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

Aiken, South Carolina

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SAVANNAH RIVER SITE • AIKEN, SOUTH CAROLINA

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Aiken, South Carolina

LIST OF ACRONYMS AND ABBREVIATIONS *(continued)*

msl	mean sea level
MZ	mixing zone
MZCL	mixing zone concentration limit
N/A	not applicable
NBN	no building number
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRDC	National Resources Defense Council
NTCR	non-time critical removal
O&M	operation and maintenance
ORWBG	Old Radiological Waste Burial Ground
OU	operable unit
PBRP	P-Area Burning/Rubble Pit (131-P)
PCE	tetrachloroethylene
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyl
ρCi/g	picoCuries per gram
ρCi/mL	picoCuries per milliliter
ρCi/L	picoCuries per liter
PCR	Post Construction Report
PRG	Preliminary Remediation Goal
PTSM	principal threat source material
Q	quarter
RAO	remedial action objective
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	remedial goal
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
RSL	regional screening level
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SEMS	Superfund Enterprise Management System
SRL	Savannah River Laboratory
SRLSB	Savannah River Laboratory Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)

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

SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SSHASP	site-specific health and safety plan
SVE	soil vapor extraction
SWP	southwest plume
TCE	trichloroethylene
TZ	transmissive zone
UAZ	upper aquifer zone
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USFS-SR	United States Department of Agriculture Forest Service – Savannah River
VOC	volatile organic compound
WSRC	Washington Savannah River Company
WSRC	Westinghouse Savannah River Company
yd	yards
yd^3	cubic yards

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

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

Basis for Taking Action

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

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

Remedial Actions

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

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

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 their implementation, and reference to the OU-specific land use control implementation plan (LUCIP) are described 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 soil cover.

Table 2 lists the remedial actions for each of the OUs in this five-year remedy review report. The remedial actions are described in greater detail in the OU-specific appendices (Appendix C through Appendix L). Table 3 provides a summary of the LUC objectives for the OUs with engineered cover systems.

Status of Implementation

The remedial actions listed in Table 2 have been implemented. LUCs are ongoing at all OUs discussed in this five-year remedy review. The status of all response actions or remedial actions for each of the engineered cover systems is discussed in greater detail in the OU-specific appendices (Appendix C though Appendix L). These actions include removal and remedial actions conducted prior to a final Record of Decision (ROD).

Systems Operation and Maintenance

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

The costs of the O&M activities for the individual OUs have been compiled as part of this five-year remedy review. As part of the process of selecting the most appropriate action for each OU, the cost of implementing each of the remedial alternatives was estimated and reported in the respective remedy decision documents. Table 4 compares the actual costs incurred at SRS OUs with engineered cover systems over the time period from fiscal year (FY) 2016 to FY2020 to the estimated costs from the remedy decision documents projected for the same time period. The review for the actual costs incurred (i.e., FY2016 to FY2020) is based on the time-period since the last review for these OUs was conducted in the Fifth Five-Year Remedy Review Report (SRNS 2018a). Site-specific details concerning costs incurred are included for each OU in Appendix C through Appendix L.

In support of the beneficial reuse of brownfield locations, the U.S. Department of Agriculture Forest Service – Savannah River (USFS-SR) began establishing pollinator habitats in 2019 within the boundaries of previously closed waste units located in M-Area, P-Area, R-Area, and T-Area where they will not interfere with existing cover systems or land use controls. Additionally, the USFS-SR also plants 100 acres of pollinator habitat annually at SRS, primarily along powerline rights-of-way. Other USFS-SR practices

include adjusted planning practices to encourage a more diverse plant population, and thinning of 3,500 acres of forest annually, which creates conditions more conducive to pollinator habitat.

III. PROGRESS SINCE LAST REVIEW

For the OUs evaluated in this review, the previous protectiveness statements from the Fifth Five-Year Remedy Review Report (SRNS 2018a) concluded that the remedies for these OUs were protective (Table 5). There were no recommendations from the Fifth Five-Year Remedy Review Report that impact the OUs with engineered soil covers evaluated in this report.

IV. FIVE-YEAR REMEDY REVIEW PROCESS

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

- Submitted a scoping summary to USDOE, USEPA, and SCDHEC on August 1, 2020 and conducted a scoping meeting on September 28, 2020. The USDOE, USEPA, and SCDHEC agreed to the scope and schedule of the remedy review report, which is discussed in the scoping summary;
- Publication of an announcement on October 8, 2020 that the USDOE is conducting the Sixth Five-Year Remedy Review in phases. The announcement stated that the third phased submittal will focus on OUs with engineered cover systems. The public was notified though mailings of *The Savannah River 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 annually 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, documentation (i.e., including RODs, Early Action RODs [EARODs], Interim RODs [IRODs], Explanation of Significant Differences), and 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 L;
- Confirmed protectiveness of the remedial actions through inspections and interviews. Cognizant personnel were interviewed as to the status and success of the current remedial systems. The results of the inspections and interviews are documented in the Site Inspection Checklist included with the OU-specific reports located in Appendix C through Appendix L;
- Reviewed changes in standards and to-be-considered guidance 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 the Section V (Technical Assessment) and 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 Sixth Five-Year Remedy Review Report for SRS OUs with Engineered Cover Systems.

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 to the SRS mailing list. The report will be made available to the public at four information repositories and online.

Data Review, Site Inspections, and Interviews

According to the data review, 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 the remedy selection are still valid for all OUs included in this report. No new information has come to light that calls into question the protectiveness of the remedies.

USEPA and SCDHEC are expected to perform site inspections of OUs with engineered cover systems prior to submittal of the Revision 1 report. The Revision 0 report ~~will be~~was submitted on ~~or before~~ December 17, 2020.

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 (Appendices C through L) are 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 engineered cover remedies and related activities are functioning as intended as demonstrated below.

Table 2. SRS OUs with Engineered Cover Systems

#	Appendix	Operable Unit	SEMS No.	Decision Document Issuance Year[a]	Remedial Action	Area Covered (acres)	LUCs (acres)
1	C	Central Shops Burning/Rubble Pits (631-1G/631-3G)	50	2003	Stormwater Management, LUCs	0.43	2.8
2	D	D-Area Burning/Rubble Pit (431-D/431-1D)	15	1997	LUCs	0.54	0.7
3	E	F-Area Hazardous Waste Management Facility (F-Area Seepage Basins [904-41G, 904-42G, 904-43G])	6	1993	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	7	10
4	F	Ford Building Seepage Basin (904-91G)	58	2002	Excavation, Consolidation, ~~Low Permeability~~Soil Cover, LUCs	0.22	0.3
5	G	H-Area Hazardous Waste Management Facility (H-Area Seepage Basins [904-44G, 904-45G, 904-46G, 904-56G])	7	1993	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	22	25
6	H	K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)	40	2001	Soil Cover, Groundwater Mixing Zone, LUCs	0.8	1.2
7	I	M-Area Hazardous Waste Management Facility (Lost Lake [904-51G] and M-Area Settling Basin [904-112G])	1	1992	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	2.4	4.5
8	J	Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)	2	1992	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	0.2	3.5
9	K	Mixed Waste Management Facility (643-28E)	33	1994	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	58	85
10	L	SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)	47	2000	Excavation, Offsite Disposal, LUCs	2.1	2.6

a Reflects the year the decision document (i.e., RODs, EARODs, IRODs, and ROD Amendments) was issued or the year of the last signature on the decision document.

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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)[a]	LUC Objectives[b]	Title of LUC Instrument Implemented and Date (or Planned)
Central Shops Burning/Rubble Pits (631-1G, 631-3G)	Soils~~, Groundwater~~	Yes	Yes	50	• Preclude residential use of the area • Prevent contact, removal, and excavation of the buried waste in the pits	WSRC 2005
D-Area Burning/ Rubble Pits (431-D, 431-1D)	Soils	Yes	Yes	15	• Prevent hypothetical future industrial workers from exposure to PCBs in surface and subsurface soils at concentrations exceeding target risk levels	WSRC 1998
F-Area Hazardous Waste Management Facility (F-Area Seepage Basins [904-41G, 904-42G, 904-43G])	Soils, Groundwater	Yes	Yes	6	• Preclude unauthorized access or intrusive activities	SCDHEC 2014
Ford Building Seepage Basin (904-91G)	Soils~~, Groundwater~~	Yes	Yes	58	• Maintain the use of the OU for industrial activities only • Prevent unauthorized access to the closed FBSB OU as long as the waste remains a threat to human health and environment • Preserve the cover and prevent disturbance of the dispositioned soil.	WSRC 2003a

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)[a]	LUC Objectives[b]	Title of LUC Instrument Implemented and Date (or Planned)
H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G)	Soils, Groundwater	Yes	Yes	7	• Preclude unauthorized access or intrusive activities	SCDHEC 2014
K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)	Soils, Groundwater	Yes	Yes	40	• Prevent contact, removal, or excavation of buried waste in the OU areas designated in the LUCIP and preclude future residential or agricultural use of the area • Prevent unauthorized access to groundwater	WSRC 2002b
M-Area Hazardous Waste Management Facility (Lost Lake [904-112G] and M-Area Settling Basin [904-51G])	Soils, Groundwater	Yes	Yes	1	• Restrict access to authorized personnel with appropriate training or applicable requirements • Preclude unauthorized access or intrusive activities	SCDHEC 2014
Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)	Soils, Groundwater	Yes	Yes	2	• Restrict access to authorized personnel with appropriate training or applicable requirements • Preclude unauthorized access or intrusive activities	SCDHEC 2014

Table 4. Operation and Maintenance Cost Comparison for SRS OUs with Engineered Cover Systems

Operable Unit	Main Remedy	Remedy Decision Document Year	FY2016-FY2020 O&M Estimated Cost	FY2016-FY2020 O&M Actual Cost	% of Estimate	Comments
Central Shops Burning/Rubble Pits (631-1G/631-3G)	Stormwater Management, LUCs	2003	$40,000	$124,868	312%	Actual costs are higher than estimated because estimated costs in the ROD did not fully include all O&M activities for site maintenance, inspections, and monitoring.
D-Area Burning/Rubble Pit (431-D/431-1D)	LUCs	1997	$3,000	$91,247	3,041%	Actual costs are higher than estimated because costs for annual inspections and cover system maintenance were not included in the ROD estimate.
F-Area Hazardous Waste Management Facility (F-Area Seepage Basins [904-41G, 904-42G, and 904-43G])	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1993	0	$226,658	N/A	No estimated costs were provided in the ROD for the RCRA unit.
Ford Building Seepage Basin (904-91G)	Excavation, Consolidation, ~~Low Permeability~~Soil Cover, LUCs	2002	$50,000	$40,252	81%	Actual costs are as expected.
H-Area Hazardous Waste Management Facility (H-Area Seepage Basins [904-44G, 904-45G, 904-46G, and 904-56G])	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1993	0	$701,044	N/A	No estimated costs were provided in the ROD for the RCRA unit.

Table 4. Operation and Maintenance Cost Comparison for SRS OUs with Engineered Cover Systems (continued/end)

Operable Unit	Main Remedy	Remedy Decision Document Year	FY2016-FY2020 O&M Estimated Cost	FY2016-FY2020 O&M Actual Cost	% of Estimate	Comments
K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)	Soil Cover, Groundwater Mixing Zone, LUCs	2001	$27,812	$97,494	351%	Actual costs are higher than expected because groundwater monitoring and reporting have continued longer than expected.
M-Area Hazardous Waste Management Facility (Lost Lake [904-51G] and M-Area Settling Basin [904-112G])	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1992	0	$237,953	N/A	No estimated costs were provided in the ROD for the RCRA unit.
Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1992	0	$559,614	N/A	No estimated costs were provided in the ROD for the RCRA unit.
Mixed Waste Management Facility (643-28E)	In Situ Stabilization/Solidification, RCRA Soil Cover, LUCs	1994	0	$1,272,185	N/A	No estimated costs were provided in the ROD for the RCRA unit.
SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)	Excavation, Offsite Disposal, LUCs	2000	$25,000	$68,752	275%	Actual costs are higher than expected because annual O&M costs were not included in the ROD estimate.

Table 5. Protectiveness Determination/Statements from the Fifth Five-Year Remedy Review for SRS OUs with Engineered Cover Systems (SRNS 2018a)

SEMS No.	Operable Unit	Protectiveness Determination	Protectiveness Statement
50	Central Shops Burning/Rubble Pits (631-1G, 631-3G)	Protective	The remedy at the CSBRP OU is protective of human health and the environment.
15	D-Area Burning/Rubble Pits (431-D, 431-1D)	Protective	The remedy at the DBRP OU is protective of human health and the environment.
6	F-Area Hazardous Waste Management Facility (F-Area Seepage Basins [904-41G, 904-42G, 904-43G])	Protective	The remedy at the FHWMF OU is protective of human health and the environment.
58	Ford Building Seepage Basin (904-91G)	Protective	The remedy at the FBSB OU is protective of human health and the environment.
7	H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G0	Protective	The remedy at the HHWMF OU is protective of human health and the environment.
40	K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)	Protective	The remedy at the KBRP/KRP OU is protective of human health and the environment.
1	M-Area Hazardous Waste Management Facility (Lost Lake [904-112G] and M-Area Settling Basin [904-51G])	Protective	The remedy at the MHWMF OU is protective of human health and the environment.
2	Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)	Protective	The remedy at the Met Lab HWMF OU is protective of human health and the environment.
33	Mixed Waste Management Facility (643-28E)	Protective	The remedy at the MWMF OU is protective of human health and the environment.
47	SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, 904-55G)	Protective	The remedy at the SRLSB OU is protective of human health and the environment.

Table 6. Operable Units without Issues and Recommendations in the Sixth Five-Year Remedy Review Report

OU(s) without Issues/Recommendations Identified in the Five-Year Review	
SEMS #:	1, 2, 6, 7, 15, 33, 40, 47, 50, 58

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

Issues and Recommendations Identified in the Five-Year Review				
SEMS #: N/A	**Issue Category:** N/A			
	Issue: None			
	Recommendation: None			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
N/A	N/A	N/A	N/A	N/A

N/A – Not Applicable

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 2016 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 2017).

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

The U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for Non-Radiological Constituents (May 2020), USEPA Preliminary Remediation Goals (PRGs) for Radionuclides (November 2019), and USEPA Maximum Contaminant Levels (MCLs) for radiological and chemical constituents were evaluated in this review. These values are identified as 2020 RSLs, 2020 PRGs, and MCLs in Tables B-1 through B-3 and were compared to the values available in 2016 when the last five-year remedy review for these OUs was initiated. Standards and toxicity values for both the industrial worker and hypothetical residential receptor are provided for comparative purposes for most media.

The comparison tables do not make any distinction between COCs that were the primary drivers for the selected remedial action and other analytes that were simply addressed through the same remedy. Most importantly, the values presented in Tables B-1 through B-3 are not cleanup levels and should not be considered remedial goals unless otherwise noted in the OU-specific remedy reviews. Therefore, the information in Appendix B is not standalone, but must be considered in

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

Changes to a standard or toxicity factor are unique to each analyte and are often related to revisions in exposure assumptions, reference doses, cancer potency factors, and exposure pathways used to calculate the value. For the reasons explained in the previous paragraph, the impact that more stringent RSLs or PRGs have on protectiveness must be considered with respect to the OU-specific remedy. In most cases, a change in a standard or toxicity value is irrelevant because the analyte(s) may no longer be present or is (are) significantly reduced if the selected remedy also included excavation and offsite disposal. In addition, exposure to contaminants ~~may be~~is controlled by an engineered ~~a~~ cover system and land use controls. Therefore, risk-based cleanup goals for each OU do not warrant revision as a result of changes to toxicity criteria, RSLs/PRGs, exposure factors/assumptions, or risk methodology, because the engineered cover system remedy is effective in eliminating the exposure pathways of concern. In addition, 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 December 2016, a major revision to the approach for calculating PRGs was announced by USEPA. The primary change was that the plus daughter (+D) isotopes designation was removed and the secular equilibrium PRG calculation was identified as the preferred (i.e., default) value. The PRGs for each daughter are combined with the parent on a fractional basis to produce a single PRG for the parent, and the resulting PRG is based on secular equilibrium of the full chain regardless of half-life. By comparison, the PRG (+D) values available in May 2016 only included daughter products with a half-life of six months or less. For this reason, the difference in the criteria for inclusion of the daughter products must be considered when comparing the 2016 and 2020 PRG values.

There are two entries for the 2020 PRGs in Table B-2. For each constituent, the top entry is the PRG for the individual radionuclide (i.e., no daughter products). The bottom entry (in parentheses) is the default secular equilibrium PRG that includes the subsequent daughter products from the entire decay chain. Differences between the 2016 and the 2020 PRGs for the +D analytes (radium-226, radium-228, thorium-228, uranium-235, uranium-238) are primarily due to the daughter

products considered in the calculation as described in the previous paragraph (6 month half-lives verses entire decay chain). The slight change to the cesium-137 and strontium-90 PRGs are due to implementation of updated soil gamma shielding factors.

In June 2017, the RSLs for polycyclic aromatic hydrocarbons (PAHs) were revised due to toxicity value changes based on a new Integrated Risk Information System (IRIS) profile. These include benzo(a)pyrene and chemicals with associated relative potency factors. Both the residential and industrial worker soil values increased by almost a full order of magnitude (i.e., less stringent). The revised RSLs are highlighted in orange in Table B-1.

The evaluation for each remedy to determine if exposure assumptions, toxicity data, cleanup levels, and remedial action objectives are still valid is discussed in each OU-specific review located in Appendix C through Appendix L. The evaluations shown in Tables B-1 through B-3 confirm that there have been no significant changes in standards or toxicity factors that would affect the protectiveness of the remedies evaluated in this report.

DOCUMENTS REVIEWED

SRNS, 2017. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Engineered Cover Systems (U)* Aiken, South Carolina, SRNS-RP-2016-00609, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

Analyte[a]	2016 RSLs[b]		2020 RSLs[c]		SEMS Number(s)[d]
	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	
Aluminum	7.7E+04	1.1E+06	7.7E+04	1.1E+06	1, 33
Arsenic	6.8E-01	3.0E+00	6.8E-01	3.0E+00	7, 15, 40, 58
Barium	1.5E+04	2.2E+05	1.5E+04	2.2E+05	6, 7, 33
Cadmium	7.1E+01	9.8E+02	7.1E+01	9.8E+02	6, 7, 33
Chloride	1.8E-01	7.8E-01	1.8E-01	7.8E-01	1
Chloroform	3.2E-01	1.4E+00	3.2E-01	1.4E+00	33
Chromium	3.0E-01	6.3E+00	3.0E-01	6.3E+00	6, 15, 47
Copper	3.1E+03	4.7E+04	3.1E+03	4.7E+04	6, 7
Cyanide	2.3E+01	1.5E+02	2.3E+01	1.5E+02	2, 6
1,1-Dichloroethane	3.6E+00	1.6E+01	3.6E+00	1.6E+01	33
1,2-Dichloroethylene (trans)	1.6E+03	2.3E+04	1.6E+03	2.3E+04	33
Dioxin (2,3,7,8-TCDD)	4.8E-06	2.2E-05	4.8E-06	2.2E-05	15
Iron	5.5E+04	8.2E+05	5.5E+04	8.2E+05	33
Lead	4.0E+02	8.0E+02	4.0E+02	8.0E+02	1, 6, 7, 33
Manganese	1.8E+03	2.6E+04	1.8E+03	2.6E+04	15, 33
Mercury	1.1E+01	4.6E+01	1.1E+01	4.6E+01	6, 7, 47
Nickel	1.5E+03	2.2E+04	1.5E+03	2.2E+04	1, 6, 7, 33
Nitrate	1.3E+05	1.9E+06	1.3E+05	1.9E+06	1, 2, 6, 7
Phenol	1.9E+04	2.5E+05	1.9E+04	2.5E+05	33
Phosphate	3.8E+06	5.7E+07	3.8E+06	5.7E+07	1
Polychlorinated biphenyls (PCBs)					
~Aroclor 1254	2.4E-01	9.7E-01	2.4E-01	9.7E-01	58
~Aroclor 1260	2.4E-01	9.9E-01	2.4E-01	9.9E-01	15
Polycyclic Aromatic Hydrocarbons (PAHs)					
~Benzo[a]anthracene	1.6E-01	2.9E+00	1.1E+00	2.1E+01	40, 50
~Benzo[b]fluoranthene	1.6E-01	2.9E+00	1.1E+00	2.1E+01	40, 50
~Benzo[a]pyrene	1.6E-02	2.9E-01	1.1E-01	2.1E+00	15, 40, 50
~Benzo[k]fluoranthene	1.6E+00	2.9E+01	1.1E+01	2.1E+02	40
~Dibenzo[a,h]anthracene	1.6E-02	2.9E-01	1.1E-01	2.1E+00	40, 50
~Indeno[1,2,3-cd]pyrene	1.6E-01	2.9E+00	1.1E+00	2.1E+01	40, 50
Sulfate	NA	NA	NA	NA	1, 2
Tetrachloroethylene (PCE)	2.4E+01	1.0E+02	2.4E+01	1.0E+02	1, 6, 7, 33
Trichloroethylene (TCE)	9.4E-01	6.0E+00	9.4E-01	6.0E+00	1, 6, 33
1,1,1, Trichloroethane	8.1E+03	3.6E+04	8.1E+03	3.6E+04	1
Vanadium	3.9E+02	5.8E+03	3.9E+02	5.8E+03	7
Zinc	2.3E+04	3.5E+05	2.3E+04	3.5E+05	6, 7, 33

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix L
b USEPA Nonradiological RSLs, May 2016.
c USEPA Nonradiological RSLs, May 2020.
d OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-5.

mg/kg = milligram per kilogram
Revised RSLs are highlighted in orange

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

Analyte[a]	2016 PRGs[b]		2020 PRGs[c]		SEMS Number(s)[d]
	Residential Soil (pCi/g)	Industrial Worker Soil (pCi/g)	Residential Soil (pCi/g)	Industrial Worker Soil (pCi/g)	
Actinium-228	7.35E+02	1.1E+03	7.4E+02 (1.0E-02)	1.1E+03 (1.5E-02)	47
Americium-241	2.27E+00	4.7E+00	2.3E+00 (5.2E-02)	4.7E+00 (8.4E-02)	6, 47
Carbon-14	3.17E+02	1.1E+03	3.2E+02 (3.2E+02)	1.1E+03 (1.1E+03)	7, 33
Cesium-137(+D)	6.05E-02	9.1E-02	2.5E+01 (4.6E-02)	5.7E+01 (6.9E-02)	6, 47, 58
Cobalt-60	3.30E-02	4.8E-02	3.3E-02 (9.4E-03)	4.8E-02 (1.4E-02)	6, 7, 47, 58
Curium-243	3.50E-01	5.4E-01	3.5E-01 (3.9E-02)	5.4E-01 (6.2E-02)	6, 47
Curium-244	8.76E+00	3.3E+01	8.8E+00 (9.8E-03)	3.3E+01 (1.5E-02)	6, 47
Europium-154	4.73E-02	7.0E-02	4.7E-02 (2.0E-02)	7.0E-02 (3.0E-02)	58
Iodine-129	2.75E+00	9.2E+00	2.8E+00 (2.8E+00)	9.2E+00 (9.2E+00)	7
Tritium (H-3)	2.37E-01	3.0E-01	2.4E-01 (1.3E-01)	3.0E-01 (1.6E-01)	6, 7, 33
Potassium-40	1.44E-01	2.2E-01	1.4E-01 (1.4E-01)	2.2E-01 (2.2E-01)	47
Lead-212	3.40E+03	5.0E+03	3.4E+03 (1.6E-02)	5.0E+03 (2.4E-02)	47
Neptunium-239	1.33E-01	2.0E-01	5.7E+02 (3.7E-02)	8.3E+02 (5.9E-02)	47
Plutonium-238	4.28E+00	1.4E+01	4.3E+00 (1.3E-02)	1.4E+01 (2.0E-02)	47
Plutonium-239	3.79E+00	1.2E+01	3.8E+00 (4.5E-02)	1.2E+01 (7.3E-02)	47
Radium-226(+D)	1.38E-02	2.1E-02	1.0E+00 (1.3E-02)	3.1E+00 (2.0E-02)	6, 7, 15
Radium-228(+D)	8.82E-02	1.3E-01	1.5E+00 (9.9E-03)	7.5E+00 (1.5E-02)	6, 7, 15, 47
Strontium-90(+D)	4.20E+00	9.0E+00	1.3E+01 (3.1E+00)	3.8E+01 (6.8E+00)	6, 7, 47
Technetium-99	1.13E+02	7.7E+02	1.1E+02 (1.1E+02)	7.7E+02 (7.7E+02)	6, 7
Thorium-228(+D)	2.80E+01[e]	1.1E+02[e]	2.8E+01 (1.6E-02)	1.1E+02 (2.4E-02)	47
Thorium-230	5.07E+00	1.8E+01	5.1E+00 (1.3E-02)	1.8E+01 (2.0E-02)	47
Thorium-232	4.67E+00	1.7E+01	4.7E+00 (9.9E-03)	1.7E+01 (1.5E-02)	47

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

Analyte[a]	2016 PRGs[b]		2020 PRGs[c]		SEMS Number(s)[d]
	Residential Soil (pCi/g)	Industrial Worker Soil (pCi/g)	Residential Soil (pCi/g)	Industrial Worker Soil (pCi/g)	
Uranium-233	5.63E+00	2.5E+01	5.6E+00 (8.9E-02)	2.6E+01 (1.5E-01)	1, 6, 7, 47
Uranium-234	5.83E+00	2.8E+01	5.8E+00 (1.3E-02)	2.8E+01 (2.0E-02)	1, 6, 7, 33, 47
Uranium-235(+D)	1.94E-01	3.0E-01	2.0E-01 (4.6E-02)	3.2E-01 (7.3E-02)	33, 47
Uranium-238(+D)	7.98E-01	1.4E+00	6.5E+00 (1.2E-02)	3.1E+01 (2.0E-02)	1, 6, 33

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix L
b USEPA Radiological PRGs, November 2014.
c USEPA Radiological PRGs, November 2019.
d OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-5.
e PRG shown for Thorium-228 only. PRG for Thorium-228 plus daughters (+D) was not published in the November 2014 and November 2019 updates.

pCi/g = picoCuries per gram
Revised RSLs are highlighted in orange

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

Analyte[a]	2016 RSL[b] (µg/L)	2020 RSL[c] (µg/L)	MCL (µg/L)[d]	SEMS Number(s)[e]
Tetrachloroethylene (PCE)	--	--	5	2, 40
Trichloroethylene (TCE)	--	--	5	2, 40

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix L
b USEPA Non-Radiological RSLs for tapwater, May 2016.
c USEPA Non-Radiological RSLs for tapwater, May 2020.
d Current MCL table is provided for reference only. Comparative analysis is not shown because MCLs have not changed since the previous five-year remedy review.
e OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-5.

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

System Operations/Operation and Maintenance

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

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

Table C-3 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 2002). The estimated O&M cost for fiscal year (FY) 2016 to FY2020 was $40,000 for site inspections and maintenance and LUCs. The actual O&M cost for FY2016 to FY2020 is $124,868. The O&M costs during the last five years (i.e., FY2016 to FY2020) have been higher than estimated because the estimated costs in the ROD did not fully include all O&M activities for site maintenance, inspections, and monitoring.

V. Progress since Last Review

The previous protectiveness statement concluded that implementation of institutional controls (i.e., LUCs) at the CSBRP OU is expected to remain protective of human health and the environment. Institutional controls (i.e., LUCs) and enhanced stormwater management have been implemented and are functioning properly. It is recommended that

water level measurements continue to be taken at the two piezometers (CSR 14PZ and CSR 17PZ).

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

Data Review

The improved stormwater management has been moderately effective in reducing the water level in Pit 631-3G. Generally, ~~R~~reduction of water elevation in Pit 631-3G since the stormwater management improvements were made indicate that the improvements have been working as designed. Data from two piezometers (CSR 14PZ and CSR 17PZ) sampled at CSBRP OU are shown in Figure C-5. Piezometer CSR 14PZ results indicate that water elevation increased above the bottom of the basin (3 m [10 ft]) due to 18 cm (7.1 in) of rain that fell during October 2015, 20.3 cm (7.99 in) of rain that fell in November 2018, and 25.3 cm (9.98 in) of rain that fell in February 2020. Piezometer CSR 17PZ has no water elevation measurements above the bottom of the basin. The increases in rainfall caused the water level increase of perched water in portions of Pit 631-3G. The increase in water levels was not of concern for the effectiveness of the remedy since the levels were temporary and PAHs are not miscible in water.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Phil Carter, EC&ACP Post-Closure Lead, on August 4, 2020 at the O&M organization offices. No issues were identified for the CSBRP OU during these interviews. The CSBRP OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) EC&ACP on July 21, 2020. No issues were identified during this inspection.

The CSBRP OU was inspected by SRNS EC&ACP and USDOE personnel on November 24, 2020. No issues were identified during this inspection.

A site inspection ~~will be~~was conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control personnel, accompanied by USDOE and SRNS personnel, via Microsoft Teams on March 16, 2021~~prior to submittal of the Revision 1 of this document~~. Photographs and drone videos were used to inspect the OU virtually. No~~It is anticipated that no~~ significant problems regarding this OU ~~will be~~were identified during the inspection.

Scheduled annual site inspections conducted from FY2016 through FY2020 identified the following issues: active ant mounds and overgrown vegetation. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

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

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

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

The Land Use Control Implementation Plan for the CSBRP OU, located in Appendix F of the PCR/CMIR/FRR, governs LUC implementation, maintenance, monitoring, reporting and enforcement of LUCs (WSRC 2005). The LUCs that are in place include physical access controls to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the CSBRP 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 Remedial Action Objectives still valid?

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

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

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

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

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

Figure C-4. Current Photo of CSBRP OU (2020)

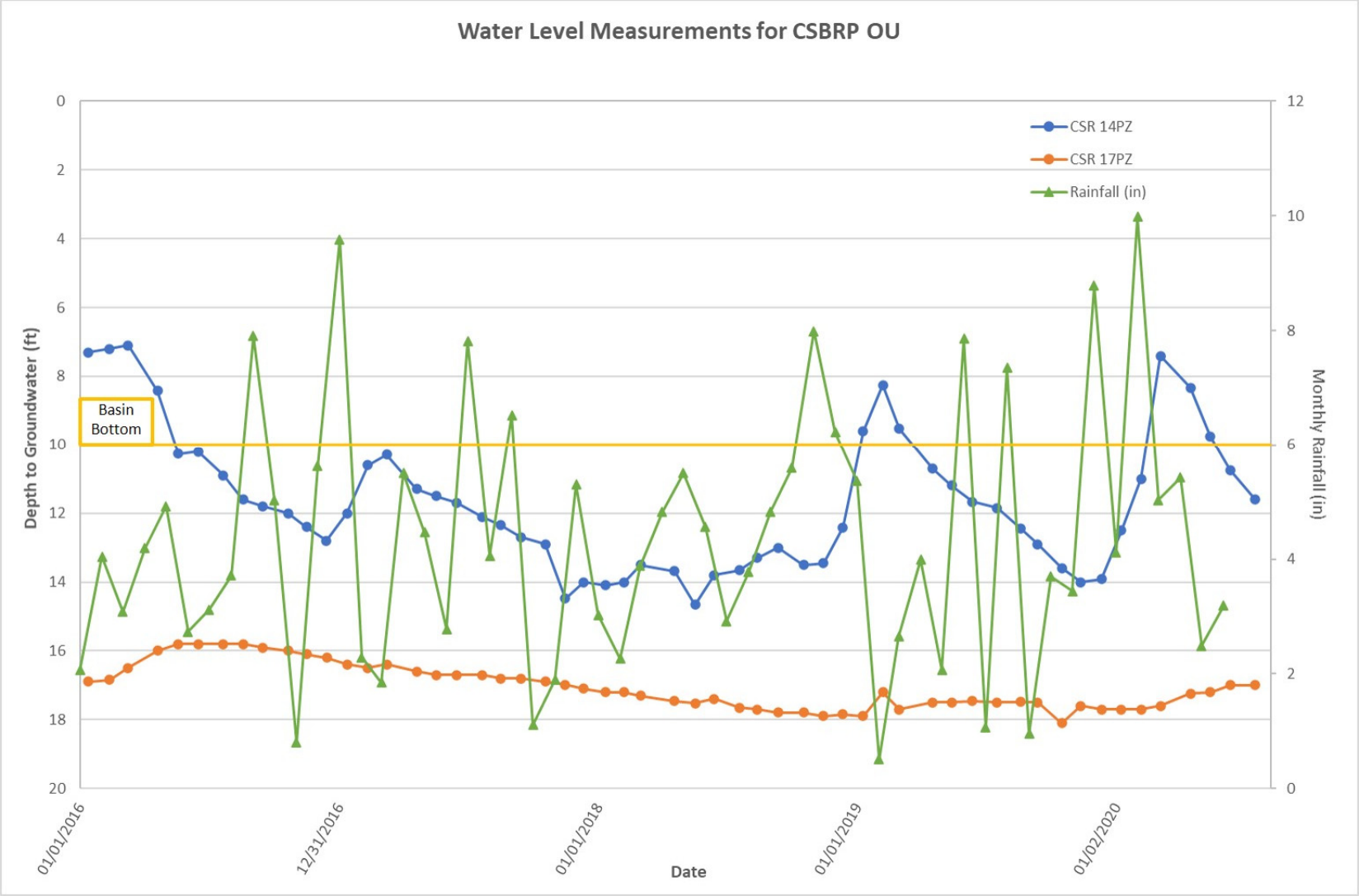

Figure C-5. Water Level Measurements from CSR 14PZ and CSR 17PZ (2016-2020)

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

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

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

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

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

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 11/24/2020 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

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

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

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

Remarks:

B. Other Site Conditions

Remarks: Inspections conducted from FY2016 through FY2020 identified active ant mounds and overgrown vegetation. All issues were resolved soon after discovery.

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

A. Landfill Surface

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

Areal extent _____ Depth _____

Remarks:

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

Lengths _____ Widths _____ Depths _____

Remarks:

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

Areal extent _____ Depth _____

Remarks:

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

Areal extent _____ Depth _____

Remarks:

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

Areal extent _____ Depth _____

Remarks:

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

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

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

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

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

Remedy Implementation

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

- Warning signs will be posted in the near term indicating that this area was used to manage hazardous materials;
- Existing SRS access controls will be used to maintain the use of this site for industrial use only;
- Institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements; and
- In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner in compliance with Section 120(h) of CERCLA that includes notification disclosing former DBRP OU waste management and disposal activities, results from groundwater monitoring, and

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

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

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

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

Table D-3 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 1997). The estimated O&M cost for fiscal year (FY) 2016 to FY2020 is $3000 for five-year remedy reviews. The actual O&M cost for FY2016 to FY2020 is $91,247 for annual site inspections and maintenance. The O&M costs during the last five years (i.e., FY2016 to FY2020) have been higher than estimated because annual costs inspections and cover system maintenance were not included in the ROD estimate.

V. Progress since Last Review

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

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

Data Review

A review of the groundwater monitoring program for the five-year period between 1998 and 2003, as summarized in Table D-4, indicated there were no exceedance of MCLs by any of the risk and hazard drivers. The data provides evidence of no appreciable leaching to groundwater of these chemicals. Based on the results of sampling over that five-year period, the U.S. Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) approved discontinuing sampling of groundwater for this OU in 2004.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 4, 2020 at the O&M organization offices. No issues were identified for the DBRP OU during these interviews. The DBRP OU was inspected by SRNS EC&ACP on July 21, 2020. No issues were identified during this inspection.

The DBRP OU was inspected by SRNS EC&ACP and USDOE personnel on November 24, 2020. No issues were identified during this inspection.

A site inspection ~~will be~~was conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control personnel, accompanied by USDOE and SRNS personnel, via Microsoft Teams on March 16, 2021~~prior to submittal of the Revision 1 of this document~~. Photographs and drone videos were used to inspect the OU virtually. No~~It is anticipated that no~~ significant problems regarding this OU ~~will be~~were identified during the inspection.

The field inspection frequency for the DBRP OU was changed from semiannual to annual in 2015. Scheduled annual inspections performed at the DBRP OU from FY2016 through FY2020 identified the following issues: active ant mounds, signs needing to be replaced, and evidence of hog damage. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

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

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

The Land Use Control Implementation Plan for the DBRP OU, located in Section 2.0 of the FRR, 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 contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the DBRP OU. Warning signs are in good condition, and no activities were observed that would have violated the LUCs. All LUC objectives are being met.

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

I. Introduction

This report is the sixth five-year review for the F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) (FHWMF) Operable Unit (OU). The review was conducted from July 2020 through December 2020. Contaminants have been left in place at the FHWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the FHWMF OU is protective of human health and the environment. This report documents the results of the review.

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

II. OU Chronology

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

III. Background

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

The groundwater is being addressed by the F-Area Groundwater OU and will be discussed in the five-year remedy review reports for the SRS OUs with operating equipment. Groundwater corrective actions are performed under the RCRA Hazardous and Mixed Waste Permit Renewal for SRS.

Physical Characteristics

The FHWMF is located in the central portion of SRS, approximately 8 km (5 mi) from the nearest site boundary (Figure E-1). The FHWMF consists of three unlined basins, F-1 (904-41G), F-2 (904-42G) and F-3 (904-43G) and the associated F-Area Inactive Process Sewer Line (FIPSL). Figure E-2 shows the site layout for the FHWMF. The dimensions and volumetric capacity of the basins were as follows:

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

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

The FIPSL that was used to convey wastewater to FHWMF is outside the scope of the FHWMF Record of Decision (ROD). The FIPSL RCRA closure action will be completed as part of the closure of the F-Area Tank Farm and Separations facility to avoid impacting underground and overhead interferences necessary to ensure safe operation of the F-Area facilities (SRNS 2016).

Land and Resource Use

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

Systems Operations/Operation and Maintenance

There are no system operational requirements associated with the cover system and land use controls (LUCs).

The following maintenance activities are ongoing:

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

Costs associated with the selected remedy for FHWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls (i.e., LUCs). The actual O&M cost during fiscal year (FY) 2016 to FY2020 is $226,658. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost data comparison is not provided in this remedy review.

V. Progress since Last Review

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

Per recommendation from the last five-year review, the field inspection frequency for the FHWMF OU was changed from monthly to quarterly (Q) in 2018.

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 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls;
- Ensured that all actions required under the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014) were implemented (i.e., routine inspections and maintenance to the soil covers and groundwater monitoring); and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 4, 2020 at the O&M organization offices. No issued were identified for the FHWMF OU during these interviews. The FHWMF OU was inspected by SRNS EC&ACP on July 21, 2020. No issues were identified during this inspection.

The FHWMF OU ~~is schedule to be~~was inspected by SRNS EC&ACP and USDOE personnel on December 15, 2020. ~~It is anticipated that no~~No issues ~~will be~~were identified during this inspection.

A site inspection ~~will be~~was conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control personnel, accompanied by USDOE and SRNS personnel, via Microsoft Teams on March 16, 2021~~prior to submittal of the Revision 1 of this document~~. Photographs and drone videos were used to inspect the OU virtually. No~~It is anticipated that no~~ significant problems regarding this OU ~~will be~~were identified during the inspection.

The field inspection frequency for the FHWMF OU was changed from monthly to quarterly in 2018. Scheduled monthly inspections (FY2016-1Q2018) and scheduled quarterly inspections (2Q2018-FY2020) performed at the FHWMF OU identified the following issues: active ant mounds, signs and subsidence markers needing to be replaced, overgrown vegetation, small animals burrowing under fencing, and rutting caused by mowing equipment. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy, in situ stabilization/solidification, RCRA soil cover with institutional controls (i.e., LUCs) is effective in preventing exposure to contaminant risk above 1E-06 risk levels and mitigating further migration of contaminants to groundwater and is functioning as intended.

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

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). The closure/post-closure requirements are discussed in the RCRA Permit Renewal Application for the F-Area Hazardous Waste Management Facility (F-Area HWMF) Postclosure (SRNS 2016). Therefore, a Land Use Control Implementation Plan is not required for this OU. The LUCs that are in place include physical access controls to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the FHWMF 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 Remedial Action Objectives still valid?

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

As the remedial work has been completed, the applicable standards set forth in the ROD (WSRC 1993) and the RCRA closure plan (WSRC 1991), associated with soils and basin sediments, have been met. Groundwater is being addressed by the F-Area Groundwater OU and will be discussed in the five-year remedy review reports for SRS OUs with operating equipments ~~for the F-Area Groundwater OU~~.

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 FHWMF OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

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

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

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

VIII. Issues

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

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by stabilization and placement of all contaminated materials under a low-permeability cap and institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated soil media and mitigating further migration of contaminants to groundwater. All threats to the FHWMF OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the FHWMF OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2027.

XII. Documents Reviewed

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

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

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

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

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

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

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

Various - Post-Closure Inspection F-Area Hazardous Waste Management Facilities 904-41G, 904-42G, 904-43G, ER-IDS-019-019, Inspection period FY2016 through FY2020 (monthly/quarterly)

The FBSB OU was inspected by SRNS EC&ACP and USDOE personnel on November 24, 2020. No issues were identified during this inspection.

A site inspection ~~will be~~was conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC) personnel, accompanied by USDOE and SRNS personnel, via Microsoft Teams on March 16, 2021. Photographs and drone videos were used to inspect the OU virtually. No ~~prior to submittal of the Revision 1 of this document. It is anticipated that no~~ significant problems regarding this OU ~~will be~~were identified during the inspections.

The field inspection frequency for the FBSB OU was changed from semiannual to annual in 2014. The USDOE submitted a letter (USDOE 2014) to USEPA and SCDHEC to reduce inspection frequencies from semiannual to annual for FBSB OU. USEPA and SCDHEC approved the request on October 2, 2014 and September 17, 2014, respectively. Scheduled annual inspections performed at the FBSB OU from FY2016 through FY2020 identified the following issues: active ant mounds. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Documents?

The remedy, excavation, consolidation, ~~low permeability~~common fill cover with LUCs, is effective in preventing exposure to contaminants above 1E-06 risk level and is functioning as intended.

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

The Land Use Control Implementation Plan for the FBSB OU, located in Appendix A of the Post-Construction Report/Corrective Measures Implementation Report/Final Remediation Report, governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2003). The LUCs that are in place include physical access controls to prevent unauthorized contact, removal or excavation or subsurface soils,

and restrictions to prevent disturbance of the FBSB 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 Remedial Action Objectives still valid?

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

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

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

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

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

VIII. Issues

There are no issues related to current site conditions or activities that could call into question the protectiveness of the remedy.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

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

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The selected remedy for the FBSB OU was excavation, consolidation, backfilling, ~~vegetative~~ common fill cover, and institutional controls (i.e., LUCs) to protect future industrial workers and terrestrial ecological receptors from exposure. Selected remedy for the FBSB OU is functioning as intended. There are no issues requiring corrective actions.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of semiannual/annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU) have been implemented. The O&M procedures are adequately maintaining the FBSB OU and the condition of the warning signs is good. When maintenance activities are identified during inspections (e.g., active ant mounds), repairs are scheduled and performed. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

End of Checklist

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

I. Introduction

This report is the sixth five-year review for the H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) (HHWMF) Operable Unit (OU). This review was conducted from July 2020 through December 2020. Contaminants have been left in place at the HHWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the HHWMF OU is protective of human health and the environment. The report documents the results of the review.

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

II. OU Chronology

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

III. Background

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

The groundwater is being addressed by the H-Area Groundwater OU and will be discussed in the five-year remedy review reports for SRS OUs with operating equipment. Groundwater corrective actions are performed under the RCRA Hazardous and Mixed Waste Permit Renewal for SRS.

Physical Characteristics

The HHWMF is located in the central portion of SRS, approximately 9.6 km (6 mi) from the nearest site boundary (Figure G-1). The HHWMF consists of four unlined basins, H-1 (904-44G), H-2 (904-45G), H-3 (904-46G) and H-4 (904-56G) and the associated H-Area Inactive Process Sewer Line (HIPSL) (Figure G-2).

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

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

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

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

Land and Resource Use

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

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

Systems Operations/Operation and Maintenance

There are no operational requirements for the cover system and LUCs.

The following maintenance activities are ongoing:

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

Costs associated with the selected remedy for HHWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls (i.e., LUCs). The actual O&M cost during fiscal year (FY) 2016 to FY2020 is $701,044. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost data comparison is not provided in this remedy review.

V. Progress since Last Review

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

Per recommendation from the last five-year review, the field inspection frequency for the HHWMF OU was changed from monthly to quarterly (Q) in 2018.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 4, 2020 at the O&M organization offices. No issued were identified for the HHWMF during these interviews. The HHWMF OU was inspected by SRNS EC&ACP on July 21, 2020. No issues were identified during this inspection.

The HHWMF OU ~~is scheduled to be~~was inspected by SRNS EC&ACP and USDOE personnel on December 15, 2020. ~~It is anticipated that no~~No issues ~~will be~~were identified for the HHWMF during this inspection.

A site inspection ~~will be~~was conducted by U.S. Environmental Protection Agency (USEPA) and SCDHEC personnel, accompanied by USDOE and SRNS personnel, ~~prior to submittal of the Revision 1 of this document. It is anticipated that no~~ via Microsoft Teams on March 16, 2021. Photographs and drone videos were used to inspect the OU

virtually. No significant problems regarding this OU ~~will be~~was identified during the inspections.

The field inspection frequency for the HHWMF was changed from monthly to quarterly in 2018. Scheduled monthly inspections (2016-1Q2018) and quarterly inspections (2Q2018-FY2020) performed at the HHWMF OU identified the following issues: active ant mounds, signs and subsidence markers needing to be replaced, overgrown vegetation, small animals burrowing under fencing, and rutting caused by mowing equipment. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy, in situ stabilization/solidification, RCRA soil cover with institutional controls (i.e., LUCs) is effective in preventing exposure to contaminant risk above 1E-06 risk levels and mitigating further migration of contaminants to groundwater and is functioning as intended.

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

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). The closure/post-closure requirements are discussed in the RCRA Permit Renewal Application for the H-Area Hazardous Waste Management Facility (H-Area HWMF) Postclosure (SRNS 2016). Therefore, a Land Use Control Implementation Plan is not required for this OU. The LUCs that are in place include physical access controls to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the HHWMF 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 Remedial Action Objectives still Valid?

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

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

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 HHWMF OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

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

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

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

VIII. Issues

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

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by stabilization and placement of all contaminated materials under a low-permeability cap and institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated soil media and mitigating further migration of contaminants to groundwater. All threats to the HHWMF OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the HHWMF OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2027.

XII. Documents Reviewed

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

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

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

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

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

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

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

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

Various - *Post-Closure Inspection H-Area Hazardous Waste Management Facilities 904-45G, 904-46G, 904-56G*, ER-IDS-019-021, Inspection period FY2016 through FY2020 (monthly/quarterly)

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*		
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A
H. Retaining Walls	☐ Applicable	☒ N/A
I. Perimeter Ditches/Offsite Discharge	☒ Applicable	☐ N/A

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

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

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

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks: The drainage ditches at Basin H4 (904-56G) have been relined with concrete.

VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☒ N/A

X. OTHER REMEDIES

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

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

Attachment G-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G) OU *(continued)*

XI. OVERALL OBSERVATIONS
1. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Closure of the four basins (904-44G, 904-45G, 904-46G, and 904-56G) by dewatering, physically and chemically stabilizing the remaining waste, and placement of a low permeability cap has met the remedial objectives of preventing physical exposure to contaminants and mitigating further migration of contaminants to the groundwater. Selected remedy for the HHWMF OU is functioning as intended. There are no issues requiring corrective actions for the cover system and LUCs.
2. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of site inspections and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the HHWMF OU and the condition of the warning signs is good. When maintenance activities are identified during inspections (e.g., treating ant mounds, vegetation removal), repairs are scheduled and performed. There are no issues requiring corrective actions for the cover system and LUCs.
3. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
4. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

End of Checklist

rocks, and dirt that were discovered near the soil removal area. Confirmatory sampling verified no COCs remained in the soil removal area (WSRC 2002).

- Installed a 0.6 m (2-ft) thick minimum common fill soil cover over KBRP/KRP OU per South Carolina Regulation 61-107, 11, Part IV, Subtitle G using conventional and commercially available earth-moving equipment. The soil cover system covers 0.3 hectares (0.8 acres) per the Post Construction Report (PCR) (WSRC 2002).
- Implemented LUCs for 0.47 hectares (1.15 acres) and posted warning signs at the perimeter of KBRP/KRP OU.
- Installed groundwater monitoring wells and established a long-term groundwater monitoring program for MNA to ensure maximum groundwater mixing zone (GMZ) concentration limits are not exceeded per the groundwater mixing zone application (GMZA) (WSRC 1999b). The following changes listed below have been made to the monitoring network and sampling since the development of the GMZA. Changes have been documented within the various annual groundwater reports.
- Additional cone penetrometer technology data collected in 2002 indicated that the compliance boundary well KRP 7 would likely exceed the MCLs for PCE and TCE and was not suitable as a compliance boundary well. The KRP cluster (KRP 14D and KRP 14C) was proposed and accepted as new compliance boundary wells installed further downgradient of KRP 7.
- Later in 2002, PCE and TCE exceeded MCLs in one well (KRP 14D), a compliance boundary well. Since the number of exceedances was small; the USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) directed SRS to do a moderate corrective action plan. The plan included continued quarterly sampling in the GMZ network and the installation of the KRP 15 well cluster (WSRC 2003).
- In 2004, it was again reported that well KRP 14D exceeded the MCL for TCE. The USDOE, USEPA, and SCDHEC agreed that it would not be feasible to pursue the contamination beyond KRP 14 because the plume was migrating toward the congested

subsurface of the K-Reactor facility and could merge with the additional uncharacterized plumes associated with K Area. Per USEPA, SCDHEC and USDOE agreement, the KRP 14 cluster (KRP 14D and KRP 14C) was removed from the monitoring network. It was further agreed that the GMZA would not be modified, no additional modeling was needed, and no additional monitoring wells needed to be installed. Well KRP 7 was designated as the new compliance boundary well.

- In 2006, the USEPA, SCDHEC and USDOE agreed to reduce the sampling frequency from quarterly to semiannual ~~to quarterly~~ due to steady or declining concentration trends, and compliance boundary wells being considerably below MCLs. USEPA, SCDHEC, and USDOE also approved the reduction of the analytical list from all of the Method 8260 analytes to only PCE, TCE, and their daughter products (vinyl chloride, 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene).
- In 2012, the USEPA, SCDHEC, and USDOE agreed to reduce the sampling frequency at KBRP/KRP OU from semiannually to annually due to steady or declining concentration trends and compliance boundary wells being considerably below MCLs. Sampling of the four Lower Aquifer Zone (LAZ) wells and three Transmissive Zone (TZ) wells was also suspended due to contamination remaining in one or two upper aquifer zone (UAZ) wells. It was also agreed that water levels will continue to be collected from the three suspended TZ wells to provide data for mapping the potentiometric surface of the TZ. Sampling of water levels in the LAZ wells will remain suspended (SRNS 2012a).

System Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs);

- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit); and
- Sampling of the GMZA monitoring wells. The MNA monitoring program verifies the natural decrease of contaminant concentrations in the groundwater to levels below MCLs for PCE and TCE. Sampling will continue until MCLs have been attained, the MNA has achieved its RAOs, and the remedial action is complete. The results were reported via annual effectiveness monitoring reports since 2003. Starting in 2008, the monitoring results for KBRP/KRP OU were combined with the L-Area Burning Rubble Pit (131-L) (LBRP) OU and P-Area Burning/Rubble Pit (131-P) (PBRP) OU monitoring reports into a single abbreviated annual groundwater data summary, with full detailed reports every five years (USDOE 2008). The first five-year detailed report was submitted in June 2012 (SRNS 2012b) followed by the second report submitted in June 2017 (SRNS 2017). The next five-year detailed report is to be submitted in June 2022. LBRP was removed from the reports starting in 2018 due to achieving its remedial goals (RGs). For KBRP/KRP OU, the MNA remedy was expected to reduce groundwater concentrations to below MCLs by 2005 due to the processes of advection and dispersion (WSRC 1999c). However, contaminant concentrations did not decrease below MCLs until 2016. Groundwater monitoring is still ongoing at KBRP/KRP OU to ensure concentrations remain below the MCLs.

Table H-3 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 2000). The estimated O&M cost for fiscal year (FY) 2016 to FY2020 was $27,812 for inspections, maintenance, GMZA monitoring, and institutional controls (i.e., LUCs). The actual O&M cost for FY2016 until FY2020 is $97,494. The actual O&M costs are higher than expected because groundwater monitoring and reporting have continued longer than expected.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedy of a soil cover over the KBRP/KRP OU with institutional controls (i.e., LUCs) and MNA for the groundwater at

the KBRP/KRP OU is protective of human health and the environment. Since the last five-year remedy review for the KBRP/KRP OU, groundwater contaminants have diminished to concentrations below their respective MCLs. Groundwater monitoring remains in place until it is agreed that the RGs have been met, and that groundwater is no longer a threat to human health and the environment. The soil cover with institutional controls (i.e., LUCs) also remains in place. The current remedy is functioning as intended.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Reviewed the groundwater monitoring data (Table H-4);
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment H-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Annual groundwater reports or data summaries have been submitted for the KBRP/KRP OU since 2003 and were thoroughly reviewed for this Five-Year Remedy Review. An agreement with the USEPA, SCDHEC, and USDOE was reached in 2008 to combine the reports for KBRP/KRP OU, LBRP OU, and PBRP OU into an annual groundwater monitoring data summary letter with a detailed groundwater report every fifth year beginning June 30, 2012 (USDOE 2008). LBRP OU was removed from the reports starting in 2018 due to achieving its RGs. The last detailed report was submitted in June 2017. The report included time-series plots of PCE and TCE at each station, a plume map, and a comprehensive review of the monitoring activities and monitoring results from 2016 (SRNS 2017). Contaminant concentrations in all KBRP/KRP OU wells were observed

below MCLs as discussed in the last detailed report. Data summary letters submitted from 2018 to present (SRNS 2018, SRNS 2019, SRNS 2020) show that concentrations continue to remain below the MCLs in all wells except for a small increase in PCE and TCE at one well, KRP 9, in 2018 (Figure H-5). PCE and TCE concentrations in well KRP 9 were below MCLs in 2019.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 4, 2020 at the O&M organization offices. No issues were identified for the KBRP/KRP OU during these interviews. The KBRP/KRP OU was inspected by SRNS EC&ACP on July 28, 2020. No issues were identified during this inspection.

The KBRP/KRP OU ~~is scheduled to be~~was inspected by SRNS EC&ACP and USDOE personnel on December 15, 2020. ~~It is anticipated that no~~No issues ~~will be~~were identified during this inspection.

A site inspection ~~will be~~was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, ~~prior to submittal of the Revision 1 of this document. It is anticipated that no~~ via Microsoft Teams on March 16, 2021. Photographs and drone videos were used to inspect the OU virtually. No significant problems regarding this OU ~~will be~~were identified during the inspection.

The field inspection frequency for the KBRP/KRP OU was changed from semiannual to annual in 2015. Scheduled inspections conducted from FY2016 through FY2020 identified the following issues: active ant mounds, signs needing to be replaced, and hog damage on soil covers. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The soil cover, groundwater mixing zone, and LUC remedy, is effective in preventing exposure to contaminants above 1E-06 risk level and is functioning as intended as demonstrated below:

- The soil cover continues to protect present and future industrial workers from unacceptable exposures to PAHs in soil at the KBRP/KRP OU, and arsenic in soil at the KRP;
- LUCs (including institutional controls) are continuing to prevent human exposure to contaminated soils and groundwater; and
- The MNA program and monitoring well network provides sufficient data to assess the progress of natural attenuation within the groundwater. MNA is preventing further degradation of groundwater and has returned it to levels below MCLs. Core plume contaminant levels, as seen in well KRP 9, have diminished below MCLs in the last few years, except during 2018 when a slight increase in concentrations were observed (Figure H-5). Groundwater contamination persisted longer than originally expected due to reductions in dispersion and groundwater recharge, as well as possible increases in the sorption of contaminants. The VOC plume has not increased in areal size or migrated below the uppermost aquifer zone. Based on the annual monitoring reporting, the requirements of the GMZ are being satisfied. All groundwater monitoring results are below mixing zone contaminant levels (MZCLs) and MCLs as shown in Table H-4.

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

The Land Use Control Implementation Plan for KBRP/KRP OU is located in Appendix D of the PCR and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2002). The LUCs that are in place include physical access controls to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the KBRP/KRP 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 Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of final remedy selection are still valid. The MCLs for PCE and TCE have remained the same since the remedies were implemented (Appendix B). There have been no changes in standards or physical conditions of the KBRP/KRP 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 KBRP/KRP OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

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

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

No other 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 prevent the remedy from being protective for this OU.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The remedy at KBRP/KRP OU is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to the KBRP/KRP OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the KBRP/KRP OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2027.

XII. Documents Reviewed

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

SRNS, 2012a. *K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-3L, and 131-2L) (LBRP), and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units (OUs) Detailed Combined*

Groundwater Monitoring Report (U), SRNS-RP-2012-00200, Revision 1, December 2012, Savannah River Site, Aiken, SC

SRNS, 2012b. *K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-3L, and 131-2L) (LBRP), and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units (OUs) Detailed Combined Groundwater Monitoring Report (U)*, SRNS-RP-2012-00200, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2017. *K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-3L, and 131-2L) (LBRP), and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units (OUs) Detailed Combined Groundwater Monitoring Report (U)*, SRNS-RP-2017-00356, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2018. *Submittal Letter for the 2017 K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP) and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units Combined Groundwater Monitoring Report (Sampling Summary), CERCLIS Numbers: 40 and 59*, SRNS-J2000-2018-00359, June 2018, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2019. *Submittal Letter for the 2018 K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP) and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units Combined Groundwater Monitoring Report (Sampling Summary), CERCLIS Numbers: 40 and 59*, SRNS-J2000-2019-00396, June 2019, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *Submittal Letter for the 2019 K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP) and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units Combined Groundwater Monitoring Report (Sampling Summary), CERCLIS Numbers: 40 and 59*, SRNS-J2000-2020-00379, June 2020, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

USDOE, 2008. *Submittal of the Proposal to Standardize Sampling and Reporting Requirements of Groundwater Data for P, L, and K Area Burning/Rubble Pit Operable Units, CERCLIS Numbers 59, 56, 40*, ACP-08-133, January, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1998. *RCRA Facility Investigation/Remedial Investigation Report with the Baseline Risk Assessment for the K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-97-442, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

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

WSRC, 1999b. *Groundwater Mixing Zone Application for the K-Area Burning/Rubble Pit and Rubble Pile*, WSRC-RP-98-4084, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999c. *Groundwater Flow and Solute Transport Modeling Report for the K-Area Burning/Rubble Pit and Rubble Pile*, WSRC-RP-98-5052, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000. *Record of Decision Remedial Alternative Selection for the K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-97-862, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2002. *Post-Construction Report (PCR) for the K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-2002-4095, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Comparison of Groundwater Monitoring Data with Modeling Predictions for the K-Area Burning/Rubble Pit and Rubble Pile Groundwater Contamination and Plan*

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

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

2. Health and Safety Plans (HASPs):

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

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.120, HAZWOPER.

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

Attachment H-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: _____

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

A. Fencing

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

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

B. Signs

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

Remarks: Signs and monuments are in good condition.

M-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-51G AND 904-112G) OPERABLE UNIT

I. Introduction

This report is the fifth five-year review for the M-Area Hazardous Waste Management Facility (904-51G and 904-112G) (MHWMF) Operable Unit (OU). The review was conducted from July 2020 through December 2020. Contaminants have been left in place at the MHWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the MHWMF OU is protective of human health and the environment. This report documents the results of the review.

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

II. OU Chronology

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

III. Background

MHWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the MHWMF OU is soil. Groundwater is not addressed under this OU. Per the Interim Action Record of Decision (IROD) (WSRC 1992), the MHWMF groundwater is being addressed under the A/M Area Groundwater OU and will be discussed in the five-year remedy review

reports for SRS OUs with operating equipment. Groundwater corrective actions are performed under the RCRA Hazardous and Mixed Waste Permit Renewal for SRS.

Physical Characteristics

The MHWMF is located in M Area near the northwest edge of SRS (Figure I-1). The nearest site boundary is approximately 1,740 m (5,800 ft) northwest of this OU. The MHWMF has been designated as a source-specific OU within the A/M Area Fundamental Study Area. The MHWMF consists of an unlined surface impoundment known as the M-Area Settling Basin (904-51G) (MASB), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina Bay known as the Lost Lake (904-112G) (Figure I-2).

The MASB dimensions were approximately 99 m (325 ft) by 84 m (276 ft) (surface dimensions) by 5.1 m (17 ft) deep with a volumetric capacity of approximately 30.3 million liters (8 million gal). Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake.

Land and Resource Use

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

History of Contamination

The MASB was constructed in 1958 to settle out metals (primarily uranium, nickel, lead, and aluminum) discharged from M-Area manufacturing facilities for nuclear fuel components and research facilities. The manufacturing processes consisted of aluminum-forming and metal-finishing processes used to produce fuel and targets for the SRS reactors. Waste effluents were discharged from three production buildings and two support

laboratories to the MASB through an underground process sewer line. Cracks in the sewer line allowed some of the effluent to leak into the ground, contaminating underlying soils. The pipeline was slip-lined in 1983 after the cracks were discovered. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the MASB were discontinued.

The volume of waste within the MASB was estimated to be 28,920 m^3 (37,800 yd^3). The volume of contaminated soils and dried sludge in the overflow ditch, seepage area, process sewer line, and Lost Lake was estimated to be 30,370 m^3 (39,700 yd^3).

Initial Response

Contamination was detected in groundwater, surface water, soil, sediments, and air and evaluated in a 1985 risk analysis, which was used to develop closure alternatives. Closure of the MHWMF OU was initiated in 1988. The MHWMF OU was closed by removal and treatment of any standing water remaining in the basin; discharge of effluent to the National Pollutant Discharge Elimination System permitted M-04 Outfall; excavation, dewatering, and stabilization of the basin sludge with Portland cement; placement, consolidation, and compaction of stabilized sludge in the basin; excavation of a portion of the process sewer line and the contaminated soils associated with the sewer line, drainage ditch, seepage area, and Lost Lake; placement and compaction of contaminated materials in the basin; construction of a low permeability cap over the MASB and restoration of the area. The drainage ditch soils were excavated and stabilized with cement in the basin during closure activities.

The MHWMF was ~~certified~~ closed in accordance with the Closure Plan for M-Area Settling Basin and Vicinity at the Savannah River Plant (DPSPU-84-11-11, July 1990) and was certified closed in 1990 and was accepted by the South Carolina Department of Health and Environmental Control (SCDHEC) in 1991 as being in compliance with RCRA requirements.

Basis for Taking Action

The MHWMF was subject to closure under South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79-265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (SRNS ~~2000~~2020). Per the approved 2014 RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014), post-closure care is regulated under SCHWMR R.61-79-264. In addition, an ongoing program of corrective action and groundwater monitoring at the MHWMF is administered through the 2014 RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014).

Characterization efforts prior to the IROD (WSRC 1992) indicated contamination was present in basin surface water, basin soil, basin sludge, overflow ditch soils/sediments, seepage area soils/sediments, and Lost Lake soils/sediments. The major contaminants identified were nitrate as nitrogen, phosphate, sulfate, chloride, sodium, aluminum, nickel, uranium, lead, trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane (SRNS ~~2000~~2020).

IV. Remedial Actions

Remedy Selection

As stated in the IROD (WSRC 1992), the remedial action objectives (RAOs) are to prevent the physical exposure to contaminants and mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The MHWMF RCRA preventative action of stabilization and placement of all contaminated material under a low-permeability cap satisfied both RAOs.

As stated in the IROD, the selected interim action remedy is the previous MHWMF RCRA preventative action of stabilization and placement of all contaminated materials under a low-permeability cap. Since the preventative action is protective to human health and the environment and satisfies CERCLA requirements, no further action under CERCLA is necessary for this source control OU.

zone near the MASB~~,~~. To address the vadose zone contamination, eight MicroBlowers™ and two BaroBalls™ were installed along the M-Area Abandoned Process Sewer Line in 2020. Additional characterization of the vadose zone in this area will also be conducted to determine the full extent of contamination. A new recovery well was installed southeast of the MASB to capture a high concentration VOC groundwater plume. The new recovery well became operational in 2020. Both of these corrective actions were ~~which will require additional corrective action to be~~ taken under the direction of the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014). These corrective actions are discussed as part of the A/M-Area Groundwater OU in the five-year remedy review reports for the SRS OUs with operating equipment.

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 4, 2020 at the O&M organization offices. No issues were identified for the MHWMF during these

interviews. The MHWMF OU was inspected by SRNS EC&ACP on July 14, 2020. No issues were identified during this inspection

The MHWMF OU was inspected by SRNS EC&ACP and USDOE personnel on November 24, 2020. No issues were identified for the MHWMF OU during this inspection.

A site inspection ~~will be~~was conducted by U.S. Environmental Protection Agency (USEPA) and SCDHEC personnel, accompanied by USDOE and SRNS personnel, ~~prior to submittal of the Revision 1 of this document. It is anticipated that no~~via Microsoft Teams on March 16, 2021. Photographs and drone videos were used to inspect the OU virtually. No significant problems regarding this OU ~~will be~~were identified during the inspection.

Scheduled quarterly site inspections conducted from FY2016 to FY2020 identified the following issues: overgrown vegetation, active ant mounds, hog damage on the soil cover, signs needing to be replaced, and evidence of small animals burrowing. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy, in situ stabilization/solidification, RCRA soil cover with institutional controls (i.e., LUCs), is effective in preventing exposure to contaminant risk above 1E-06 risk levels and mitigating further migration of contaminants to groundwater and is functioning as intended.

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

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). The closure/post-closure requirements are discussed in the RCRA

Permit Renewal Application for the M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities (M-Area and Met Lab HWMF) Postclosure (SRNS 2020). Therefore, a Land Use Control Implementation Plan is not required for this OU.

The LUCs that are in place include physical access controls to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the MHWMF OU. Warning signs are in good condition, and no activities were observed that would have violated LUCs. All LUC objectives are being met.

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

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

The applicable or relevant and appropriate requirements (ARARs) discussed in the IROD (WSRC 1992) for this limited action focus on the design and construction of the remedial action which was completed in 1990. Based on the review of this OU, the requirements of the ARAR that sets forth the performance standards for the cover system (i.e., long-term minimization of migration of contaminants, function with minimum maintenance) continue to be met.

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 MHWMF OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

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

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

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

VIII. Issues

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

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by stabilization and placement of all contaminated materials under a low-permeability cap and institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated soil media and mitigating further migration of contaminants to groundwater. All threats to the MHWMF OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the MHWMF OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2027.

XII. Documents Reviewed

Du Pont, 1990. *Closure Plan for the M-Area Settling Basin and Vicinity at the Savannah River Plan*, DPSPU 94-11-11, E.I. du Pont de Nemours & Company, Savannah River Plant, Aiken, SC

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

SCDHEC, 2014. *South Carolina Department of Health and Environmental Control Hazardous and Mixed Waste Permit, Permit Number SC1 898 008 989, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, Module III - Postclosure Care and Module IV – Groundwater Requirements, Section A, M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC

~~SRNS, 2000. *2000 RCRA Part B Permit Renewal Application (U), Volume III, M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities (M-Area and Met Lab HWMFs) Postclosure*, WSRC-IM-98-30, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC~~

SRNS, 2020. *2013 RCRA Permit Renewal Application (U), Volume III, M-Area Metallurgical Laboratory Hazardous Waste Management Facilities (M-Area and Met Lab HWMFs) Postclosure*, SRNS-IM-2012-00002, latest revision, 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, 1992. *Interim Action Record of Decision Remedial Alternative Selection M-Area Hazardous Waste Management Facility Operable Unit*, WSRC-RP-92-743, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

Various - *Inspection Data Sheets – Field Inspection Checklist, M-Area HWMF Post Closure Inspection (U)*, ER-IDS-019-022, Inspection period FY2016 through FY2020 (quarterly)

METALLURGICAL LABORATORY HAZARDOUS WASTE MANAGEMENT FACILITY (904-110G) OPERABLE UNIT

I. Introduction

This report is the sixth five-year review for the Metallurgical Laboratory (904-110G) (Met Lab) Hazardous Waste Management Facility (HWMF) Operable Unit (OU). The review was conducted from July 2020 through December 2020. Contaminants have been left in place at the Met Lab HWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the Met Lab HWMF OU is protective of human health and the environment. This report documents the results of the review.

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

II. OU Chronology

Table J-1 lists the chronology of site events for the Met Lab HWMF OU.

III. Background

The Met Lab HWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) for SRS (FFA 1993). The media associated with the Met Lab HWMF OU is soil. Groundwater is not addressed under this OU. Per the Interim Action Record of Decision (IROD) (WSRC 1992), the Met Lab HWMF groundwater is being addressed under the A/M Area Groundwater OU and will be discussed in the five-year remedy review reports for SRS OUs with operating equipment. Groundwater corrective actions are performed under the RCRA Hazardous and Mixed Waste Permit Renewal for SRS.

Physical Characteristics

The Met Lab HWMF OU is located in M Area of the SRS near the northwest edge of SRS (Figure J-1). The nearest site boundary is located approximately 1.2 km (0.75 mi) northwest of this OU. The Met Lab HWMF has been designated as a source-specific OU within the Upper Three Runs Watershed.

The Met Lab HWMF OU is located in the eastern portion of the A/M-Area Central Sector (Figure J-2). The OU includes the unlined Met Lab Basin, the abandoned portion of the influent process sewer line, an associated Carolina Bay, and the A-08 drainage outfall to the bay (Figure J-3). The Met Lab Basin dimensions are approximately 27 m (90 ft) by 36 m (120 ft) by 1.5 m (5 ft) deep. The Carolina Bay is a marshy, oval-shaped natural depression that covers approximately 2.4 hectares (6 acres).

Land and Resource Use

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

History of Contamination

The Met Lab Basin began receiving effluent from the Savannah River Laboratory Equipment Engineering Division Metallurgical Laboratory in 1956. The effluent consisted primarily of noncontact cooling water (water that did not contact process operations) and small quantities of laboratory rinse water containing hazardous substances. The historic wastewater discharge rate to the Met Lab Basin was estimated to be 3.8 m^3/day (5 yd^3/day). Discharges to the basin during the period from 1983 to November 8, 1985, consisted of nonhazardous effluent. All flow to the Met Lab Basin was terminated on November 8, 1985, when the process sewer line was plugged.

The Carolina Bay received wastes from three sources: (1) wastewater and surface water runoff overflow from the Met Lab Basin A-08 Outfall, (2) surface water runoff and cooling water from the A-Area coal-fired power plant and (3) A/M Area stormwater through the A-09 Outfall.

Initial Response

Contamination was detected in groundwater, basin surface water, soil, and basin sediments and evaluated in a risk assessment in 1985. The Met Lab HWMF OU was closed by removal and treatment of any standing water remaining in the basin, discharge of the effluent to the National Pollutant Discharge Elimination System (NPDES) permitted outfall, excavation, dewatering, placement, consolidation and compaction of stabilized sludge in the basin, and excavation of a portion of the process sewer line and contaminated soils associated with the sewer line. The Met Lab HWMF closure plan was submitted and approved by SCDHEC in June 1991. The Met Lab Basin closure was certified on July 17, 1992.

Characterization of the Met Lab Carolina Bay for human health risks was completed in 1991 and for ecological risks in 1993. Surface sediments and soil to a depth of 0.6 m (2 ft) were contaminated with metals and organics. Risks were found to be acceptable and no further remedial action was required.

The Met Lab HWMF underlying groundwater is being addressed under the A/M Area Groundwater OU and is not included in this review. A/M-Area Groundwater OU will be discussed in the five-year remedy review reports for SRS OUs with operating equipment. Groundwater corrective actions are performed under the RCRA Hazardous and Mixed Waste Permit Renewal for SRS.

Basis for Taking Action

On September 24, 1985, the Natural Resources Defense Council and others filed a complaint against USDOE concerning the Met Lab Basin and neighboring Carolina Bay. The associated lawsuit resulted in a Consent Decree in June 1988 which mandated that the Met Lab HWMF and associated Carolina Bay were subject to RCRA (WSRC 1992). The

Met Lab HWMF OU was subject to closure under South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.265. Closure of the basin was conducted as a landfill without excavation of soil from the basin (WSRC 1991).

At the time of the IROD, no contaminants of concern (COCs) were identified, though previous characterization efforts indicated contamination was present in groundwater, basin surface water, soil, and basin sediments. Detected contaminants in the basin and/or process sewer line sediments included sulfate, nitrate, cyanide, and metals (though all were substantially below the U.S. Environmental Protection Agency [USEPA] toxicity concentration criteria). Chlorinated solvents, specifically trichloroethylene and tetrachloroethylene, were detected in both upgradient and downgradient wells (WSRC 1992)

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the Met Lab HWMF within the RCRA closure process. Preventative activities at the Met Lab HWMF became subject to CERCLA when SRS was placed on the National Priorities List in December 1989.

The remedial action objectives (RAOs), as documented in the IROD (WSRC 1992), are to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The selected interim action remedy is the previous Met Lab HWMF RCRA preventative action of no waste removal, excavation of the process sewer line and associated contaminated sediments, placement of all contaminated materials under a low-permeability cap and no action for the Carolina Bay. The Met Lab HWMF RCRA preventative action of stabilization and placement of all contaminated materials under a low-permeability cap satisfied both RAOs. Since the preventative action is protective to human health and the environment and satisfies CERCLA requirements, no further action under CERCLA is necessary for this source control OU (WSRC 1992).

zone near the MASB~~,~~. To address the vadose zone contamination, eight MicroBlowers™ and two BaroBalls™ were installed along the M-Area Abandoned Process Sewer Line in 2020. Additional characterization of the vadose zone in this area will also be conducted to determine the full extent of contamination. A new recovery well was installed southeast of the MASB to capture a high concentration VOC groundwater plume. The new recovery well became operational in 2020. Both of these corrective actions were ~~which will require additional corrective action to be~~ taken under the direction of the RCRA Hazardous and Mixed Waste Permit Renewal (SCDHEC 2014). These corrective actions are discussed as part of the A/M-Area Groundwater OU in the five-year remedy review reports for the SRS OUs with operating equipment.

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 4, 2020 at the O&M organization offices. No issues were identified for the MHWMF during these

interviews. The MHWMF OU was inspected by SRNS EC&ACP on July 14, 2020. No issues were identified during this inspection

The MHWMF OU was inspected by SRNS EC&ACP and USDOE personnel on November 24, 2020. No issues were identified for the MHWMF OU during this inspection.

A site inspection ~~will be~~was conducted by U.S. Environmental Protection Agency (USEPA) and SCDHEC personnel, accompanied by USDOE and SRNS personnel, ~~prior to submittal of the Revision 1 of this document. It is anticipated that no~~via Microsoft Teams on March 16, 2021. Photographs and drone videos were used to inspect the OU virtually. No significant problems regarding this OU ~~will be~~were identified during the inspection.

Scheduled quarterly site inspections conducted from FY2016 to FY2020 identified the following issues: overgrown vegetation, active ant mounds, hog damage on the soil cover, signs needing to be replaced, and evidence of small animals burrowing. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy, in situ stabilization/solidification, RCRA soil cover with institutional controls (i.e., LUCs), is effective in preventing exposure to contaminant risk above 1E-06 risk levels and mitigating further migration of contaminants to groundwater and is functioning as intended.

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

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). The closure/post-closure requirements are discussed in the RCRA

Permit Renewal Application for the M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities (M-Area and Met Lab HWMF) Postclosure (SRNS 2020). Therefore, a Land Use Control Implementation Plan is not required for this OU.

The LUCs that are in place include physical access controls to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the MHWMF OU. Warning signs are in good condition, and no activities were observed that would have violated LUCs. All LUC objectives are being met.

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

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

The applicable or relevant and appropriate requirements (ARARs) discussed in the IROD (WSRC 1992) for this limited action focus on the design and construction of the remedial action which was completed in 1990. Based on the review of this OU, the requirements of the ARAR that sets forth the performance standards for the cover system (i.e., long-term minimization of migration of contaminants, function with minimum maintenance) continue to be met.

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 MHWMF OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

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

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2027.

XII. Documents Reviewed

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

SCDHEC, 2014. *South Carolina Department of Health and Environmental Control Hazardous and Mixed Waste Permit, Permit Number SC1 898 008 989, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, Module III - Postclosure Care and Module IV – Groundwater Requirements, Section A, M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC

SRNS, 2020. *2013 RCRA Permit Renewal Application (U), Volume III, M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities (M-Area and Met Lab HWMFs) Postclosure*, SRNS-IM-2012-00002, latest revision, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

WSRC, 1991. *Metallurgical Laboratory Hazardous Waste Management Facility Closure Plan* WSRC-RP-92-423, Revision 5, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1992. *Interim Action Record of Decision Remedial Alternative Selection, Metallurgical Laboratory Hazardous Waste Management Facility Operable Unit (U),* WSRC-RP-92-745, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

MIXED WASTE MANAGEMENT FACILITY (643-28E) OPERABLE UNIT

I. Introduction

This report is the sixth five-year review for the Mixed Waste Management Facility (643-28E) (MWMF) Operable Unit (OU). The review was conducted from July 2020 through December 2020. Contaminants have been left in place at the MWMF OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the MWMF OU is protective of human health and the environment. This report documents the results of the review.

The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, no further remedial action is necessary under CERCLA.

II. OU Chronology

Table K-1 lists the chronology of site events for the MWMF OU.

III. Background

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

The groundwater is being addressed by the MWMF Groundwater OU. Groundwater corrective actions are performed under the RCRA Hazardous and Mixed Waste Permit Renewal for SRS.

Physical Characteristics

The MWMF OU is located in the central portion of SRS between F- and H-Areas, approximately 8 km (5 mi) from the nearest site boundary (Figures K-1 and K-2). The MWMF is a source-specific OU within the Burial Ground Complex and within the Upper Three Runs Watershed. The MWMF consists of 118 slit trenches, one engineered low-

level trench (ELLT), and a naval core barrel mound. This facility comprises approximately 23.5 hectares (58 acres).

The slit trenches are generally 6 m (20 ft) deep and 6 m (20 ft) wide with varying lengths up to 360 m (1200 ft). The trenches were spaced approximately 3 m (10 ft) apart. The trenches were backfilled with natural soil during landfilling operations to minimize the potential for fire and airborne releases. This practice was modified in 1985 with the initiation of ELLT operation, which consisted of stacking waste containerized in B-25 boxes (metal disposal containers, 1.2 m x 1.2 m x 1.8 m [4 ft x 4 ft x 6 ft] in dimension) in the trench completely before backfilling the trench. The dimensions of the ELLT are 40.2 m (134 ft) by 150 m (500 ft) by 6.6 (22 ft) deep. Approximately 9,600 B-25 boxes were placed in ELLT-1. An earthen mound was used for the disposal of naval reactor equipment.

Land and Resource Use

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

History of Contamination

The MWMF operated from 1969 until March 11, 1986. During that time, this facility received low-level radioactive waste materials produced at SRS. Some of these materials are classified under RCRA as mixed waste containing both hazardous and radioactive components. Waste from SRS was disposed of in the form of job control waste and sent to the MWMF (e.g., rags, gloves and coveralls, soil, construction debris, failed equipment, spent air filters, spent lithium-aluminum targets, irradiated scrap metal, naval reactor hardware, lead shielding, waste oil, scintillation fluids, cadmium, and silver-coated beryl

system. Later in 1994, portions of the RCRA LLRWDF 5.3-hectare (13-acre) geosynthetic cover system was tied into the MWMF cover system. The LLRWDF closure consisted of twelve discrete areas (i.e., ELLT-2, ELLT-3, ELLT-4, and Trench Areas 1 to 9 [Figure K-2]). The MWMF small cap was covered by the ELLT-2 and Trench Area 7 cover system. ELLT-3 and Trench Areas 1, 3 to 6, and 8 were integrated into the MWMF cover system (WSRC 1999b).

Figure K-3 provides current photographs of the MWMF OU.

Systems Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Inspection and repair, as necessary, of the groundwater monitoring wells associated with the post-closure groundwater monitoring program for the MWMF.
- Quarterly site inspections for a minimum of 30 years to verify the integrity of the cover system, OU-specific perimeter fencing, signs, etc. Any repairs will be made as necessary to maintain the integrity and effectiveness of the initial cover including making repairs to the surface cap as necessary to correct the effects of settling, subsidence, erosion, or other events.
- Institutional controls (i.e. LUCs) to restrict access to authorized personnel with appropriate training on applicable requirements and preclude unauthorized access or intrusive activities through the SRS Site Use/Site Clearance program and SRS site security. The survey plat and records associated with deed restriction use of the MWMF have been filed with Aiken County.

Operation and maintenance (O&M) costs associated with the selected remedy for MWMF OU include costs of the soil cover inspection and maintenance, institutional controls (i.e. LUCs) and five-year remedy reviews. The actual O&M cost during fiscal year (FY) 2016 to FY2020 is $1,272,185. RCRA documentation does not require estimated project

costs to be prepared. Therefore, actual cost data comparison to estimated cost data is not included in this remedy review.

V. Progress Since Last Review

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

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

Data Review

Groundwater

Fact sheets provided on the U.S. Environmental Protection Agency (USEPA) webpage regarding emerging contaminants were reviewed for applicability to this site. Due to the presence of chlorinated solvents at the MWMF, 1,4-dioxane was identified as a potential contaminant for the groundwater and has been sampled dating back to 1992. As shown in Figure K-4, 1,4-dioxane has been detected in the Southwest Plume (SWP), comingled with

the tritium plume. As previously stated, groundwater is regulated by the RCRA Hazardous Waste Permit Renewal (SCDHEC 2014) and is addressed in the MWMF Groundwater OU.

The low permeability cap over the Old Radiological Waste Burial Ground (ORWBG) has reduced the tritium concentration in the SWP by approximately 40%. The groundwater is managed under the MWMF RCRA permit. It is expected that the concentration of chlorinated solvents and 1,4-dioxane will eventually be reduced due to the effects of the cap (SRNS 2012).

The current phytoremediation/spray irrigation system operating in the SWP to address the tritium appears to be curtailing expansion of the 1,4-dioxane plume. 1,4-dioxane is prone to volatilization and photo-oxidation in air (7 to 10-hour half-life, maximum lifetime of 23 hours) in a spray irrigation setting. The remedial approach for the 1,4-dioxane is described in the 2013 RCRA Permit Renewal Application for the MWMF (SRNS 2015).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 4, 2020 at the O&M organization offices. No issues were identified for the MWMF OU during these interviews. The MWMF OU was inspected by SRNS EC&ACP on July 28, 2020. No issues were identified during this inspection.

The MWMF OU ~~is scheduled to be~~was inspected by SRNS EC&ACP and USDOE personnel on December 15, 2020. ~~It is anticipated that n~~No issues ~~will be~~were identified during this inspection.

A site inspection ~~will be~~was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, ~~prior to submittal of the Revision 1 of this document. It is anticipated that no~~via Microsoft Teams on March 16, 2021. Photographs and drone videos were used to inspect the OU virtually. No significant problems regarding MWMF OU ~~will be~~were identified during the inspection.

Scheduled quarterly site inspections conducted from FY2016 through FY2020 identified the following issues: overgrown vegetation, active ant mounds, signs needing to be replaced, minor rutting from mowing equipment, and repairs to drainage channels. These findings were documented on the field inspection checklists and resolved soon after discovery. As part of drainage enhancements implemented by USDOE, the previously existing one-inch weep holes were replaced with a French style drainage system that feeds into a three-inch pipe. This enhancement was designed to prevent future clogging of the drainage system. Additionally, USDOE repaired and cleaned the concrete associated with the drainage channels to ensure ongoing protectiveness.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy, in-situ stabilization/solidification, RCRA soil cover with institutional controls (i.e., LUCs), is effective in preventing exposure to contaminant risk above 1E-06 risk levels and mitigating further migration of contaminants to groundwater and is functioning as intended.

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

The LUC requirements are discussed and approved as part of the closure/post-closure/ permit application process and are governed by the RCRA Permit Renewal for the SRS (SCDHEC 2014). The closure/post-closure requirements are discussed in the RCRA Permit Renewal Application for the Mixed Waste Facility (MWMF) Postclosure (SRNS 2015). Therefore, a Land Use Control Implementation Plan is not required for this OU.

The institutional controls (i.e., LUCs) that are in place include physical access controls to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the MWMF OU. Warning signs are in good condition, and no

activities were observed that would have violated LUCs. All LUC objectives are being met.

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

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

As the remedial work has been completed, the applicable standards, set forth in the ROD (WSRC 1994) and RCRA closure plan (WSRC 1991), have been met. All standards and to-be-considered values associated with groundwater will be addressed as part of the MWMF Groundwater OU. Groundwater corrective actions are performed under the RCRA Hazardous and Mixed Waste Permit Renewal for SRS.

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 MWMF OU were not significant, and RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. 1,4-dioxane was identified in 1992 and was added to the Groundwater Protection Standards for the SWP emanating from the MWMF (SRNS 2015). The 2013 RCRA Renewal Application (SRNS 2015) describes the corrective action for 1,4-dioxane. None of the other listed emerging contaminants were identified as applicable to this OU.

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

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

VIII. Issues

There are no issues that prevent the remedy for the MWMF OU from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risk are being controlled by stabilization and placement of all contaminated material under a low-permeability cap and institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated soil media and mitigating further migration of contaminants to groundwater. All threats to the MWMF OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the MWMF OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Engineered Cover Systems is scheduled for January 2027.

XII. Documents Reviewed

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

SCDHEC, 2014. *South Carolina Department of Health and Environmental Control Hazardous and Mixed Waste Permit, Permit Number SC1 898 008 989, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, Module IV - Postclosure Care and Module IV – Groundwater Requirements, Section D, Mixed Waste Management Facility*, South Carolina Department of Health and Environmental Control,

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

SRNS, 2012. *Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility and the Mixed Waste Management Facility (U)*, SRNS-RP-2012-00045, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2015. *2013 RCRA Permit Renewal Application: Mixed Waste Management Facility (MWMF) Post Closure*, SRNS-IM-2012-00002, Volume VII, Revision 2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U),* SRNS-RP-2020-00166, Volume I, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

WSRC, 1991. *Mixed Waste Management Facility (MWMF) Closure Plan*, Revision 4, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1994. *Final Record of Decision Remedial Alternative Selection for Mixed Waste Management Facility (U),* WSRC-RP-93-1511, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

WSRC, 1999b. *Mixed Waste Management Facility Closure Plan (LLRWDF), Volume II (U)*, Q-CLP-E-00001, Revision 4, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist, Mixed Waste Management Facility Post Closure Inspection (U)*, ER-IDS-019-018, Inspection Period FY2016 to FY2020 (quarterly)

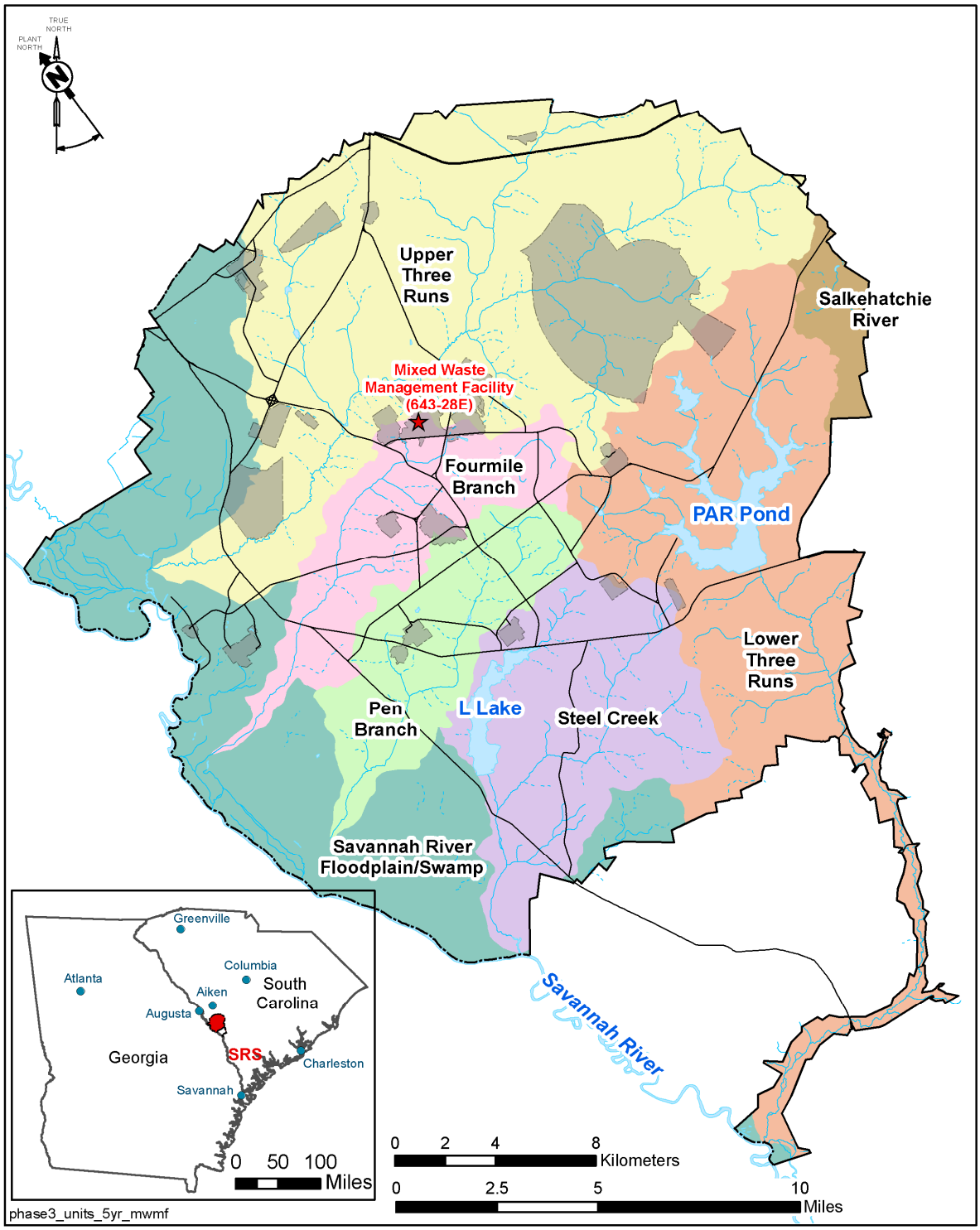

Figure K-1. MWMF OU at SRS

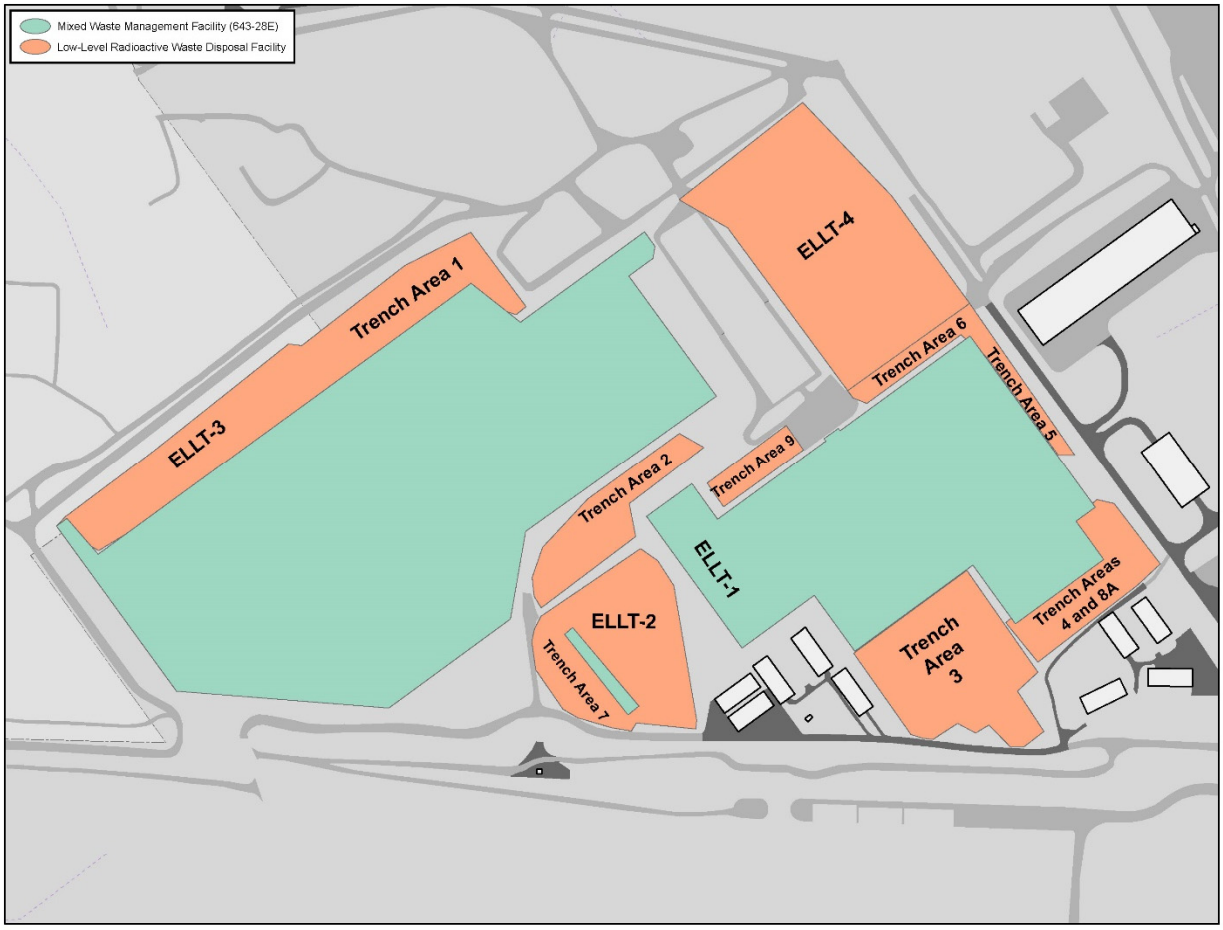

Figure K-2. ~~Site Layout of MWMF OU~~LLRWDF Units in Relation to MWMF Units

interviews. The SRLSB OU was inspected by SRNS EC&ACP on July 21, 2020. No issues were identified during this inspection.

The SRLSB OU was inspected by SRNS EC&ACP and USDOE personnel November 24, 2020. No issues were identified for the SRLSB OU during this inspection.

A site inspection ~~will be~~was conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control personnel, accompanied by USDOE and SRNS personnel, via Microsoft Teams on March 16, 2021. Photographs and drone videos were used to inspect the OU virtually. No ~~prior to submittal of the Revision 1 of this document. It is anticipated that no~~ significant problems regarding this OU ~~will be~~were identified during the inspection.

Scheduled annual site inspections conducted from FY2016through FY2020 identified the following issues: active ant mounds, evidence of burrowing animals, and shallow rutting caused by mowing equipment. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy, excavation, off-site disposal, and institutional controls (i.e., LUCs) is effective in preventing exposure to contaminants above 1E-06 risk levels and is functioning as intended.

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

The Land Use Control Implementation Plan for SRLSB OU is included as Appendix A of the Corrective Measure Implementation Report / Post-Construction Report / Final

Remediation Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2001). The LUCs that are in place include physical access controls to prevent unauthorized contact, removal or excavation of subsurface soils, and restrictions to prevent disturbance of the SRLSB 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 Remedial Action Objectives still valid?

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

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

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

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

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

VIII. Issues

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

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

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

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident
Areal extent _____ Depth _____
Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent _____
☐ Ponding ☐ Location shown on site map Areal extent _____
☐ Seeps ☐ Location shown on site map Areal extent _____
☐ Soft subgrade ☐ Location shown on site map Areal extent _____
Remarks: _____

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

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

C. Letdown Channels ☐ Applicable ☒ N/A
(Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

D. Cover Penetrations ☐ Applicable ☒ N/A

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

F. Cover Drainage Layer ☐ Applicable ☒ N/A

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

H. Retaining Walls ☐ Applicable ☒ N/A

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

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

Attachment L-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

X. OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Excavation and Off-Site Disposal ☒ Applicable ☐ N/A Excavation and off-site disposal was performed at SRLSB OU. The remedy is performing as designed.
XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedial action for the SRLSB OU was removal of contaminated soil and the installation of soil covers. The remedy is fully established and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover system, ~~fencing,~~ and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the OU) have been implemented. The O&M procedures are adequately maintaining the SRLSB OU and the condition of the warning signs are good. When maintenance activities are identified during inspections, (e.g., treating ant mounds, vegetation removal), repairs are scheduled and performed. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

End of Checklist