revision 0 of the Seventh 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, if necessary, 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 (postal service and email) to the SRS mailing list. The SRS mailing list consists of DOE and SRS contractor personnel, SRS Citizens Advisory Board, members of the public surrounding SRS, community leaders and organizations, etc. The report and Fact Sheet will be posted on the SRS external webpage and will be made available to the public at the four information repositories listed in the *Environmental Bulletin*.

### **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.

The Revision 0 report ~~will be~~ was submitted ~~by on~~ on December 21, 2023. USEPA and SCDHEC ~~are expected to~~ performed site inspections of OUs with native soil covers and/or LUCs ~~prior to submittal of the Revision 1 of this document on~~ February 28, 2024. No problems regarding protection of the remedies for the OUs were identified during the inspections.

## 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 N) 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 2018 to the current 2023 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 Seventh 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 t~~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. Therefore, the remedy will be protective of human health and the environment upon completion. In the interim, remedial activities completed to date (i.e., LUCs) have adequately addressed all exposure pathways that could present unacceptable risks in these areas.

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 with native soil covers and/or LUCs 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~~ will 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~~ are adequately addressed by the LUCs that 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 N.

## 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 residual 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 Eighth Five-Year Remedy Review Report is due no later than ~~January 21, 2034~~ December 31, 2033.

## 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 N.

## 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

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: U.S. Department of Energy		
Author name (Federal or State Project Manager): N/A		
Author affiliation: Savannah River Nuclear Solutions, LLC		
Review period: July 15, 2023 – January 21, 2025 (SRS OUs with Native Soil Covers and/or LUCs)		
Date of site inspection: August 2023 to December 2023 (SRS OUs with Native Soil Covers and/or LUCs)		
Type of review: Statutory		
Review number: 7		
Triggering action date: <del>January 21, 2024</del> <u>December 31, 2023</u> (includes all five phases)		
Due date (five years after triggering action date): <del>January 21, 2029</del> <u>December 31, 2028</u> (includes all five phases)		

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Table 2. SRS OUs with LUCs

#	Appendix	Operable Unit	SEMS No.	Remedy Decision Document Year <sup>a</sup>	Remedial Action <sup>b</sup>	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 <sup>c</sup>	79, 90, 91	2009	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 and 643-3G) and P-Area Bingham Pump Outage Pits (643-4G)	26, 39	2000	LUCs	1.18	1.2
9	K	Lower Three Runs IOU <sup>d</sup>	35	1995, 2012, 2021	<ul style="list-style-type: none"> <li>• Repair Dam and Maintain PAR Pond Level at 58.5 m (195 ft) Elevation Minimum</li> <li>• LUCs with Monitored Natural Recovery</li> <li>• Excavation, Treatment, and Disposal of Principal Threat Source Material Sediment/Soil</li> <li>• Maintain Water in Ponds</li> </ul>	NA	9,890.7
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
12	N	Wetland Area at Dunbarton Bay in Support of Steel Creek IOU	71	2018, 2023	Excavation, LUCs	NA	<del>2539</del>

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.

d The Lower Three Runs IOU includes the Upper, Middle, and Lower Subunits. PAR Pond (685-G) and the Pre-Cooler Ponds and Canals are identified as the Upper Subunit. The Middle and Lower Subunits (Tail Portion) have been combined with the Lower Three Runs IOU Upper Subunit and identified as the Lower Three Runs IOU in its entirety.

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 <sup>a</sup>	Title of LUC Instrument Implemented and Date (or Planned)
C-Area Operable Unit	Soil, Concrete, Steel, Gravel, Sediment, Surface Water	Yes	Yes	79	<ul style="list-style-type: none"> <li>• Restrict unauthorized worker access to prevent contact, removal, or excavation of contaminated media</li> <li>• Prohibit the development and use of property for residential house, elementary and secondary schools, childcare facilities, and playgrounds</li> </ul>	SRNS 2015a
C-, K-, L-Reactor Complexes <sup>b</sup>	Concrete, Sediment, Metal, Soil, Groundwater	Yes	Yes	79, 90, 91	<ul style="list-style-type: none"> <li>• Restrict unauthorized worker access to prevent contact, removal, or excavation of contaminated media</li> <li>• Prohibit the development and use of property for residential house, elementary and secondary schools, childcare facilities, and playgrounds</li> <li>• Maintain the integrity of any current or future remedial or monitoring systems</li> <li>• Prevent access or use of contaminated groundwater until cleanup levels are met</li> <li>• Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion</li> </ul>	SRNS 2010a

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 <sup>a</sup>	Title of LUC Instrument Implemented and Date (or Planned)
Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, R-1B, R-1C	Soil	Yes	Yes	22	<ul style="list-style-type: none"> <li>Prevent contact, removal, or excavation of subsurface soil</li> <li>Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds</li> </ul>	SRNS 2010b
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	Soil	Yes	Yes	14	<ul style="list-style-type: none"> <li>Restrict the land to future industrial use</li> </ul>	WSRC 1998a (Section 2.0)
Gunsite 012 (including ECODS G-3)	Soil and Groundwater	Yes	Yes	78	<ul style="list-style-type: none"> <li>Prevent unrestricted use of the Building Pad Subunit and the Parking Area Subunit</li> <li>Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds</li> </ul>	SRNS 2011

Table 3. LUC Summary Table (continued/end)

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 <sup>a</sup>	Title of LUC Instrument Implemented and Date (or Planned)
Wetland Area at Dunbarton Bay	Soil, <u>Surface Ash</u>	Yes	Yes	71	<ul style="list-style-type: none"> <li>• Prevent contact, removal or excavation of ash/contaminated soil media</li> <li>• Maintain the integrity of any current or future remedial system or monitoring system</li> <li>• Prohibit the development and use of property for residual housing, elementary and secondary schools, childcare facilities, and playgrounds</li> </ul>	SRNS 2018d

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

c The Lower Three Runs IOU includes the Upper, Middle, and Lower Subunits. PAR Pond (685-G) and the Pre-Cooler Ponds and Canals are identified as the Upper Subunit. The Middle and Lower Subunits (Tail Portion) have been combined with the Lower Three Runs IOU Upper Subunit and identified as the Lower Three Runs IOU in its entirety.

UU/UE – unlimited use/unrestricted exposure

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

Operable Unit	Main Remedy <sup>a</sup>	ROD Issue Date	FY2019-FY2023 O&M Estimated Cost	FY2019-FY2023 O&M Actual Cost	% of Estimate	Comments
C-Area Operable Unit	LUCs	2015	\$43,750	\$108,728	249%	Actual costs are higher than expected <del>is attributed due</del> to the maintenance costs being underestimated. <u>The standard unit of cost for inspections/maintenance is generally a few acres and did not account for CAOU's large footprint (64.2 acres) or the three subunits that comprise the CAOU.</u>
C-, K-, L-, R-Reactor Complexes <sup>b</sup>	LUCs	2009	\$52,500	\$41,990	80%	Actual costs are as expected.
Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, R-1B, R-1C	LUCs	2010	\$65,000	\$39,582	61%	Inspections/maintenance costs were overestimated. Based on inspections, maintenance activities completed on the ECODS include removing fallen and dead trees, trees growing near the soil cover that needed removal, and ant mounds on the native soil covers.
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	LUCs	1997	\$5,500	\$78,109	1420%	Maintenance costs were not included in the estimate. Based on inspections, maintenance activities completed on FBRP include addressing woody vegetation, bare spots, and ant mounds on the native soil covers.
Gunsite 012 (including ECODS G-3)	LUCs	2011	\$27,500	\$76,702	279%	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	\$27,500	\$69,385	252%	Maintenance costs were <del>slightly</del> underestimated. Additional maintenance activities completed included dirt eroding from around one of the monuments.

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

Operable Unit	Main Remedy	ROD Issue Date	FY2019-FY2023 O&M Estimated Cost	FY2019-FY2023 O&M Actual Cost	% of Estimate	Comments
K-Area Bingham Pump Outage Pit (643-1G)	LUCs	1998	\$16,036	\$95,935	598%	Five-year remedy review and maintenance costs were underestimated. Additional maintenance activities completed included addressing active ant mounds.
L-Area Bingham Pump Outage Pits (643-2G, 643-3G) and P-Area Bingham Pump Outage Pits (643-4G)	LUCs	2000	\$30,167	\$96,498	320%	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.
Lower Three Runs IOU <sup>c</sup>	LUCs	1995, 2012, 2021	\$327,500	\$161,127	49%	The actual costs are as expected. The cost for maintaining the water level in PAR Pond is not included in the comparison because this activity is part of Site Infrastructure maintenance. O&M activities for the Upper Subunit will begin in FY2024.
R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3	LUCs	2003	\$32,500	\$58,077	179%	Maintenance costs were underestimated. Additional maintenance activities completed included addressing active ant mounds on the soil cover and removing overgrown vegetation near the road and dead trees.
Silverton Road Waste Unit (731-3A)	LUCs	1997, 2005	\$5,500	\$74,132	1,348%	Five-year remedy review, inspection, and mowing costs were underestimated. Additional maintenance activities completed at SRWU include removing dead trees that have fallen onto the soil cover, faded signs need to be replaced, drainage erosion in the southwest drainage ditch.
Wetland Area at Dunbarton Bay in Support of the Steel Creek IOU	LUCs	2018	\$20,750	\$8,929	43%	The actual costs are as expected. The estimated costs were estimated to start in 2019. However, O&M costs were not incurred until 2023.

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 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.

c The Lower Three Runs IOU includes the Upper, Middle, and Lower Subunits. PAR Pond (685-G) and the Pre-Cooler Ponds and Canals are identified as the Upper Subunit. The Middle and Lower Subunits (Tail Portion) have been combined with the Lower Three Runs IOU Upper Subunit and identified as the Lower Three Runs IOU in its entirety.

**Table 5. Protectiveness Determinations/Statements from the Sixth Five Year Remedy Review for SRS OUs with Native Soil Covers and/or LUCs (SRNS 2019)**

SEMS No.	Operable Unit	Protectiveness Determination	Protectiveness Statement
79	C-Area Operable Unit <sup>a</sup>	<del>NA</del> Protective	<u>The remedy at the CAOOU is protective of human health and the environment.</u> <del>NA</del>
79, 90, 91	C-, K-, L-Reactor Complexes <sup>b</sup>	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 EAROD to implement 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-5G 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.

**Table 5. Protectiveness Determinations/Statements from the Sixth Five Year Remedy Review for SRS OUs with Native Soil Covers and/or LUCs (SRNS 2019) (continued/end)**

SEMS No.	Operable Unit	Protectiveness Determination	Protectiveness Statement
35	Lower Three Runs IOU <sup>c</sup>	Protective	The remedy at Lower Three Runs IOU is protective of human health and the environment.
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.
71	Wetland Area at Dunbarton Bay in Support of the Steel Creek IOU <sup>a</sup>	<del>Protective</del> <u>NA</u>	<del>The remedy at the WADB is protective of human health and the environment.</del> <u>NA</u>

a OUs not included in the Sixth 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.

c The Lower Three Runs IOU includes the Upper, Middle, and Lower Subunits. PAR Pond (685-G) and the Pre-Cooler Ponds and Canals are identified as the Upper Subunit. The Middle and Lower Subunits (Tail Portion) have been combined with the Lower Three Runs IOU Upper Subunit and identified as the Lower Three Runs IOU in its entirety.

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

<b>Protectiveness Statement(s)</b>		
<i>Operable Unit:</i> C-AREA OPERABLE UNIT SEMS # 79	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the C-Area Operable Unit is protective of human health and the environment.		
<i>Operable Unit:</i> C-, K-, AND L-REACTOR COMPLEXES, SEMS # 79, 90, 91 <sup>a</sup>	<i>Protectiveness Determination:</i> <del>Short Term</del> Will be Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the C-, K-, and L-Reactor Complexes is <u>expected to be 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 upon completion. In the interim, remedial activities completed to date (i.e., LUCs) have adequately addressed all exposure pathways that could present unacceptable risks in these areas.</u>		
<i>Operable Unit:</i> EARLY CONSTRUCTION AND OPERATIONAL DISPOSAL SITE (ECODS) L-1, N-2, P-2, and R-1A, -1B, - 1C, SEMS #22	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> 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.		
<i>Operable Unit:</i> F-AREA BURNING/RUBBLE PITS (FBRP) (231-F, 231-1F, AND 231-2F), SEMS #14	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the FBRP OU is protective of human health and the environment.		
<i>Operable Unit:</i> GUNSITE 012 (INCLUDING ECODS G- 3), SEMS #78	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the Gunsite 012 OU is protective of human health and the environment.		
<i>Operable Unit:</i> HEAVY EQUIPMENT WASH BASIN (HEWB) (NBN) AND CENTRAL SHOPS BURNING/RUBBLE PIT (CSBRP) (631- 5G), SEMS #53	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the HEWB/CSBRP OU is protective of human health and the environment.		
<i>Operable Unit:</i> K-AREA BINGHAM PUMP OUTAGE PIT (KBPOP) (643-1G), SEMS #20	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the KBPOP OU is protective of human health and the environment.		

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

<b>Protectiveness Statement(s) (continued)</b>		
<i>Operable Unit:</i> L-AREA AND P-AREA BINGHAM PUMP OUTAGE PITS (L&P BPOPs) (643-2G, 643-3G, AND 643-4G), SEMS #26, 39	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the L&P BPOPs OU is protective of human health and the environment.		
<i>Operable Unit:</i> LOWER THREE RUNS INTEGRATOR OPERABLE UNIT <sup>b</sup> , SEMS #35	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at PAR Pond is protective of human health and the environment.		
<i>Operable Unit:</i> 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	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the RBPOPs/RUNKs OU is protective of human health and the environment.		
<i>Operable Unit:</i> SILVERTON ROAD WASTE UNIT (731-3A), SEMS #13	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the Silverton Road Waste Unit OU is protective of human health and the environment.		
<i>Operable Unit:</i> WETLAND AREA AT DUNBARTON BAY IN SUPPORT OF THE STEEL CREEK IOU, SEMS #71	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date (if applicable):</i> N/A
<i>Protectiveness Statement:</i> The remedy at the WADB 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.

b The Lower Three Runs IOU includes the Upper, Middle, and Lower Subunits. PAR Pond (685-G) and the Pre-Cooler Ponds and Canals are identified as the Upper Subunit. The Middle and Lower Subunits (Tail Portion) have been combined with the Lower Three Runs IOU Upper Subunit and identified as the Lower Three Runs IOU in its entirety.

## SEVENTH FIVE-YEAR REMEDY REVIEW REPORT PHASED REVIEWS

### I. FIVE-YEAR REMEDY REVIEW PHASES

The size of the Savannah River Site (SRS) five-year remedy review reports has grown considerably since the first report was issued in 1997 with respect to the number of operable unit (OU) remedies evaluated and the level of detail required. 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 Remedies;
- (3) Engineered Cover Systems;
- (4) Geosynthetic or Stabilization/Solidification (S/S) 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 Seventh Five-Year Remedy Review Report is due no later than ~~January 21~~ December 31, 2029 ~~2028~~. ~~For the seventh five-year remedy review reports, Table A-1 provides a schedule for issuance of the~~ The remedy reviews for the five OU remedy groupings are issued ~~to ensure that the five-year limit between decision document reviews~~ in compliance with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution

Contingency Plan to ensure the five-year limit between decision documents is not exceeded.

A list of the SRS OUs with remedy decision documents grouped into the five phased reviews is provided in Table A-21. Table A-2-1 will be updated in future remedy review reports as additional remedy decision documents are approved and added. A general description of the five remedy types is provided below.

***Phase 1: Native Soil Covers and/or LUCs***

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

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

LUCs are maintained for all OUs where residual 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 when active measures are determined not to be practicable 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 4: Geosynthetic or Stabilization/Solidification Cover Systems***

For purposes of the seventh five-year phased remedy review, SRS OUs that installed a geosynthetic or stabilization/solidification cover system are grouped in the Geosynthetic or S/S 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 stormwater 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 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 S/S 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 seventh 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. Pump and treat systems (e.g., air strippers and associated recovery wells) are used to remove contaminant mass and exert hydraulic control over contaminated groundwater plumes. Thermal technologies have been employed in several areas to mobilize dense non-

aqueous phase liquid (DNAPL) VOCs in the vadose zone and groundwater. Dynamic Underground Stripping is a technology employed at SRS that utilizes steam injection to enhance removal from large DNAPL source zones. Electrical Resistance Heating has been used in smaller DNAPL source zones.

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

## II. SRS OUS WITH REMEDIAL DECISIONS

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

- Table A-~~3~~2 provides a summary of SRS OUs for remedial actions without operating equipment;
- Table A-~~4~~3 provides a summary for the SRS OUs for remedial actions with operating equipment;
- Table A-~~5~~4 chronologically lists all SRS issued decision documents. Document numbers are provided for reference;
- Table A-~~6~~5 provides a summary of the No Remedial Actions selected in the decision documents; and
- Table A-~~7~~6 provides the OU subunits with issued remedial decision documents and their associated Superfund Enterprise Management System (SEMS) number.

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

<b>Seventh Five-Year Review</b>		<b>Eighth Five-Year Review</b>	<b>Remedy Type</b>
<b>Issuance Year</b>	<b>Years Between Reviews</b>	<b>Issuance Year</b>	
2025 <sup>a</sup>	5	2030	Phase 1: Native Soil Covers and/or LUCs
2026	5	2031	Phase 2: Groundwater
2027	5	2032	Phase 3: Engineered Cover Systems
2028	5	2033	Phase 4: Geosynthetic or Stabilization/ Solidification Cover Systems
2029	5	2034	Phase 5: Operating Equipment

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

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**Seventh Five-Year Remedy Review Report for SRS OUs  
with Native Soil Covers and/or Land Use Controls (U)  
Savannah River Site - Appendix A  
~~December 2023~~ June 2024**

**Table A-12. Seventh 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	
<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>	<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>	<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>	<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>	<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>
<b>2023</b>	<del>2025</del> <b>2024</b>	<b>2024</b>	<del>2026</del> <b>2025</b>	<b>2025</b>	<del>2027</del> <b>2026</b>	<b>2026</b>	<del>2028</del> <b>2027</b>	<b>2027</b>	<del>2029</del> <b>2028</b>
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/731-1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A)	
C-, K-, and L-Reactor Complexes		Chemicals, Metals, and Pesticides Pit (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G)		D-Area Burning/Rubble Pits (431-D and 431-1D)		C-Area Reactor Seepage Basins (904-66G and 904-68G)		A-Area Miscellaneous Rubble Pile (731-6A)	
Early Construction and Operational Disposal Site (ECODs) L-1, N-2, P-2, and R-1A, -1B, -1C		D-Area Oil Seepage Basin (631-G)		F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G)		D-Area Expanded Operable Unit (Consisting of D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D])		A/M-Area Groundwater	
ECODS N-1, Central Shops Scrap Lumber Pile (631-2G), Building 690-N (Ford Building) <sup>b</sup>		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) and Old C-Area Burning/Rubble Pit (NBN)	
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)		R-Area Operable Unit <sup>c</sup>		H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G)		F-Area Tank Farm		D-Area Operable Unit	
Gunsite 012		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 K-Area Rubble Pile (131-K and 631-20G)		F-Area Retention Basin (281-3F)		F-Area Groundwater Operable Unit	
Heavy Equipment Wash Basin (No Building Number [NBN])				M-Area Hazardous Waste Management Facility (904-51G and 904-112G)		General Separations Area Consolidation Unit		H-Area Groundwater Operable Unit	
K-Area Bingham Pump Outage Pit (643-1G)				Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)		H-Area Tank Farm		M-Area Settling Basin Inactive Process Sewer Lines to Manhole 1 (081-M)	

**Table A-21. Seventh Five-Year Remedy Review Phases for SRS OUs (continued/end)**

Native Soil Covers and/or LUCs		Groundwater		Engineered Cover Systems		Geosynthetic or Stabilization/Solidification Cover Systems		Operating Equipment	
<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>	<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>	<i>Submittal Date<sup>a</sup></i>	<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>	<i>Submittal Date<sup>a</sup></i>	<i>Issuance Year</i>	<i>Submittal Date<sup>a</sup></i>
<del>2018</del> 2023	<del>2020</del> 2024	<del>2019</del> 2024	<del>2021</del> 2025	<del>2020</del> 2025	<del>2018</del> 2026	<del>2020</del> 2026	<del>2019</del> 2027	<del>2021</del> 2027	<del>2020</del> 2028
L-Area and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)				Mixed Waste Management Facility (643-28E)		K-Area Reactor Seepage Basin (904-65G)		M-Area Operable Unit	
Lower Three Runs IOU				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)	
R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3						L-Area Reactor Seepage Basin (904-64G) and C-Area Reactor Seepage Basin (904-67G)		TNX Area Operable Unit	
Silverton Road Waste Unit (731-3A)						Old F-Area Seepage Basin (904-49G)			
Wetland Area at Dunbarton Bay in Support of Steel Creek IOU						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 October 12, 2023. This OU was not included in the first phase of the seventh five-year review (i.e., native soil covers and/or LUCs) because the remedy had not been implemented.

c R-Reactor Complex will be discussed as part of R-Area Operable Unit.

Table A-23. Summary of Remedial Actions without Operating Equipment at SRS

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd <sup>3</sup> )	Volume Stabilized (yd <sup>3</sup> )	Volume Consolidated (yd <sup>3</sup> )	Volume Removed (yd <sup>3</sup> )	LUC (acres)
<b>Compacted Native Soil</b>								
<del>C-Reactor Complex</del>	<del>±</del>	<del>CKL Rx</del>	0	0	0	0	0	<del>3.4</del>
<del>K-Reactor Complex</del>	<del>±</del>	<del>CKL Rx</del>	0	0	0	0	0	<del>3.8</del>
<del>L-Reactor Complex</del>	<del>±</del>	<del>CKL Rx</del>	0	0	0	0	0	<del>3.5</del>
Central Shops Burning/Rubble Pit (631-5G)	1	CSBRP 5G	0.15	0	0	0	0	0
Early Construction and Operational Disposal Site (ECODS) C-1	1	CAOU	0.16	0	0	0	0	1.27
ECODs L-1	1	ECODs L-1	0.40	0	0	0	0	0.94
ECODs N-2	1	ECODs N-2	0.47	0	0	0	0	1.31
ECODs P-2	1	ECODs P-2	0.18	0	0	0	0	2.42
ECODs R-1A, R-1B, R-1C	1	ECODs R-1A, R-1B, R-1C	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
<b>Land Use Controls Only</b>								
C-Area Operable Unit	1	CAOU	0	0	0	0	0	56.5
<del>C-Reactor Complex</del>	<del>1</del>	<del>CKL Rx</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>3.4</del>
<del>K-Reactor Complex</del>	<del>1</del>	<del>CKL Rx</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>3.8</del>
<del>L-Reactor Complex</del>	<del>1</del>	<del>CKL Rx</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>0</del>	<del>3.5</del>
D-Area Operable Unit (488-2D and west end of 488-1D)	5	DAOU	0	0	0	0	315,821	245
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	1	LTR IOU	0	0	0	0	0	9890.7
Wetland Area at Dunbarton Bay	1	WADB	0	0	0	0	22,000	<del>3839</del>

Table A-32. Summary of Remedial Actions without Operating Equipment at SRS (continued)

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd <sup>3</sup> )	Volume Stabilized (yd <sup>3</sup> )	Volume Consolidated (yd <sup>3</sup> )	Volume Removed (yd <sup>3</sup> )	LUC (acres)
<b>Water Cover</b>								
PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals)	1	PAR Pond	1,340	0	0	0	0	2556.1
<b>Geosynthetic Clay (hydraulic conductivity 1E-07 cm/sec, 1E-08 cm/sec)</b>								
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
D-Area Operable Unit (488-4D)	5	DAOU	22	975,000	0	90,800	0	245
D-Area Operable Unit (488-1D)	5	DAOU	19.5	601,910	0	298,130	0	245
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
<b>Compacted Clay (hydraulic conductivity 1E-07 cm/sec)</b>								
F-Area Hazardous Waste Management Facilities (HWMFs) (904-41G, 904-42G, and 904-43G)	3	F-Area HWMF	6.8	0	0	0	0	10
H-Area HWMFs (904-44G, 904-45G, 904-46G, 904-56G)	3	H- Area HWMF	22.1	0	0	0	0	25
M-Area HWMFs (904-51G and 904-112G)	3	M-Area 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	MWFMF	58	0	0	0	0	85
P-Area Burning/Rubble Pit (131-P)	5	PBRP	0.6	0	0	0	0	0.89
<b>Compacted Clay w/Waste Solidification (hydraulic conductivity 1E-05 cm/sec)</b>								
C-Area Reactor Seepage Basins (904-66G, 904-67G, 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
<b>Asphalt/Concrete</b>								
R-Area Operable Unit	2	RAOU	1.55	0	123,091	0	13,404	450
R-Area Reactor Seepage Basins (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	2.0

## 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 2018 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 2019).

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 in this review.

The United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for Non-Radiological Constituents (May 2023) and the USEPA Preliminary Remediation Goals (PRGs) for Radionuclides (February 2023) were evaluated in this review. These values were compared to the values available in 2018 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 N. Table B-1 shows the nonradiological (i.e., chemical) soil RSLs available in 2018 compared to the 2023 nonradiological soil RSLs. The RSLs presented in the table correspond to an HQ = 1.0 and/or risk = 1E-06, as appropriate. Table B-2 shows the radiological soil PRGs available in 2018 compared to the 2023 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.

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 N.

Change to a standard or toxicity factor is unique to each analyte and is often related to revisions in exposure assumptions, reference doses, cancer potency factors, and exposure pathways used to calculate the 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 most cases, a change in a standard or toxicity value is 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 are effectively prevented by the remedy, i.e., native soil cover and/or LUCs. Therefore, risk-based cleanup goals for the OUs evaluated in this five-year remedy review do not warrant revision as a result of changes to toxicity criteria, RSLs/PRGs, exposure factors/assumptions, or risk methodology, because the remedy is effective in eliminating the exposure pathways of concern. There are no changes in land use, including zoning changes, routes of exposure or receptors, or changes in the physical site conditions that would compromise the protectiveness of the remedy.

In May 2021, USEPA published RSLs for cis- (alpha-) and trans- (gamma-) chlordane using the reference dose for technical chlordane as a surrogate for the noncancer screening level assessment of these two dioxin isomers. The noncancer RSLs (resident = 3.6E+01 mg/kg and industrial worker = 5.0E+02 mg/kg) are greater than (i.e., less conservative) than the cancer thresholds (resident = 1.7E+00 mg/kg and industrial worker = 7.7E+00 mg/kg) for technical chlordane, which is a mixture of the alpha- and gamma- isomers). Therefore, Table B-1 identifies the more conservative carcinogenic RSLs for the alpha- and gamma- isomers found in technical mixture chlordane, and there is no change from the RSLs published in 2018 for the previous remedy review. In November 2022, the resident RSL for p,p'-dichlorodiphenyldichloroethane (DDD) changed from 1.9 mg/kg to 2.3 mg/kg (less conservative) based on new toxicity values (i.e., noncarcinogenic reference dose) due to Agency for Toxic Substances and Disease Registry (ATSDR) updates. The revised RSL is highlighted in bold in Table B-1. The updates to the alpha- and gamma- chlordane and

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

Analyte	2018 RSLs <sup>a</sup>		2023 RSLs <sup>b</sup>		SEMS Number(s) <sup>c</sup>
	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	6.8E-01	3.0E+00	6.8E-01	3.0E+00	13, 14, 71
alpha-Chlordane	1.7E+00	7.7E+00	1.7E+00	7.7E+00	53
gamma-Chlordane	1.7E+00	7.7E+00	1.7E+00	7.7E+00	53
p,p'-DDD <sup>d</sup>	1.9E+00	9.6E+00	<b>2.3E+00</b>	9.6E+00	53
p,p'-DDT	1.9E+00	8.5E+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	7.0E-02	3.3E-01	7.0E-02	3.3E-01	53
<b>Polychlorinated biphenyls (PCBs)</b>					
~Aroclor 1254	2.4E-01	9.7E-01	2.4E-01	9.7E-01	14, 26, 39
~Aroclor 1260	2.4E-01	9.9E-01	2.4E-01	9.9E-01	26, 39
<b>Polynuclear Aromatic Hydrocarbons (PAHs)</b>					
~Benzo[a]anthracene	1.1E+00	2.1E+01	1.1E+00	2.1E+01	26, 39, 78
~Benzo[a]pyrene	1.1E-01	2.1E+00	1.1E-01	2.1E+00	13, 14, 26, 38, 39, 53, 78, 79
~Benzo[b]fluoranthene	1.1E+00	2.1E+01	1.1E+00	2.1E+01	26, 39, 78, 79
~Benzo[k]fluoranthene	1.1E+01	2.1E+02	1.1E+01	2.1E+02	78
~Dibenzo[a,h]anthracene	1.1E-01	2.1E+00	1.1E-01	2.1E+00	13, 26, 38, 39, 78
~Indeno[1, 2, 3-cd]pyrene	1.1E+00	2.1E+01	1.1E+00	2.1E+01	78
Uranium	1.6E+01	2.3E+02	1.6E+01	2.3E+02	79, 90, 91

a USEPA Nonradiological RSLs for soil media (HQ = 1.0 or risk = 1E-06, as appropriate), May 2018.

b USEPA Nonradiological RSLs for soil media (HQ = 1.0 or risk = 1E-06, as appropriate), May 2023.

c OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-7.

d The non cancer RfD changed for the child (increased), which made the carcinogenic screening level more conservative. The industrial worker does not consider the child scenario and therefore was not affected by the change in the RfD.

Revised RSL highlighted in bold.

mg/kg = milligram per kilogram

DDT = dichlorodiphenyltrichloroethane

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### 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.

ECODS C-1 (NBN) is located near the CADC and consists of a set of two trenches that were used from January 1953 to sometime after June 1954 to dispose of waste material associated with C Area construction. Construction waste was buried in the trenches and some sections of the trenches may have been used as a burn pit for combustible waste disposal. After waste disposal operations ended, the trenches were backfilled with soil to create a native soil cover.

### Initial Response

Several CAOU subunits have undergone removal actions. A Non-Time Critical Removal (NTCR) action was completed for a portion of 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). Reactor cooling water lines, fire water lines, water treatment lines, and sanitary sewers are not considered as part of the C-Area PSLs. These lines never received direct discharges from the C-Reactor Building (105-C). Water treatment lines from the Reactor CWS (186/190-C) and water treatment facilities are not considered as part of the C-Area PSLs and would not be contaminated since they are located upstream of the reactor process.

All active sewer systems, process lines, and structures that service the ongoing mission of the C-Area Reactor Building (105-C) due to their receipt of facility water runoff and storm water are defined within the scope of the C-Area Reactor Building (105-C) and include Manhole (904-1C), 100-C Effluent Outfall Structure (904-5G), and storm water sewer

lines. These active sewer lines and structures will be closed as part of the final action for the C-Area Reactor Building (105-C) and are not included in the scope of the C-Area PSL subunit. 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

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) 2019 to FY2023 was \$43,750 for annual inspections, maintenance, and LUCs. The actual O&M cost for FY2019 to FY2023 is \$108,728. The difference in estimated versus actual costs is attributed to the inspection/maintenance costs being underestimated. The standard unit of cost for inspections/maintenance is generally a few acres and did not account for CAOU's larger footprint (64.2 acres) or the three subunits that comprise the CAOU.

## V. PROGRESS SINCE LAST REVIEW

This review is the second five-year review for the CAOU. The previous protectiveness statement concluded that the remedy of LUCs is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are being addressed through the LUCs.

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

## VI. FIVE-YEAR REVIEW PROCESS

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, 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 Phil Carter, Savannah River Nuclear Solutions, LLC

(SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshew, SRNS EC&ACP Post-Closure Lead, on August 23, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The CAOOU was inspected by SRNS EC&ACP on July 6, 2023. No issues were identified during this inspection.

A site inspection of CAOOU was conducted by SRNS EC&ACP and USDOE personnel on December 7, 2023. No issues were identified for the CAOOU during this inspection.

A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of CAOOU and ~~will be~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to be~~ were identified during the inspection.

Scheduled annual site inspections conducted from FY2019 to FY2023 identified overgrown vegetation and fallen trees. These findings were documented on the field inspections 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 CAOOU 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 CAOOU, 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 CAOOU 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 CAOOU. 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 CAOOU 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 CAOOU as shown in Appendix B. The changes to the values for COCs at the CAOOU 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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 eighth~~ five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January 2030~~ December 2029.

## 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)*,

Various – Inspection Data Sheets - *Field Inspection Checklist for Outfall C-03*, ER-IDS-019-076, Inspection period FY2019 through FY2023 (annually)

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

<b>D. General</b>			
<b>1. Vandalism/Trespassing:</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> <input type="checkbox"/>	No vandalism is evident
Remarks: _____			
<b>2. Land use changes onsite:</b>	<input checked="" type="checkbox"/> N/A		
Remarks: _____			
<b>3. Land use changes offsite:</b>	<input checked="" type="checkbox"/> N/A		
Remarks: _____			
<b>VI. GENERAL SITE CONDITIONS</b>			
<b>A. Roads</b>	<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A	
<b>1. Roads damaged:</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Roads adequate	<input type="checkbox"/> N/A
Remarks: _____			
<b>B. Other Site Conditions:</b> <u>Annual site inspections conducted from FY2019 through FY2023 identified the presence of overgrown vegetation and fallen trees. These findings were document on the field inspection checklist and resolved soon after discovery.</u>			
Remarks: <u>Site vegetation is mowed routinely.</u>			
<b>VII. LANDFILL COVER/CONTAINMENT</b>			
	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
<b>VIII. VERTICAL BARRIER WALLS</b>			
	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
<b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>			
	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
<b>X. OTHER REMEDIES</b>			
	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
<b>XI. OVERALL OBSERVATIONS</b>			
<b>A. Implementation of the Remedy</b>			
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.).			
<u>The remedy for this OU is LUCs to prevent human exposure to contaminants in soil. The remedy is fully established, effective, and functioning as designed.</u>			
<b>B. Adequacy of O&amp;M</b>			
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.			
<u>The O&amp;M procedures consisting of annual (FY2019-FY2023) 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&amp;M procedures are adequately maintaining CAOU and the condition of warning signs is good. There are no issues requiring corrective actions.</u>			
<b>C. Early Indicators of Potential Remedy Failure</b>			
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.			
<u>N/A</u>			
<b>D. Opportunities for Optimization</b>			
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.			
<u>N/A</u>			

*End of Checklist*

## C-, K-, L-REACTOR COMPLEXES

### I. Introduction

This report is the fourth 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). The first Savannah River Site (SRS) reactor complex to select ISD as the final remedy was the P-Reactor Complex (WSRC 2008). 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~~ is presented with the RAOU in ~~a subsequent phase of the Sixth Five-Year Remedy Review Report for SRS OUs with Groundwater Remedies.~~ The remedy review for the P-Reactor Complex is presented in the P-Area Operable Unit in the Five-Year Remedy Review Report for the SRS OUs with Geosynthetic or Solidification/Stabilization Cover Systems. 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 2023 through November 2023. 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* (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 (Figure D-1). 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-2). 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

The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the CKL Rx as being within an 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 CKL Rx is reasonably anticipated to remain industrial with the USDOE maintaining control of the land.

A regulatory field inspection meeting with USDOE, USEPA and SCDHEC personnel ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of the CKL Rx OU and ~~will~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU ~~are anticipated to be~~ identified during the inspection.

Scheduled annual site inspections conducted from FY2019 through FY2023 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 cleanup levels have not been determined. The methods to calculate preliminary remedial goals, COCs, and cleanup levels 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 (<https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern.html>) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

#### **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.

#### **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 expected to be~~ protective of human health and the environment upon completion. In the interim, remedial activities completed to date (i.e., LUCs) have adequately address all exposure pathways that could present unacceptable risks in these areas.

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~~ implemented.

## XI. Next Review

~~As shown in Appendix A, Table A-1, t~~The next eight five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

## 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 FY2019 through FY2023 (annually)

Various - Inspection Data Sheets – *Field Inspection Checklist K-Reactor Complex (U)*, ER-IDS-019-058, Inspection period FY2019 through FY2023 (annually)

Various - Inspection Data Sheets – *Field Inspection Checklist L-Reactor Complex (U)*, ER-IDS-019-059, Inspection period FY2019 through FY2023 (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, 2008. *Early Action Record of Decision Remedial Alternative Selection for the P-Area Operable Unit (U)*, WSRC-RP-2008-4027, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

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

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

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

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 contaminant migration constituents of concern. Several other radiological constituents have a risk < 1E-03 but > 1E-06.

## 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 fourth 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 2023 through November 2023. 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 to create a native soil cover. 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 cleanup levels 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. The following LUC objectives are necessary to ensure protectiveness of the remedy:

- Prevent contact, removal, or excavation of subsurface soils.

- Prohibit the development and use of property for residential housing, elementary, and secondary schools, childcare facilities and playgrounds.

The LUCs for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU are shown in Figure E-7.

### 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). Figures E-7 and E-8 include current (2023) photographs of the ECODS.

### System Operations/Operations & Maintenance

There are no system operational requirements at the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU.

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 five 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) 2019 until the end of FY2023 is \$65,000 as compared to the actual O&M cost of ~~\$34,124~~\$34,582 for the same period. The difference between estimated and actual costs can be attributed to inspection and maintenance costs for the ECODS being overestimated. 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 review is the fourth 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 the remedial actions of LUCs are protective of human health and the environment. Exposure pathways that could result in unacceptable risks are being addressed through the LUCs.

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

## **VI. Five-Year Review Process**

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment E-1; and
- Reviewed changes in standards and to-be-considered guidance.

### *Summary of Inspections and Interviews*

Interviews were conducted with Phil Carter, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshew, SRNS EC&ACP Post-Closure Lead, on August 3, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU was inspected by SRNS EC&ACP on July 6, 2023 (ECODS L-1, ECODS N-2, ECODS P-2) and July 13, 2023 (ECODS R-1A, R-1B, and R-1C). No issues were identified during these inspections.

A site inspection of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU was conducted by SRNS EC&ACP and USDOE personnel. ECODS L-1, N-2, P-2, and R-1A, R-1B, and R-1C OU were inspected on December 14, 2023. 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 regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC) personnel ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also be present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU -and ~~will be~~ were provided an opportunity to walk down the OU. ~~The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU.~~ No significant problems regarding this OU ~~are anticipated to be~~ were identified during the inspection.

Scheduled annual site inspections conducted from FY2019 through FY2023 identified the presence of fallen and dead trees, trees growing near soil cover that needed removal, overgrown vegetation, 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage

provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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, Table A-1, t~~The next ~~eight~~ five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

## 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 FY2019 through FY 2023 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, N-Area ECODS N-2*, ER-IDS-019-054, Inspection period FY 2019 through FY 2023 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, P-Area ECODS P-2*, ER-IDS-019-055, Inspection period FY 2019 through FY 2023 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, R-Area ECODS R-1A, R-1B, and R-1C*, ER-IDS-019-052, Inspection period FY 2019 through FY 2023 (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

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 231-1F 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).

The following LUC objective is necessary to ensure protectiveness of the remedy:

- Restrict the land to future industrial use.

Figure F-5 shows the LUC Boundary for the FBRP OU.

##### 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).

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.

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 Phil Carter, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshaw, SRNS EC&ACP Post-Closure Lead, on August 3, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The FBRP OU was inspected by SRNS EC&ACP on July 6, 2023. No issues were identified during this inspection.

A site inspection of FBRP OU was conducted by SRNS EC&ACP and USDOE personnel on December 14, 2023. No issues were identified for the FBRP OU during the inspection.

A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) personnel ~~will be schedule after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will were~~ also be present in the

meeting. During the meeting, the participants ~~will-viewed~~ viewed drone footage of FBRP OU and ~~will-be~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to be~~ were identified during the inspection.

Scheduled annual site inspections conducted from FY2019 through FY2023 identified the woody vegetation, bare spots, 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, 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 cleanup levels established for the FBRP OU (Table F-4), 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 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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~~ eight five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

## 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, 2019. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, October 2019, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, November 2020, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2021. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, November 2021, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2023. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, February 2023, 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

- 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.

The following LUC objectives have been selected for this OU:

- 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, childcare facilities and playgrounds.

### **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.

The LUC Boundary for the Gunsite 012 OU is shown in Figure G-4. Figure G-5 presents current (2023) 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 five years to the estimated cost from the ROD. The estimated direct O&M cost from fiscal year (FY) 2019 to FY2023 is \$27,500 as compared to the actual O&M cost of

\$76,702 for the same period. The difference in estimated versus actual costs is attributed to the maintenance costs being underestimated.

## V. Progress Since Last Review

This is the fourth 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 Phil Carter, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshaw, SRNS EC&ACP Post-Closure Lead, on August 3, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The Gunsite 012 OU was inspected by SRNS EC&ACP on July 13, 2023. No issues were identified during this inspection.

A site inspection of the Gunsite 012 OU was conducted by SRNS EC&ACP and USDOE personnel on December 7, 2023. No issues were identified for the Gunsite 012 OU during these inspections.

A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) personnel ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also be present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of Gunsite 012 OU and ~~will~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to~~ were identified during the inspection.

Scheduled annual site inspections conducted from FY2019 through FY2023 identified the presence of fallen trees 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~~ cleanup levels 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 soils, 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

### **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 eighth~~ five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

## 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 FY2019 through FY2023 (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

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 native 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 dichlorodiphenyltrichloroethane (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 cleanup levels 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 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; and

- Implementing access controls at the SRS boundary to control and restrict public and trespasser access to HEWB subunit.

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

- 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 unit remains a potential threat to human health and 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 disturbances of the soil in the HEWB.

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

Current photos of the HEWB are shown in Figures H-4 and H-5. Figure H-6 shows the Land Use Control Boundary for the HEWB/CSBRP-5G OU.

### **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. 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, LUCs and five-year remedy reviews. Table H-3 compares the actual O&M cost over the last five 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) 2019 to FY2023 are \$25,000 as compared to the actual O&M cost of \$69,385 for the same period. The actual O&M costs (Table H-3) are higher than expected due to underestimation of maintenance costs.

## **V. PROGRESS SINCE LAST REVIEW**

This is the fifth five-year review for the HEWB/CSBRP-5G OU. The previous protectiveness statement concluded that because the remedial action of 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 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 Phil Carter, Savannah River Nuclear Solutions, LLC

(SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshew, SRNS EC&ACP Post-Closure Lead, on August 3, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The HEWB OU was inspected by SRNS EC&ACP on July 6, 2023. No issues were identified during this inspection.

A site inspection of the HEWB OU was conducted by SRNS EC&ACP and USDOE personnel on December 7, 2023. No issues were identified for the HEWB OU during this inspection.

A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) personnel ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also be present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of HEWB OU and ~~will~~ be were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to be~~ were identified during the inspection.

Scheduled annual site inspections conducted from 2019 through 2023 identified that dirt had eroded from around one of the monuments (i.e., OU corner markers). This finding was 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 HEWB/CSBRP-5G is effective in preventing residential exposure to RCOCs and is functioning as intended.

The above remedial activities are meeting the cleanup levels 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 (<https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern.html>) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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 eighth~~ five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

**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

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

### I. Introduction

This report is the sixth five-year review for the K-Area Bingham Pump Outage Pit (643-1G) (KBPOP) Operable Unit (OU). The review was conducted from July 2023 through November 2023. 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

The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the KBPOP OU as being within an 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 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~~native soil. 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 fewer 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 cleanup levels 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 cleanup levels 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.

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

- Prevent contact, removal, or excavation of buried waste in the area.
- Preclude residential use of the area.

### **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); and
- Posting of warning signs at appropriate locations in sufficient numbers to be seen from any approach.

Figures I-3 and I-4 are current photos (2023) of the KBPOP OU. The LUC Boundary for KBPOP is shown in Figure I-5.

### **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 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 five 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) 2019 to FY2023 is ~~\$5,636~~ 16,036 as compared to the actual O&M cost of \$95,935 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 addressing active ant mounds.

#### **V. Progress Since Last Review**

This is the ~~five~~ sixth 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 Phil Carter, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshew, SRNS EC&ACP Post-Closure Lead, on August 3, 2023

at the O&M organization offices. No issues were identified as an outcome of these interviews.

The KBPOP OU was inspected by SRNS EC&ACP on July 13, 2023. No issues were identified during these inspections.

A site inspection of the KBPOP OU was conducted by SRNS EC&ACP and USDOE personnel on December 14, 2023. No issues were identified for the KBPOP OU during this inspection.

A regulatory field inspection meeting with DOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) personnel ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also be present at the meeting. During the meeting, the participants ~~will~~ viewed drone footage of KBPOP OU and ~~will be~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU ~~are anticipated to be~~ were identified during the inspection.

Scheduled annual site inspections conducted from 2019 through 2023 identified active ant mounds on the soil cover. 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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 eighth~~ five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

**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

**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 sixth 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 2023 through November 2023. 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 through J-6 show current (2023) photographs of LBPOP and PBPOP.

### Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a) designates the LBPOP/PBPOP OU as being within an 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 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~~ native soil. 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 cleanup levels 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.

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

- Prevent contact, removal or excavation of buried waste in the area.
- Preclude residential use of the area.

### 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.

The LUC Boundary for the LBPOP/PBPOP OU is shown in Figure J-7.

### 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 five 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) 2019 to FY2023 is \$30,167 as compared to the actual O&M cost of \$96,498 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 on the soil cover, small saplings growing on the perimeter around the soil cover, and areas of thinning grass and a small subsidence.

## **V. PROGRESS SINCE LAST REVIEW**

This is the sixth 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 Phil Carter, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshaw, SRNS EC&ACP Post-Closure Lead, on August 3, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The LBPOP/PBPOP OU were inspected by SRNS EC&ACP on July 6, 2023. No issues were identified during these inspections.

A site inspection of the LBPOP/PBPOP was conducted by SRNS EC&ACP and USDOE personnel on December 14, 2023, respectively. No issues were identified during the interviews.

A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of ~~CAOU-LBPOP~~ and ~~will~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding this OU were identified during the inspection.

Scheduled annual site inspections conducted from 2019 through 2023 identified active ant mounds on the soil cover, small saplings growing on the perimeter around the soil cover, and areas of thinning grass and a small 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 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 cleanup levels 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding

emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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 eighth~~ five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

## 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 2019 through 2023

Various - Inspection Data Sheets – Field Inspection Checklist P-Area Bingham Pump Outage Pit (Bldg. 643-4G) (U), ER-IDS-019-006, Inspection period 2018 through 2023

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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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, 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) amsl. Under severe drought conditions, and if necessary, the River Water System could be used to maintain PAR Pond water levels (USDOE 1998).

***Lower Three Runs IOU Middle and Lower Subunits (Tail Portion)***

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 Lower Three Runs 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 final ROD for the Lower Three Runs IOU was issued in 2021 and documented the remedial action for the Middle and Lower Subunits as the final remedial action (SRNS 2021). The RAO for the middle and lower tail portions of the Lower Three Runs IOU is as follows:

- Prevent exposure of the adolescent trespasser to contaminated sediment/soil in the middle and lower tail portions of the Lower Three Runs IOU (SRNS 2012a).

***Lower Three Runs IOU Upper Subunit (PAR Pond and Pre-Cooler Ponds and Canals)***

The following RAOs are identified in the final ROD for the Lower Three Runs IOU for the Upper subunit of the Lower Three Runs IOU and are protective of the IOU onsite worker:

- Protect IOU onsite workers from exposure to cesium-137 and cobalt-60 in sediment/soil that exceeds 1E-06 risk threshold or background levels. The primary exposure route of concern is the external radiation pathway.
- Protect the recreational fisherman from exposure to cesium-137 and mercury in fish tissue that exceed risks of 1E-06 and hazard quotient (HQ) of 1, respectively. The primary route of exposure is the ingestion of fish pathway.

Cleanup levels for the Upper, Middle, and Lower subunits are identified in Table K-2 (SRNS 2017, SRNS 2021).

### **Lower Three Runs IOU**

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

- Prevent contact, removal or excavation of sediment/soil within the LTR IOU.
- Prohibit the development and use of property for residential use within the LTR IOU.
- Prevent fishing within the LTR IOU.
- 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.

### **Remedy Implementation**

The LUC Boundary for the Lower Three Runs IOU is shown in Figure K-7. Figures K-8 and K-9 show current photographs of the Lower Three Runs IOU and PAR Pond.

### ***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

for path and maintenance are estimated to be \$27,000. Every 5 years all signs will be inspected at an estimated cost of \$33,750. Table K-3 compares the actual O&M cost over the last five years to the estimated cost from the IROD. The estimated direct O&M cost from fiscal year (FY) 2019 to FY2023 is ~~\$614,600~~ \$327,500 as compared to the actual O&M cost of \$161,127 for the same period. The costs for maintaining the water level in PAR Pond was not included in the estimated direct O&M costs. Likewise, the actual costs do not include maintaining the water level in PAR Pond as this activity is conducted as part of Site Infrastructure maintenance.

Annual inspection and maintenance of signs and fences in the Upper subunit at access points will be initiated in fiscal year FY2024.

Monitoring of dam structures and water levels, annual inspections, and periodic maintenance of physical attributes that make water retention viable will also be initiated in FY2024.

## **V. Progress Since Last Review**

This is the seventh five-year review for the PAR Pond. This is the fourth five-year review for the Lower Three Runs IOU Tail Portion (Middle and Lower Subunit). This is the first five-year review for the Lower Three Runs IOU (Upper Subunit) and for the entire Lower Three Runs IOU. The previous protectiveness statement concluded that because the remedial actions at the Lower Three Runs IOU 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 Lower Three Runs 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) amsl 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 2019 through September 2023 indicates a pool level minimum of 60.6 m (198.62 ft) amsl on February 10, 2020 and a pool level high of 61.1 m (200.50 ft) amsl on January 13, 2020 (Figure K-10 through K-12).

The TCRA and implementation of LUCs (i.e., signage and fencing) in the middle and lower tail portions of the Lower Three Runs IOU was completed in August 2012. Inspections are conducted as discussed under System O&M (Section IV).

### ***Summary of Inspections and Interviews***

Interviews concerning Lower Three Runs IOU were conducted with Phil Carter, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshew, SRNS EC&ACP Post-Closure Lead, on August 3, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

An interview concerning PAR Pond was conducted with Richard Swygart, O&M Site Manager, on July 2, 2023 by phone. No issues were identified as an outcome of these interviews.

The Lower Three Runs IOU Tail Portion was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on July 6~~13~~, 2023. No issues were identified during this inspection.

PAR Pond and the Lower Three Runs IOU Tail Portion was inspected by SRNS EC&ACP and USDOE personnel on December 7, 2023. No issues were identified during the inspections.

A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and SCDHEC ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also be present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of Lower Three Runs IOU and ~~will be~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of this OU ~~are anticipated to be~~ were identified during the inspection.

Scheduled annual site inspections conducted from FY2019 through FY2023 identified overgrown vegetation near signs, faded and illegible or damaged signs due to fallen tree/limbs, broken fences, and a monument needed replacing. 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) amsl, maintaining water levels in Pond B and Pond C, as well as LUCs for the Lower Three Runs IOU are effective in preventing human health exposure to contaminated media and is functioning as intended.

The above remedial activities are meeting the ~~RGs~~ cleanup levels established for PAR Pond and the Lower Three Runs IOU Middle and Lower subunits, 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 Lower Three Runs 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 Lower Three Runs 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 Lower Three Runs IOU 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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 for the Lower Three Runs IOU from being protective.

**IX. Recommendations and Follow-up Actions**

There are no recommendations or follow-up actions for the Lower Three Runs IOU.

**X. Protectiveness Statement(s)**

The remedy for the Lower Three Runs IOU 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 the Lower Three Runs IOU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the Lower Three Runs IOU 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 eighth~~ The next eighth five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

**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, 2007. *Government Performance and Results Act Human Exposure Environmental Indicator Letter*, February 6

SRNS, 2012a. *Explanation of Significant Differences (ESD) for the Revision 0 Interim Action Record of Decision Remedial Alternative Selection: PAR Pond Unit – 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.

SRNS, 2020. *Feasibility Study for the Lower Three Runs Integrator Operable Unit (U)*, SRNS-RP-2018-00199, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2021. *Record of Decision Remedial Alternative Selection for the Lower Three Runs Integrator Operable Unit Upper Subunit (U)*, SRNS-RP-2020-00542, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2022. *Remedial Action Implementation Plan for the Lower Three Runs Integrator Operable Unit Upper Subunit (U)*, SRNS-RP-2022-00011, 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*

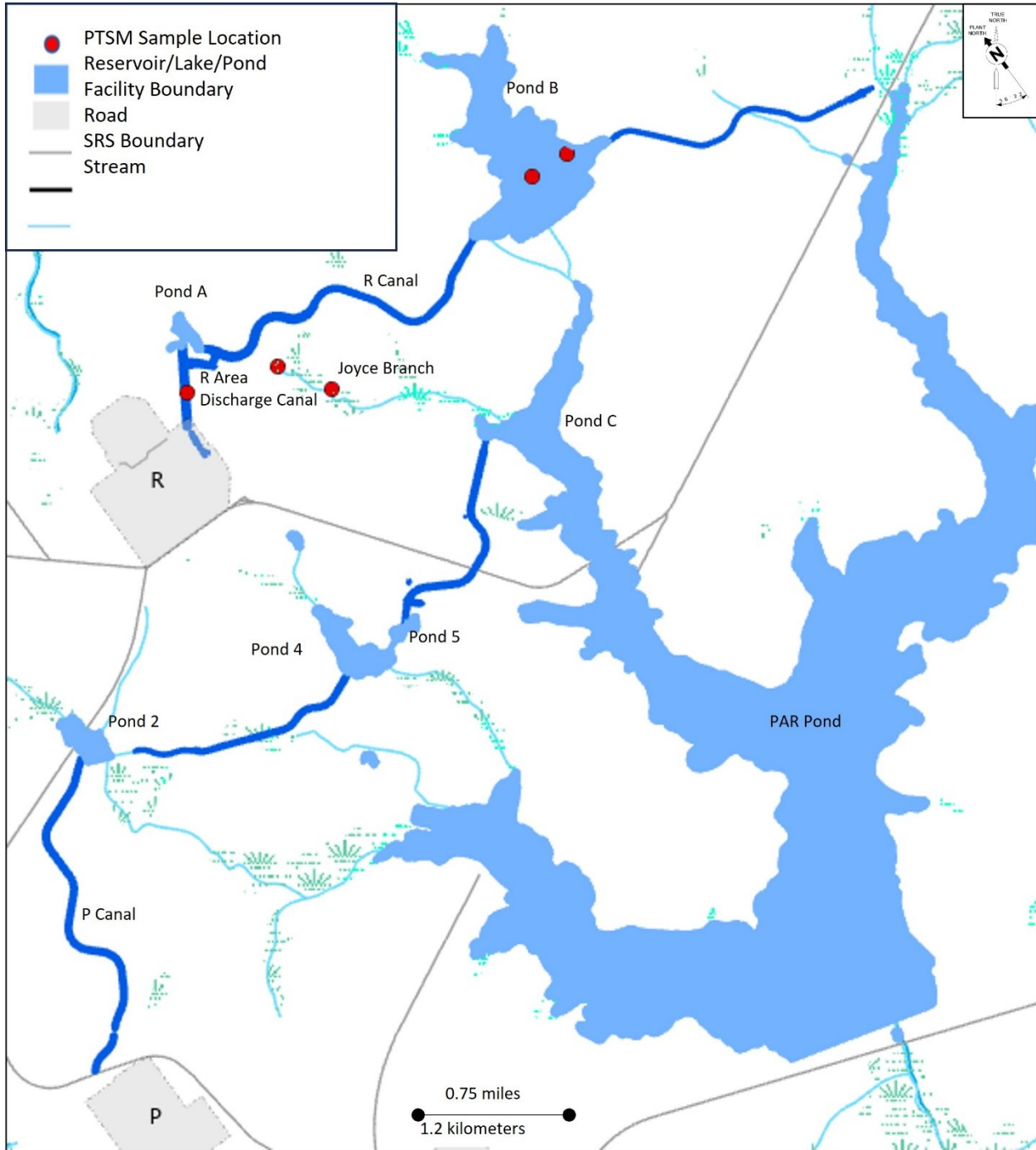


Figure K-3. Lower Three Runs IOU Ponds and Canal System

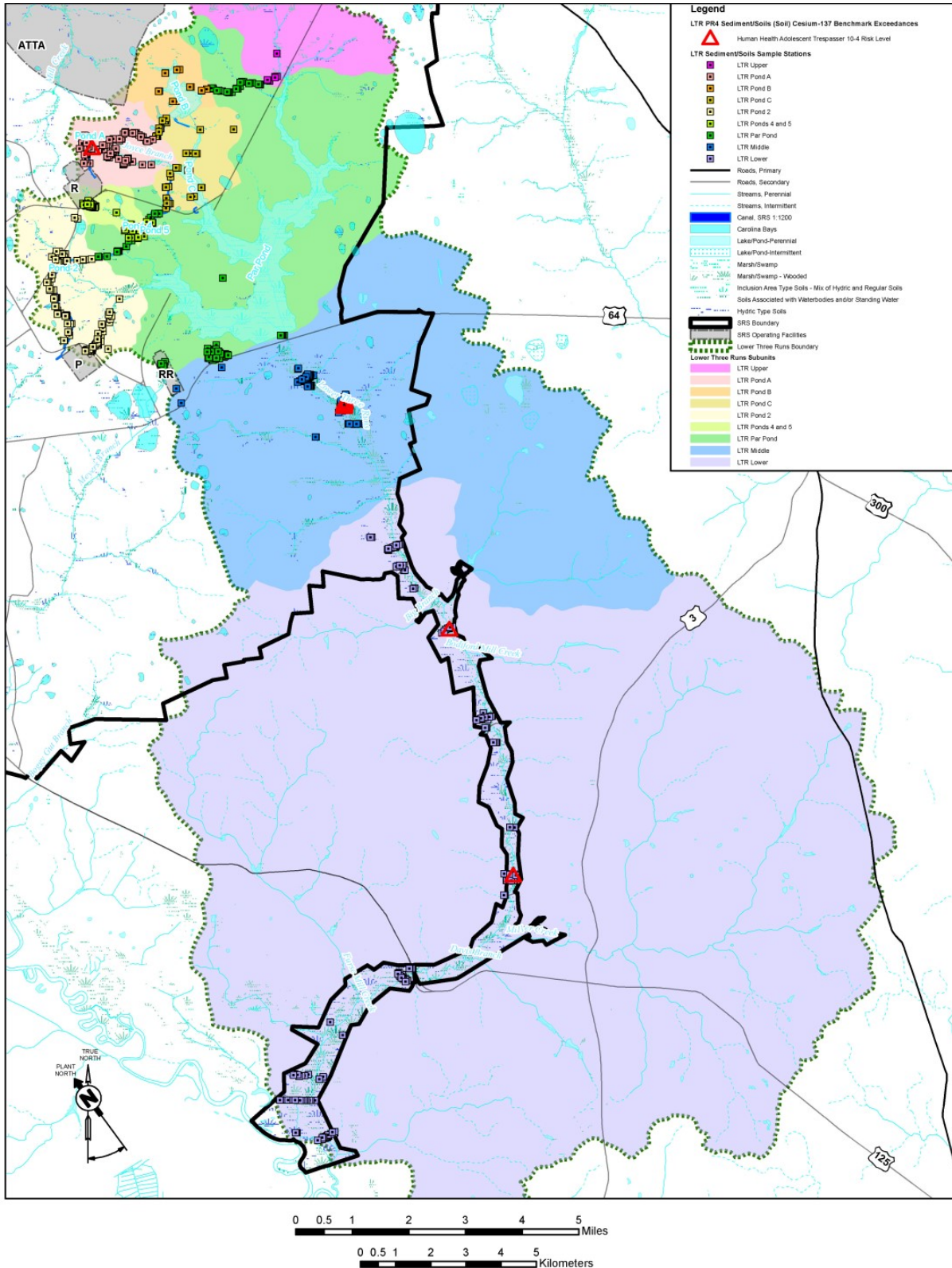


Figure K-4. Human Health Risk Exceedances (>1E-04) for Adolescent Trespasser for the Lower Three Runs IOU Tail Portion

## 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 fifth 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 2023 through November 2023. 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~~ native soil. 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<sup>3</sup> (14,000 yd<sup>3</sup>) (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~~ native soil 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]fluoranthene, 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 cleanup levels 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<sup>3</sup> (14,000 yd<sup>3</sup>) (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 cleanup levels.

As stated in the ROD, the selected remedial action for the RBPOPs and RUNKs OU is institutional controls (i.e., land use controls [LUCs]). The following LUC objectives are necessary to ensure protectiveness of the remedy:

- Maintain use of the site for industrial activities only.
- Prevent unauthorized access, contact, removal and excavation of buried RCOCs exceeding cleanup levels at the closed CERCLA units as long as the waste unit remains a threat to human health or the environment.

##### 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 (2023) of the RBPOP OU. The LUC Boundary for the RBPOP OU is shown in Figure L-5.

### **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) 2019 to FY2023 is \$32,500 as compared to the actual O&M cost of \$58,077 for the same period. The actual O&M costs over the last five years (Table L-3) are ~~slightly~~ higher than estimated costs primarily due to maintenance costs being underestimated.

## V. Progress Since Last Review

This is the ~~fourth~~ fifth 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 Phil Carter, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshaw, SRNS EC&ACP Post-Closure Lead, on August 3, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The RBPOPs and RUNKS OU was inspected by SRNS EC&ACP on July 13, 2023. No issues were identified during this inspection.

A site inspection of the RBPOPs and RUNKS OU was conducted by SRNS EC&ACP and USDOE personnel on December 14, 2023. No issues were identified for the RBPOPs and RUNKS OU during the inspection.

A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC personnel ~~will~~ be schedule after submittal of the revision 0 of this document was held on February 28, 2024. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of RBPOPs and RUNKS OU and ~~will~~ be ~~were~~ provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to be~~ were identified during the inspection.

Scheduled annual site inspections conducted from FY2019 through FY2023 identified several spots of thinning grass, shallow subsidence, 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 cleanup levels 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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~~ eight five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

**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

**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 / November 5, 2019

**Table L-2. RCOCs and Cleanup Levels for RBPOP and RUNKS OU Soil**

Subunit	RCOC	Type of COC	Cleanup Levels	Basis
RBPOPs and RUNKS	<i>Polycyclic aromatic hydrocarbons (mg/kg)</i>			
	Benzo(a)pyrene	HH	2.56E-01	Future Industrial Worker
	Dibenzo(a,h)anthracene	HH	2.56E-01	Future Industrial Worker
	<i>Radionuclides (pCi/g)</i>			
	Cesium-137	HH	1.12E-01	Future Industrial Worker
	Cobalt-60	HH	2.24E-02	Future Industrial Worker

**Table L-3. Actual versus Estimated O&M Costs**

	FY2019	FY2020	FY2021	FY2022	FY2023	Five-Year Total
Total Actual O&M Costs (\$)	17,565	6,925	7,148	9,873	16,566	58,077
Total ROD Estimated Direct O&M Costs (\$)*	3,500	3,500	3,500	3,500	18,500	32,500

\* 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 FY2023.

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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			
<b>Site Name:</b>	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	<b>Date of Inspection:</b>	07/13/2023
<b>Location and Region</b>	SRS, USEPA Region 4	<b>EPA ID:</b>	SEMS #38
<b>Agency, Office, or Company leading the Five-Year Review</b>	USDOE	<b>Weather/ Temperature</b>	91°F and sunny
<b>Remedy Includes:</b> <i>(Click all that apply)</i>			
<input type="checkbox"/> Landfill Cover/Containment <input checked="" type="checkbox"/> Access Controls <input checked="" type="checkbox"/> Institutional Controls <input type="checkbox"/> Groundwater Pump and Treatment <input type="checkbox"/> Other _____		<input type="checkbox"/> Surface Water Pump and Treatment <input type="checkbox"/> Monitored Natural Attenuation <input type="checkbox"/> Groundwater Containment <input type="checkbox"/> Vertical Barriers	
<b>Attachments:</b> <input type="checkbox"/> Inspection team roster attached <input type="checkbox"/> Site map attached			
II. INTERVIEWS <i>(Click all that apply)</i>			
EC&ACP Post Closure Waste Site			
<b>1. O&amp;M Site Manager:</b>	<u>George Joyner</u> (Name)	<u>Brian Hanshew</u> (Title)	<u>10/26/2018</u> (Date)
<b>Interviewed:</b>	<input type="checkbox"/> At Site	<input checked="" type="checkbox"/> At Office	<input type="checkbox"/> By Phone    Phone No.: <u>803-952-33244949</u>
<b>Problems/Suggestions:</b>	<input type="checkbox"/> Report Attached _____		
<b>2. O&amp;M Staff:</b>			
EC&ACP Post Closure Waste Site			
	<u>Richard Feagin</u> (Name)	<u>Phil Carter</u> (Title)	<u>08/03/2023</u> (Date)
<b>Interviewed:</b>	<input type="checkbox"/> At Site	<input checked="" type="checkbox"/> At Office	<input type="checkbox"/> By Phone    Phone No.: <u>803-952-4416</u>
<b>Problems/Suggestions:</b>	<input type="checkbox"/> Report Attached _____		
<b>3. Local Regulatory Authorities and Response Agencies</b> (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.			
<b>Agency:</b>	<u>N/A</u>		
<b>Contact:</b>	_____	_____	_____
	(Name)	(Title)	(Date)

**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 <i>(Click all that apply)</i>			
<b>1. O&amp;M Documents:</b>			
<input type="checkbox"/> O&M Manual	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> As-Built Drawings	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Maintenance Logs	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
Remarks: <u>Annual site inspections are performed per SRS procedure, <i>Waste Unit Inspection and Maintenance</i> (ER-SOP-019), <i>Field Inspection Checklist for RBPOPs and RUNKs OU</i> (ER-IDS-019-026).</u>			
<b>2. Health and Safety Plans (HASPs):</b>			
<input type="checkbox"/> Site-Specific Health and Safety Plans	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Contingency Plan/Emergency Response Plan	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
Remarks: <u>Routine O&amp;M activities do not require a Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.1201, <i>Hazardous Waste Operations</i>. A SSHASP is prepared if needed.</u>			
<b>3. O&amp;M and OSHA Training Records:</b> <input checked="" type="checkbox"/> Readily Available <input checked="" type="checkbox"/> Up to Date <input type="checkbox"/> N/A			
Remarks: <u>Training Records are complete and up to date per EC&amp;ACP training matrix.</u>			
<b>4. Permits and Service Agreements:</b>			
<input type="checkbox"/> Air Discharge Permit	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Effluent Discharge	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Waste Disposal; POTW	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Other Permits	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
Remarks: _____			
<b>5. Gas Generation Records:</b> <input type="checkbox"/> Readily Available <input type="checkbox"/> Up to Date <input checked="" type="checkbox"/> N/A			
Remarks: _____			
<b>6. Settlement Monument Records:</b> <input type="checkbox"/> Readily Available <input type="checkbox"/> Up to Date <input checked="" type="checkbox"/> N/A			
Remarks: _____			
<b>7. Groundwater Monitoring Records:</b> <input type="checkbox"/> Readily Available <input type="checkbox"/> Up to Date <input checked="" type="checkbox"/> N/A			
Remarks: _____			
<b>8. Leachate Extraction Records:</b> <input type="checkbox"/> Readily Available <input type="checkbox"/> Up to Date <input checked="" type="checkbox"/> N/A			
Remarks: _____			
<b>9. Discharge Compliance Records:</b>			
<input type="checkbox"/> Air	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Water (Effluent)	<input type="checkbox"/> Readily Available	<input type="checkbox"/> Up to Date	<input checked="" type="checkbox"/> N/A
Remarks: _____			
<b>10. Daily Access/Security Logs:</b> <input type="checkbox"/> Readily Available <input type="checkbox"/> Up to Date <input checked="" type="checkbox"/> N/A			
Remarks: _____			

### **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 following LUC objective is necessary to ensure protectiveness of the remedy:

- Preclude residential use of the area.

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 2023 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

A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC) ~~will be scheduled after submittal of the revision 0 of this document~~ was held on February 28, 2024. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of ~~CAOU-SRWU OU~~ and ~~will~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to be~~ were identified during the inspection.

Scheduled annual site inspections conducted from FY2019 through FY2023 identified the presence of fallen trees on the soil cover, a small tree near the fencing, overgrown vegetation, a small depression on the soil cover, faded signs that need to be replaced, and drainage erosion in the SW drainage ditch. 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

### **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 eighth~~ five-year review for SRS OUs with Native Soil Covers and/or LUCs is scheduled for ~~January~~ December 2029.

**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

An Explanation of Significant Difference for the Revision 1 Record of Decision Alternative Selection for the Wetland Area at Dunbarton Bay in Support of the Steel Creek IOU (U) was issued in August 2023 to expand the LUCs to include the SARA and additional ash to the east of the SARA in the form of signage and institutional controls (SRNS 2023b).

### **Basis for Taking Action**

The WADB ash deposition area begins on the south side of the PAB and extends in a southerly direction for approximately 762 m (2,500 ft) into Dunbarton Bay, one of many Carolina bays on the SRS. The area of ash deposition is approximately 15.4 ha (38 ac) with a total volume of approximately 61,332 m<sup>3</sup> (80,220 yd<sup>3</sup>) of ash (SRNS 2018a).

The primary source of contamination at the WADB is coal ash from the PAB and runoff from Outfall P-007. Arsenic, cesium-137 (+D), potassium-40, radium-226 (+D), and uranium-238 (+D) were identified as human health refined contaminants of concern (RCOCs) for both the future resident scenario and the future industrial worker scenario (Table N-2). Arsenic, cesium-137 (+D), potassium-40, radium-226 (+D) were identified as human health RCOCs for both the IOU onsite worker and the adolescent trespasser (Table N-2).

No ecological RCOCs and no CMC RCOCs were identified at the WADB. Additionally, there were no PTSM contaminants identified.

## **IV. REMEDIAL ACTIONS**

### **Remedy Selection**

As stated in the Record of Decision (ROD) (SRNS 2018b), the following remedial action objectives (RAOs) is identified for the WADB and is protective of the most likely receptor, the IOU onsite worker:

- Prevent the IOU onsite worker from exposure to RCOC contaminants in surface ash/soil exceeding 1.0E-06 risk or exceeding SRS background concentrations.

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

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

- Excavation of 16,820 m<sup>3</sup> (22,000 yd<sup>3</sup>) of ash and contaminated soil media from the boundary of the PAB to the edge of the 30-m (100-ft) buffer around the Dunbarton Bay and transporting the waste to an approved ex situ contaminant facility located off-SRS property; and
- Land Use Controls (LUCs) (access and deed restrictions/notifications) for soil/ash since the entire volume of waste will not be excavated and some materials are left in place at the Dunbarton Bay (wetland area).

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

- Prevent contact, removal or excavation of ash/contaminated soil media;
- Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playgrounds.
- Maintain the integrity of any current or future remedial system or monitoring system.

Figure N-3 shows the WADB as it looked in 1955. Figures N-4 and N-5 are current (2023) photos of the WADB.

### **Remedy Implementation**

Unexcavated portions of the WADB will be maintained as an industrial use area by implementation of the property record notices and restrictions and the LUCs.

LUCs were placed at the WADB and include the following:

- Signage at the WADB will be maintained to alert onsite workers to the presence of hazardous substances. The signs will also convey the restrictions of unauthorized personnel. Access control warning signs will be placed and maintained around the WADB to prevent unknowing entry and unrestricted use.
- Access controls and use restrictions for the IOU onsite 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.

Per the Explanation of Significant Difference for the Revision 1 Record of Decision Alternative Selection for the Wetland Area at Dunbarton Bay in Support of the Steel Creek IOU (U) (SRNS 2023b), the remedial action requires an expanded LUC boundary for the WADB beyond the initial LUC area established for Dunbarton Bay (Figure N-6).

The expanded LUC boundary for the WADB extends from Powerline Road to the 30-m (100-ft) buffer along the northern edge of Dunbarton bay. The LUC boundary maintains the previously designated LUC are within the 30-m (100-ft) buffer and within Dunbarton Bay. The entirety of the expanded LUC Boundary consist of approximately 16 ha (39 ac) (Figure N-6).

### **System Operations/Operation and Maintenance**

There are no systems in operation at the WADB. Surveillance is 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 WADB.

The operation and maintenance (O&M) cost associated with the selected remedy for the WADB includes the annual inspections, maintenance, and LUCs. Table N-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 2018b). The estimated O&M costs for Fiscal Year (FY) 2019 to FY2023 was \$20,750 for annual inspections, maintenance, and LUCs. Inspection on the WADB began in FY2023. The actual O&M cost for FY2019 to FY2023 is \$8,929. The actual costs are as expected considering only one year of O&M has been completed.

## V. PROGRESS SINCE LAST REVIEW

This is the first five-year remedy review for the WADB. 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 N-1; and
- Reviewed changes in standards and to-be-considered guidance.

### *Summary of Inspections and Interviews*

Interviews were conducted with Phil Carter, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Brian Hanshaw, SRNS EC&ACP Post-Closure Lead, on August 3, 2023 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The WADB was inspected by SRNS EC&ACP on July 6, 2023. No issues were identified during this inspection.

A site inspection of WADB was conducted by USDOE personnel on December 7, 2023. No issues were identified for the WADB during this inspection.

A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC ~~will be~~ scheduled after submittal of the revision 0 of this document ~~was held on February 28, 2024.~~ SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of WADB and ~~will be~~ were provided an opportunity to walk down the OU. The USEPA and SCDHEC elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems

regarding the protection of the remedy for this OU as implemented ~~are anticipated to~~  
~~be~~ were identified during the inspection.

Scheduled annual site inspections conducted in FY2023 identified overgrown vegetation. These findings were documented on the field inspections 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 WADB 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 WADB, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

The Land Use Control Implementation Plan for WADB governs LUC implementation, maintenance, monitoring, reporting, and enforcement (SRNS 2018a). 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 WADB. 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 WADB 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 as shown in Appendix B. The changes to the values for COCs at the WADB 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 ([https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern\\_.html](https://19january2021snapshot.epa.gov/fed-fac/emerging-contaminants-and-federal-facility-contaminants-concern_.html)) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitrosodimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these ~~listed~~ emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

**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 WADB from being protective.

**IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

There are no recommendations or follow-up action for WADB.

**X. PROTECTIVENESS STATEMENT(S)**

The remedy at WADB 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 and ash. All threats to the WADB

are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the WADB 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, t~~The next eight five-year review for SRS OUs with Operating Equipment is scheduled for ~~January~~ December 2029.

## 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, 2010. *Record of Decision Alternative Selection for the P-Area Operable Unit (PAOU) (U)*, SRNS-RP-2009-01368, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2018a. *Land Use Control Implementation Plan for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit (IOU) (U)*, SRNS-RP-2018-00479, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2018b. *Record of Decision Remedial Alternative Selection for the Wetland Area at Dunbarton Bay in Support of the Steel Creek Integrator Operable Unit (U)*, SRNS-RP-2013-00730, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *Post-Construction Report for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit (U)*, SRNS-RP-2020-00003, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2023a. *Addendum to the Revision 1 Land Use Control Implementation Plan for the Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit (U)*,

SRNS-RP-2023-00335, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2023b. *Explanation of Significant Difference for the Revision 1 Record of Decision Remedial Alternative Selection for the Wetland Area at Dunbarton Bay in Support of the Steel Creek Integrator Operable Unit (U)*, SRNS-RP-2022-00982, 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

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 Wetland Area at Dunbarton Bay*, ER-IDS-019-080, Inspection period FY2023 (annually)