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Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Geosynthetic or Stabilization/Solidification Cover Systems (U)

Aiken, South Carolina

SRNS-RP-2021-04229

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

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

Basis for Taking Action

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

Based on 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 R).

Remedial Actions

Remedial actions may target source areas, soil, vadose zone, and/or groundwater. Cleanup levels, formerly referred to as RGs in SRS decision documents, are defined for individual OUs, but in general, remedial action objectives (RAOs) at SRS are:

- Prevent exposure of trespassers, industrial workers, and hypothetical residents to soils 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 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 cover systems.

Table 2 lists the remedial actions for each of the OUs in this five-year remedy review report. The remedial actions are described in greater detail in the OU-specific appendices

Table 2. SRS OUs with Geosynthetic or S/S Cover Systems

#	Appendix	Operable Unit	SEMS No.	Remedy Decision Document	Decision Document Issuance Year[a]	Remedial Action	Area Covered (acres)	LUCs (acres)
1	C	B-Area Operable Unit (BAOU)	48	ROD	2013	In-Situ S/S, Concrete Cover, Groundwater Monitoring, LUCs	0.15	2
2	D	C-Area Reactor Seepage Basins (CRSB) (904-66G and 904-68G)	60	ESD	2000	In-Situ S/S, Soil Cover, LUCs	3.5	3.1
3	E	D-Area Expanded Operable Unit (DEXOU) [Consisting of D-Area Ash Basin (488-D) and D-Area Rubble Pit (431-2D)]	67	ROD	2004	Excavation, Soil Cover, Groundwater Monitoring, LUCs	25	43
4	F	E-Area Low-Level Waste Facility (LLWF) (643-26E)	86	IROD ESD	2010 2010	Interim Stormwater Runoff Covers	13.6	N/A
5	G	F-Area Retention Basin (FRB) (281-3F)	23	ROD ESD	1999 2001	In-Situ S/S, Soil Cover, ~~Groundwater Monitoring,~~ LUCs	0.6	1.07
6	H	F-Area Tank Farms (FTF) Operable Unit	23	IROD ESD ESD	2013 2013 2014	Annual Visible Engineered Barriers Inspection and Maintenance	N/A	N/A
7	I	General Separations Area Consolidation Unit (GSACU) [including Old Radioactive Waste Burial Ground (ORWBG) (643-E) and Old Solvent Tanks (OST) (650-1E through 650-22E)]	32	ROD	2002	Excavation, Consolidation, Low Permeability Cover, LUCs	77.3	86
8	J	H-Area Tank Farms (HTF) Operable Unit	89	IROD ESD	2016 2017	Annual Visible Engineered Barriers Inspection and Maintenance	N/A	N/A

Table 2. SRS OUs with Geosynthetic or S/S Cover Systems (continued/end)

#	Appendix	Operable Unit	SEMS No.	Remedy Decision Document	Decision Document Issuance Year[a]	Remedial Action	Area Covered (acres)	LUCs (acres)
9	K	K-Area Reactor Seepage Basin (KRSB) (904-65G)	55	ESD	2002	In-Situ S/S, Soil Cover, LUCs	0.2	0.7
10	L	L-Area Oil and Chemical Basin (LAOCB) (904-83G and 904-79G)	17	ROD	1998	In-Situ S/S, Soil Cover, LUCs	0.45	1.3
11	M	L-Area and C-Area Reactor Seepage Basins (LRSB, CRSB) (904-64G and 904-67G)	65, 60	ROD Amendment	2002	Soil Cover, LUCs	1.7	1.7
12	N	Old F-Area Seepage Basin (OFASB) (904-49G)	16	ROD ESD ROD Amendment	1997 1998 2004	In-Situ S/S, Groundwater Mixing Zone (GWMZ), LUCs	1.8	1.8
13	O	P-Area Operable Unit (PAOU)	94	EAROD ESD ROD	2009 2009 2010	Removal Actions (In-Situ Decommissioning [ISD] of P-Reactor Building [105-P], Excavation, Cover), Soil Fracturing with Chemical Oxidation, Soil Vapor Extraction (SVE), LUCs	18.2	126
14	P	P-Area Reactor Seepage Basins (PRSB) OU (904-61G, 904-62G, and 904-63G)	66	ESD	2003	In-Situ S/S, Consolidation, Soil Cover, LUCs	2.3	3.1
15	Q	R-Area Burning/Rubble Pits (131-R, 131-1R) and Rubble Pile (631-25G) (RBRP/RRP)	43	ROD	2004	Excavation, Soil Cover, LUCs	0.32	0.44
16	R	T-Area Operable Unit	96	ROD	2006	Cover, Excavation, Soil Amendments, LUCs	9.4	48

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.

Table 3. LUC Summary Table

Operable Unit	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	Title of LUC Instrument Implemented and Date (or Planned)
B-Area Operable Unit (BAOU)	Activated Metal and Concrete	Yes	Yes	48	• Maintain the integrity of engineering controls which provide an exposure barrier (including in-situ grouting and concrete cover) • Maintain the integrity of the groundwater monitoring well system • Restrict or prohibit groundwater use as determined to be necessary based on monitoring results • Restrict access by posting and maintaining warning signs and enforcing SRS security procedures • Prohibit the development and use of property for any use other than industrial; no residential use, school use, childcare facilities or recreational use shall be allowed	SRNS 2014a
C-Area Reactor Seepage Basins (904-66G and 904-68G) (CRSB)	Soil	Yes	Yes	60	• Prevent contact, removal, or excavation of buried waste or pipelines in the OU areas designated in the LUCIP • Maintain the use of the site for industrial activities only • Prevent unauthorized access to the closed CERCLA unit as long as the waste remains a threat to human health or the environment	WSRC 2003c
D-Area Expanded Operable Unit (DEXOU) [Consisting of D-Area Ash Basin (488-D) and D-Area Rubble Pit (431-2D)]	Soil, Surface Water, Sediment	Yes	Yes	67	• Maintain the use of the DRP and 488-DAB for industrial activities only • Prevent contact, removal, or excavation of waste left in place (beneath the geosynthetic cover) at the 488-DAB • Prevent unauthorized access to the 488-DAB as long as the waste left in place remains a threat to human health or the environment • Provide public notices for disclosing former waste management and disposal activities and remedial action taken	WSRC 2005

Table 3. LUC Summary Table *(continued)*

Operable Unit	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	Title of LUC Instrument Implemented and Date (or Planned)
E-Area Low-Level Waste Facility (LLWF) (643-26E)	Soil	~~Yes~~ Deferred	~~Yes~~ Deferred	86	• The LUCIP will be deferred until final closure of the entire E-Area LLWF	Not Applicable
F-Area Retention Basin (FRB) (281-3F)	Soil	Yes	Yes	23	• Controlled access to the FRB unit in accordance with the current site use/site clearance programs, including access controls to the sewer line by grouting the sewer pipeline, manholes, and associated structures and posting signs in the area to indicate the sewer line and soil beneath the unit has been contaminated with radionuclides	WSRC 2001a
F-Area Tank Farms (FTF) Operable Unit	Soil	~~Yes~~ Deferred	~~Yes~~ Deferred	23	• The LUCIP will be deferred until final closure of the entire FTF OU	Not Applicable
General Separations Area Consolidation Unit (GSACU) [including Old Radioactive Waste Burial Ground (ORWBG) (643-E) and Old Solvent Tanks (OST) (650-1E through 650-22E)]	Soil	Yes	Yes	32	• Prevent contact, removal, or excavation of buried waste or pipelines in the OU areas designated in this LUCIP • Maintain the use of the site for industrial activities only • Prevent unauthorized access to the closed CERCLA unit as long as the waste remains a threat to human health or the environment • Prevent unauthorized residential or agricultural access to groundwater	WSRC 2003a
H-Area Tank Farms (HTF) Operable Unit	Soil	~~Yes~~ Deferred	~~Yes~~ Deferred	89	• The LUCIP will be deferred until final closure of the entire HTF OU	Not Applicable
K-Area Reactor Seepage Basin (KRSB) (904-65G)	Soil	Yes	Yes	55	• Prevent contact, removal, or excavation of buried waste or pipelines in the OU areas designated in the LUCIP and preclude future residential or agricultural use of the area	WSRC 2002

Table 4. Operation and Maintenance Cost Comparison for SRS OUs with Geosynthetic or S/S Cover Systems

Operable Unit	Main Remedy	Remedy Decision Document Year[a]	FY2017-FY2021 O&M Estimated Cost	FY2017-FY2021 O&M Actual Cost	% of Estimate	Comments
B-Area Operable Unit (BAOU)	In-Situ S/S, Concrete Cover, Groundwater Monitoring, LUCs	2013	$45,000	$53,197	118%	Actual costs are higher than expected because routine site maintenance costs were underestimated in the ROD. No unexpected costs have been incurred.
C-Area Reactor Seepage Basins (CRSB) (904-66G and 904-68G)	In-Situ S/S, Soil Cover, LUCs	2000	$47,505	$71,013	149%	Actual costs were higher than expected because the cost for access controls was not included in the estimate in the ROD Amendment. No unexpected costs have been incurred.
D-Area Expanded Operable Unit (DEXOU) [Consisting of D-Area Ash Basin (488-D) and D-Area Rubble Pit (431-2D)]	Excavation, Soil Cover, Groundwater Monitoring, LUCs	2004	$59,000	$118,416	201%	Actual costs were higher than expected because the ROD estimated costs did not include LUCs. No unexpected costs have been incurred.
E-Area Low-Level Waste Facility (LLWF) (643-26E)	Interim Stormwater Runoff Covers	2010 2010	$92,500	$10,623	11.5%	Actual ~~O&M~~ costs (document preparation) are ~~not available~~for closed and operating portions of the OU and do not differentiate between the two because both are part of the same OU. ~~No~~ Since no significant repairs have been performed, ~~and~~ estimated costs are considered representative of expected actual costs.
F-Area Retention Basin (FRB) (281-3F)	In-Situ S/S, Soil Cover, Groundwater Monitoring, LUCs	1999 2001	$35,500	$37,033	106%	Actual costs are as expected
F-Area Tank Farms (FTF) Operable Unit	Annual Visible Engineered Barriers Inspection and Maintenance	2013 2013 2014	$35,000	$~~19,566~~ 10,623	56%	~~Actual costs are as expected.~~ Actual costs (document preparation) are for closed and operating portions of the OU and do not differentiate between the two because both are part of the same OU. Since no significant repairs have been performed, estimated costs are considered representative of expected actual costs.

Table 4. Operation and Maintenance Cost Comparison for SRS OUs with Geosynthetic or S/S Cover Systems (*continued*)

Operable Unit	Main Remedy	Remedy Decision Document Year[a]	FY2017-FY2021 O&M Estimated Cost	FY2017-FY2021 O&M Actual Cost	% of Estimate	Comments
General Separations Area Consolidation Unit (GSACU) [including Old Radioactive Waste Burial Ground (ORWBG) (643-E) and Old Solvent Tanks (OST) (650-1E through 650-22E)]	Excavation, Consolidation, Low Permeability Cover, LUCs	2002	$195,750	$458,514	234%	Actual costs are higher than expected because costs for routine site maintenance and preparation of five-year remedy reviews were underestimated in the ROD. No unexpected costs have been incurred.
H-Area Tank Farms (HTF) Operable Unit	Annual Visible Engineered Barriers Inspection and Maintenance	2016 2017	$21,250	$1,391	6.5%	~~Actual costs for maintaining the covers are not available.~~Actual costs (document preparation) are for closed and operating portions of the OU and do not differentiate between the two because both are part of the same OU. Since no significant repairs have been performed, estimated costs are considered representative of expected actual costs.
K-Area Reactor Seepage Basin (KRSB) (904-65G)	In-Situ S/S, Soil Cover, LUCs	2002	$131,060	$48,030	37%	Actual costs were lower than expected because no cover repairs were necessary.
L-Area Oil and Chemical Basin (LAOCB) (904-83G and 904-79G)	In-Situ S/S, Soil Cover, LUCs	1998	$149,900	$26,180	17%	Actual costs are lower than expected because the estimated cost for five-year remedy reviews were significantly overestimated in the ROD.
L-Area and C-Area Reactor Seepage Basins (LRSB, CRSB) (904-64G and 904-67G)	Soil Cover, LUCs	2002	$117,250	$28,363	24%	The actual O&M costs are less than expected because no cover repairs were necessary, and inspections are performed annually instead of monthly as originally estimated.
Old F-Area Seepage Basin (OFASB) (904-49G)	In-Situ S/S, GWMZ, LUCs	1997 1998 2004	$170,000	$64,992	38%	The actual O&M costs are less than expected because the estimated cost for five-year remedy reviews were significantly overestimated.

Table 4. Operation and Maintenance Cost Comparison for SRS OUs with Geosynthetic or S/S Cover Systems (*continued/end*)

Operable Unit	Main Remedy	Remedy Decision Document Year[a]	FY2017-FY2021 O&M Estimated Cost	FY2017-FY2021 O&M Actual Cost	% of Estimate	Comments
P-Area Operable Unit (PAOU)	Removal Actions (ISD of P-Reactor Building [105-P], Excavation, Cover), Soil Fracturing with Chemical Oxidation, SVE, LUCs	2009 2009 2010	$232,700	$254,502	109%	Actual costs are as expected.
P-Area Reactor Seepage Basin (PRSB) OU (904-61G, 904-62G, and 904-63G)	In-Situ S/S, Consolidation, Soil Cover, LUCs	2003	$117,250	$39,909	34%	Actual costs are lower than expected. The PSA units were shutdown sooner than estimated
R-Area Burning/Rubble Pits (131-R and 131-1R) and Rubble Pile (631-25G) (RBRP/RRP)	Excavation, Soil Cover, LUCs	2004	$30,000	$82,347	274%	The actual O&M costs are higher than expected because costs for groundwater monitoring and well maintenance were not included in the ROD estimate.
T-Area Operable Unit	Cover, Excavation, Soil Amendments, LUCs	2006	$416,381	$170,427	41%	Actual costs are lower than expected. Groundwater sampling costs transferred to TNX Groundwater.

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Table 8. Protectiveness Statements for the Sixth Five-Year Remedy Review Report for the SRS OUs with Geosynthetic or S/S Cover Systems

PROTECTIVENESS STATEMENT(S)		
Operable Unit: B-Area Operable Unit (BAOU), SEMS #48	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the BAOU is protective of human health and the environment.		
Operable Unit: C-Area Reactor Seepage Basins (CRSB) (904-66G and 904-68G) OU, SEMS #60	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the CRSB OU is protective of human health and the environment.		
Operable Unit: D-Area Expanded Operable Unit (DEXOU) [Consisting of D-Area Ash Basin (488-D) and D-Area Rubble Pit (431-2D)], SEMS #67	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the DEXOU is protective of human health and the environment.		
Operable Unit: E-Area Low-Level Waste Facility (LLWF) (643-26E), SEMS #86	***Protectiveness Determination:*** ~~Short-term~~ Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The <u>interim</u> remedy at the E-Area LLWF is protective of human health and the environment.		
Operable Unit: F-Area Retention Basin (FRB) (281-3F) OU, SEMS #23	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the FRB OU is protective of human health and the environment.		
Operable Unit: F-Area Tank Farm (FTF) OU, SEMS #23	***Protectiveness Determination:*** ~~Short-term~~ Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The <u>interim</u> remedy at the FTF OU (Waste Tanks 5, 6, 17, 18, 19, and 20) is protective of human health and the environment.		
Operable Unit: General Separations Area Consolidation Unit (GSACU) [Including Old Radioactive Waste Burial Ground (ORWBG) (643-E) and Old Solvent Tanks (OST) (650-1E through 650-22E)], SEMS #32	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the GSACU is protective of human health and the environment.		
Operable Unit: H-Area Tank Farm (HTF) OU, SEMS #23	***Protectiveness Determination:*** ~~Short-term~~ Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The <u>interim</u> remedy at the HTF OU (Waste Tanks 12 and 16) is protective of human health and the environment.		

Table 8. Protectiveness Statements for the Sixth Five-Year Remedy Review Report for the SRS OUs with Geosynthetic or S/S Cover Systems *(continue/end)*

PROTECTIVENESS STATEMENT(S)		
Operable Unit: K-Area Reactor Seepage Basin (KRSB) OU (904-65G), SEMS #55	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the KRSB OU is protective of human health and the environment.		
Operable Unit: L-Area Oil and Chemical Basin (LAOCB) OU (904-83G and 904-79G), SEMS #17	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the LAOCB OU is protective of human health and the environment.		
Operable Unit: L-Area and C-Area Reactor Seepage Basins (LRSB and CRSB) OU (904-64G and 904-67G), SEMS #65, 60	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the LRSB and CRSB OU is protective of human health and the environment.		
Operable Unit: Old F-Area Seepage Basin (OFASB) OU (904-49G), SEMS #16	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the OFASB OU is protective of human health and the environment.		
Operable Unit: P-Area Operable Unit (PAOU), SEMS #94	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the PAOU is protective of human health and the environment.		
Operable Unit: P-Area Reactor Seepage Basins (PRSB) OU (904-61G, 904-62G, and 904-63G), SEMS #66	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the PRSB OU is protective of human health and the environment.		
Operable Unit: R-Area Burning/Rubble Pits (131-R and 131-1R) and R-Area Rubble Pile (631-25G) (RBRP/RRP) OU, SEMS #43	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the RBRP/RRP OU is protective of human health and the environment.		
Operable Unit: T-Area Operable Unit (TAOU), SEMS #96	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the TAOU is protective of human health and the environment.		

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

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
Asphalt/Concrete (continued)								
P-Area Operable Unit	4	PAOU	0.86	0	117,981	0	10,905	85.32
F-Area Tank Farm	4	FTF	0.72	0	0	0	0	NA*
H-Area Tank Farm	4	HTF	0.23	0	0	0	0	NA*
Compacted Common Fill (no hydraulic conductivity requirement)								
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G)	2	CMP Pits	0.3	0	0	0	0	7.1
R-Area Ash Basin (188-R)	2	RAOU	15	0	0	0	0	15
Ford Building Seepage Basin (904-91G)	3	FBSB	0.22	0	0	0	0	0.28
K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G)	3	KBRP	0.8	0	0	10,000	0	1.15
SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)	3	SRLSB	2.1	0	0	0	6,200	2.56
P-007 Outfall	4	PAOU	4.5	0	0	0	8,000	4.5
P-Area Ash Basin (188-P)	4	PAOU	13.7	0	0	0	0	13.7
A-Area Miscellaneous Rubble Pile (731-6A)	5	AMRP	1.2	0	0	0	23.7	3.08
D-Area Operable Unit (Bubble Tower and Moderator Processing)	5	DAOU	0.7	0	0	16,500	116.7	245
C-Area Burning/Rubble Pit (131-C)	5	CBRP	0.6	0	0	0	0	141.2
D-Area Coal Pile Runoff Basin (489-D) (25% northern portion)	5	DAOU	4.8	0	0	5,720	0	4.96
New TNX Seepage Basin (904-102G)	5	NTSB	0.51	0	0	0	0	2.24

ABRP/RP = A-Area Burning/Rubble Pits and Rubble Pit
AMRP = A-Area Miscellaneous Rubble Pile
BAOU = B-Area Operable Unit
BPOP = Bingham Pump Outage Pits
CAOU = C-Area Operable Unit
CBRP = C-Area Burning/Rubble Pit
CKL Rx = C-, K-, and L-Reactor Complexes
CMP Pits = Chemicals, Metals, and Pesticides Pits
CSBRP = Central Shops Burning/Rubble Pit
CRSB = C-Area Reactor Seepage Basin
DAOU = D-Area Operable Unit
DBRP = D-Area Burning/Rubble Pit
DEXOU = D-Area Expanded Operable Unit
ECODS = Early Construction and Operational Disposal Site
FBRP = F-Area Burning/Rubble Pits
FBSB = Ford Building Seepage Basin
FRB = F-Area Retention Basin
GSACU = General Separations Area Consolidation Unit
HEWB = Heavy Equipment Wash Basin (NBN)
HWMF = Hazardous Waste Management Facility
KBRP = K-Area Burning/Rubble Pit
KRSB = K-Reactor Seepage Basin
LAOCB = L-Area Oil and Chemical Basin
LLWF = Low-Level Waste Facility
LRSB = L-Area Reactor Seepage Basin
MAOU = M-Area Operable Unit
MCB/MBP = Miscellaneous Chemical Basin / Metals Burning Pit
Met Lab = Metallurgical Laboratory
MWMF = Mixed Waste Management Facility
NBN = no building number
NTSB = New TNX Seepage Basin
OFASB = Old F-Area Seepage Basin
PAOU = P-Area Operable Unit
PAR Pond = PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and Lower Three Runs IOU Tail Portion (Middle and Lower Subunits)
PBRP = P-Area Burning/Rubble Pit (131-P)
PRSB = P-Reactor Seepage Basin
RAOU = R-Area Operable Unit
RBRP/RP = R-Area Burning/Rubble Pits and Rubble Pile
RRSB = R-Area Reactor Seepage Basin
SRLSB = SRL Seepage Basin
SRWU = Silverton Road Waste Unit
TAOU = T-Area Operable Unit
cm/sec = centimeter per second
FYR = Five-Year Remedy
yd^3 = cubic yards

*NA = Not Applicable. The LUCIP will be deferred until final closure of the entire OU. Therefore, the LUC area has not been established.

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

Document Title[a]	Document Number	Rev	Issuance Date[b]
Early Construction and Operational Disposal Site L-1, N-2, P-2, R-1A, R-1B, R-1C ROD	SRNS-RP-2009-00072	1	March 30, 2010
E-Area Low Level Waste Facility (Slit Trench Disposal Units 3 through 5) ESD to the IROD	**SRNS-RP-2009-01128**	**1**	**April 22, 2010**
P-Area Operable Unit ROD	**SRNS-RP-2009-01368**	**1**	**July 22, 2010**
Gunsite 218 Rubble Pile ROD	SRNS-RP-2010-00051	1	October 22, 2010
R-Area Operable Unit ROD	SRNS-RP-2010-01062	1	April 20, 2011
L-Area Northern Groundwater ROD	SRNS-RP-2011-00134	1	June 20, 2011
Gunsite 012 (including ECODS G-3) ROD	SRNS-RP-2010-01232	1	June 27, 2011
D-Area Operable Unit EAROD	SRNS-RP-2010-00162	1.2	September 26, 2011
PAR Pond Unit: Lower Three Runs IOU Tail Portion (Middle and Lower Subunits) ESD	SRNS-RP-2012-00121	1	September 13, 2012
B-Area Operable Unit ROD	**SRNS-RP-2012-00354**	**1**	**April 16, 2013**
F-Area Tank Farm (Waste Tanks 17 and 20) IROD	**SRR-CWDA-2013-00111**	**1**	**April 30, 2013**
TNX Area Operable Unit Second ESD to the ROD	SRNS-RP-2012-00205	1	June 12, 2013
F-Area Tank Farm (Tanks 18 and 19) ESD to the IROD	**SRR-CWDA-2013-00007**	**1.1**	**September 23, 2013**
Fourth Five-Year Remedy Review	***SRNS-RP-2012-00011***	***1.1***	***February 4, 2014***
Wetland Area at Dunbarton Bay in Support of Steel Creek IOU ROD	SRNS-RP-2013-00730	1	April 21, 2014[d]
L-Area Southern Groundwater Operable Unit ESD to the ROD	SRNS-RP-2012-00736	1	September 10, 2014
F-Area Tank Farm (Tanks 5 and 6) ESD to the IROD	**SRR-CWDA-2014-00008**	**1**	**September 11, 2014**
C-Area Operable Unit EAROD	SRNS-RP-2014-00836	1	September 2, 2015
Fifth Five-Year Remedy Review for SRS OUs with Native Soil Covers and/or LUCs	***SRNS-RP-2014-00902***	***1***	***November 30, 2015***
H-Area Tank Farm (Waste Tank 16) IROD	**SRR-CWDA-2015-00157**	**1**	**August 16, 2016**
Fifth Five-Year Remedy Review for SRS OUs with Groundwater Remedies	***SRNS-RP-2015-00419***	***1***	***February 2, 2017***
H-Area Tank Farm (Waste Tank 12) ESD to the IROD	**SRR-CWDA-2016-00107**	**0**	**April 20, 2017**
Fifth Five-Year Remedy Review for SRS OUs with Engineered Covers	***SRNS-RP-2016-00609***	***1***	***February 21, 2018***
Fifth Five-Year Remedy Review for SRS OUs with Geosynthetic or S/S Cover Systems	***SRNS-RP-2016-00610***	***1.1***	***March 27, 2018***
Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit ROD[d]	SRNS-RP-2013-00730	1	June 20, 2018

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

Document Title[a]	Document Number	Rev	Issuance Date[b]
Fifth Five-Year Remedy Review Report for SRS OUs with Operating Equipment	***SRNS-RP-2017-00567***	***1***	***December 5, 2018***
G-Area Oil Seepage Basin (761-13G) Operable Unit ROD	SRNS-RP-2018-01050	1	June 26, 2019
Sixth Five-Year Remedy Review Report for SRS OUs with Native Soil Covers and/or LUCs	***SRNS-RP-2018-00811***	***1***	***November 5, 2019***
D-Area Operable Unit Second EAROD	SRNS-RP-2018-00461	1	September 24, 2020
Stormwater Outfall A-013 (NBN) ROD	SRNS-RP-2020-00904	1	September 30, 2020
Sixth Five-Year Remedy Review Report for SRS OUs with Groundwater Remedies	***SRNS-RP-2019-00511***	***1***	***December 9, 2020***
Sixth Five-Year Remedy Review Report for SRS OUs with Engineered Cover Systems	***SRNS-RP-2020-00420***	***1***	***December 21, 2021***
Lower Three Runs Integrator Operable Unit ROD	SRNS-RP-2020-00542	1	December 21, 2021

a Shaded text identifies the SRS OUs evaluated in this report for the fourth phase of the sixth five-year review (i.e., geosynthetic or stabilization/solidification cover systems).
b Unless otherwise noted, the Issuance Date represents the date that the public was notified that the Three-Party signed document was available.
c This is the last signature date instead of the Issuance Date.
d Wetland Area at Dunbarton Bay (WADB) is included in the native soil covers and/or LUCs phase. However, since the sixth five-year remedy review document development occurred before completion of the remedy implementation, WADB was not included in this review cycle.

RCRA – Resource Conservation and Recovery Act

Table A-6. Summary of No Remedial Actions at SRS OUs

Operable Unit	Remedial Action
No Action/No Further Action	
211-FB Pu-239 Release (081-F)	No Action
716-A Motor Shops Seepage Basin (904-101G)	No Action
Burma Road Rubble Pit (231-4F)	No Action
Central Shops Burning/Rubble Pit (631-6G)	No Action
Central Shops Sludge Lagoon (080-24G)	No Action
C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, 189-P)	No Further Action
Fire Department Hose Training Facility (904-113G)	No Action
Ford Building Waste Site (643-11G)	No Further Action (Removal)
G-Area Oil Seepage Basin (761-13G)	No Action
Gas Cylinder Disposal Facility (131-2L)	No Action
Grace Road Site (631-22G)	No Action
Gunsite 113 Access Road Unit (631-24G)	No Action
Gunsite 218 Rubble Pile (621-23G)	No Action
Gunsite 720 Rubble Pit Unit (631-16G)	No Action
Hydrofluoric Acid Spill (631-4G)	No Action
K-Area and PAR Pond Sludge Land Application Site (761-4G and 761-5G)	No Action
L-Area Burning/Rubble Pit (131-L)	No Action
L-Area Hot Shop (717-G)	No Further Action
L-Area Northern Groundwater (NBN)	No Action
L-Area Rubble Pile (131-3L)	No Action
M-Area West Unit (631-21G)	No Action
Metals Burning Pit (731-5A)	No Further Action
R-Area Acid/Caustic Basin (904-77G)	No Action
R-Area Rubble Pile (631-25G)	No Further Action
Road A Chemical Basin (904-111G)	No Action
SRL Oil Test Site (080-16G)	No Action
Stormwater Outfall A-013 (NBN)	No Action
West of SRL "Georgia Fields" Site (631-19G)	No Action
No Action/No Further Action OUs Associated with OUs Requiring Remedial Action	
108-4R Overflow Basin (108-4R)[1]	No Further Action
Central Shops Burning/Rubble Pit (631-5G)[2]	No Action
ECODS B-3 and B-5 (NBN)[3]	No Further Action
ECODS G-3 (Adjacent to Gunsite 012) (NBN)[4]	No Action
~~Gas Cylinder Disposal Facility (131-2L)~~	~~No Action~~
~~L-Area Rubble Pile (131-3L)~~[5]	~~No Action~~
L-Area Acid/Caustic Basin (904-79G)[5]	No Action
Rubble Pile Across from Gunsite 012 (NBN)[4]	No Action

Table A-6. Summary of No Remedial Actions at SRS OUs *(continued/end)*

Operable Unit	Remedial Action
RCRA Units that are No Further Action under CERCLA	
H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, and 904-56G)	No Further Action (Low Permeability Cap)
Tank 105-C Hazardous Waste Management Facility (NBN)	No Further Action
F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G)	No Further Action (Low Permeability Cap, In Situ S/S)
Mixed Waste Management Facility (643-28E)	No Further Action (Low Permeability Cap)

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

Data Review

Four groundwater monitoring wells, BMW001D, BMW002D, BMW003D, and BMW004D, were sampled and analyzed in the third quarter of 2021 for the following constituents: gross alpha, nonvolatile beta, iodine-129, tritium, lead, Aroclor 1254, and Aroclor 1260. The 2021 sampling results were compared to the 2016 and 2010 sampling results (Table C-3). Aroclor 1254, Aroclor 1260, and iodine-129 continue to be non-detect. Lead was detected in all four wells in 2021, but all detections were below the MCL (15 µg/L). Gross alpha continues to be detected above the MCL (15 ρCi/L) in wells BMW002D, BMW003D, and BMW004D. Nonvolatile beta was detected in all wells, but all detections were less than the MCL (50 ρCi/L). Tritium was detected in two of four wells (BMW002D and BMW004D), but at concentrations below the MCL (20 ρCi/mL).

The gross alpha results obtained since 2009 correlate with elevated turbidity in the wells. There is no elevated tritium or iodine-129 in groundwater. Therefore, there were no contaminant migration concerns from review of the groundwater data and no significant changes from 2016 to 2021 that would call into question the effectiveness of the in situ S/S and cover system remedy at HWCTR.

Redevelopment of the BMW wells was ~~inadvertently delayed but will be~~ conducted in January 2022 and low flow bladder pumps were installed to reduce turbidity in the samples. The wells were resampled in February 2022 and all results were below detection limits or less than the respective MCLs (Table C-3). Turbidity was significantly lower at BMW002D and generally lower at BMW001D, BMW003D, and BMW004D when compared to the 3Q2021 sampling event. Since the MCL for gross alpha was not exceeded, filtering of future samples and speciation for the individual alpha emitting radionuclides are not recommended during the next sampling event in 2026.~~4Q2021 and sampling results reported in Revision 1 of this document. The redevelopment of these wells should help to reduce the turbidity. If the turbidity does not improve after redevelopment, the samples will be filtered and speciated, as needed, for individual gross alpha radionuclides.~~

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, 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 26, 2021 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The BAOU was inspected by SRNS personnel on July 14, 2021. Annual inspections since 2011 have documented the presence of small cracks in the surface of the concrete cover. Although small cracks were observed again in 2021, there is no infiltration of precipitation because the below-grade portions of the facility were grouted and sealed in place forming a stabilized structure. The conditions have not changed to the extent that would compromise the stabilization and containment of the residual waste left in place. Annual monitoring of the cap for crack growth and settlement will continue and repairs performed as needed.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on November 30, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Annual site inspections conducted since 2011 have documented the presence of small cracks in the surface of the concrete cover on the inspection checklists. The inspections conducted during this remedy review cycle are listed in Section XII.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The removal and disposal action of the contaminated sediment in ECODS B-3 and B-5 proved to be successful in preventing further leaching of contaminants into the soil. The potential for exposure to asbestos in the subsurface has been eliminated by virtue of the removal action. An evaluation of the analytical results from the clean fill material indicated that ECODS B-3 and B-5 met the requirements for an unrestricted (residential) land use scenario.

- The removal and disposal of the reactor vessel, steam generators, steel containment dome, and all above-grade components of the facility (except for the transfer coffin refueling machine) eliminated exposure of radioactive or chemical contamination posing human health risks exceeding 1E-06 in media or structures associated with the HWCTR facility. These contaminated components were properly disposed of and NFA was necessary for this equipment.

- The removal action of in situ grouting and stabilization of the HWCTR was effective in eliminating or controlling all routes of exposure to residual below grade radioactive or chemical contamination posing human health risk exceeding 1E-06 in media or structures associated with the HWCTR facility. Annual inspection and maintenance data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk.

Following completion of the removal actions, the selected remedy for HWCTR of LUCs and groundwater monitoring is effective in preventing exposure to radioactive or chemical contamination posing human health risk exceeding 1E-06 and the potential migration of residual radionuclides and chemicals constituents remaining below grade to groundwater above MCLs/RSLs. The four BAOU monitoring wells provide additional assurance regarding the effectiveness of the in situ S/S remedy. A review of the annual inspection

reports, which began in 2011 after completion of the removal action, identified no issues that required corrective action.

The Land Use Control Implementation Plan for BAOU governs LUC implementation, maintenance, monitoring, reporting, and enforcement (SRNS 2014). All LUC objectives are being met.

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

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. Because the contaminants have been stabilized and exposure to the activated metal and concrete has been mitigated via in situ grouting and stabilization of HWCTR, changes in standards or to-be-considered guidance would not impact the risks associated with the BAOU.

The USEPA standards and toxicity values have been updated since implementation of the remedy as shown in Appendix B. The changes to the values for RCOCs at the HWCTR 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 could call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perflurorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. 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 associated with the protectiveness of this OU

IX. Recommendations and Follow-up Actions

Elevated gross alpha concentrations were detected in the BMW groundwater wells at the BAOU likely due to turbidity issues. The USDOE recommended redevelopment of the BMW wells prior to the next sampling event to reduce turbidity, followed by filtering of samples and speciation, as needed, for radionuclides. Redevelopment of the wells was ~~inadvertently delayed and will be~~ conducted in 1Q2022~~4Q2021~~ and low flow bladder pumps were installed to help reduce turbidity. A resampling event took place in February 2022, turbidity was generally lower in all four wells and none of the results exceeded an MCL. Filtering of the samples and speciation for the individual alpha emitting radionuclides are not recommended during the next sampling event in 2026. ~~The sampling results from the redeveloped wells will be reported in the Revision 1 Sixth Five-Year Remedy Review Report Revision 1 for SRS OUs with Geosynthetic or S/S Cover Systems. Table C-4 presents the recommendation and follow-up action for the BAOU.~~ No additional recommendations or follow up actions are proposed for this unit.

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled with LUCs to prevent exposure to contaminated building components and equipment (i.e., metal and concrete media) remaining below grade in the HWCTR facility. Groundwater monitoring continues to evaluate the effectiveness of the in situ S/S remedy to prevent potential

migration of residual contaminants to groundwater. All threats to contaminated building components and equipment (i.e., activated metal and concrete) at the BAOU have been addressed through in situ S/S, concrete cover, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the BAOU 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 Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

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

SRNS, 2010. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the Early Construction and Operational Disposal Sites (ECODS) B-3 and B-5 Operable Unit (OU) (U)*, Revision 1, SRNS-RP-2009-01443, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011a. *Removal Action Report (RAR) for the Early Construction and Operational Disposal Sites (ECODS) B-3 and B-5 Operable Unit (OU) (U)*, SRNS-RP-2011-00210, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011b. *Removal Action Report (RAR) for the Heavy Water Components Test Reactor (770-U) (U)*, SRNS-RP-2011-01213, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Record of Decision Remedial Alternative Selection for the B-Area Operable Unit (U)*, SRNS-RP-2012-00354, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2014. *Land Use Control Implementation Plan (LUCIP) for the B-Area Operable Unit*, SRNS-RP-2013-00113, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2015. *Corrective Measures Implementation Report (CMIR)/ Remedial Action Completion Report (RACR) for B-Area Operable Unit (U)*, SRNS-RP-2014-00517, Revision 1, Savannah River Nuclear Solutions LLC, Savannah River Site, Aiken, SC

SRNS, 2018. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Geosynthetic or Stabilization/Solidification Cover Systems (U) Aiken, South Carolina*, SRNS-RP-2016-00610, Revision 1,1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

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

Various - *Inspection Data Sheets – Field Inspection Checklist B-Area Operable Unit, (U)*, ER-IDS-019-056, Inspection period 2017 through 2021 (annually)

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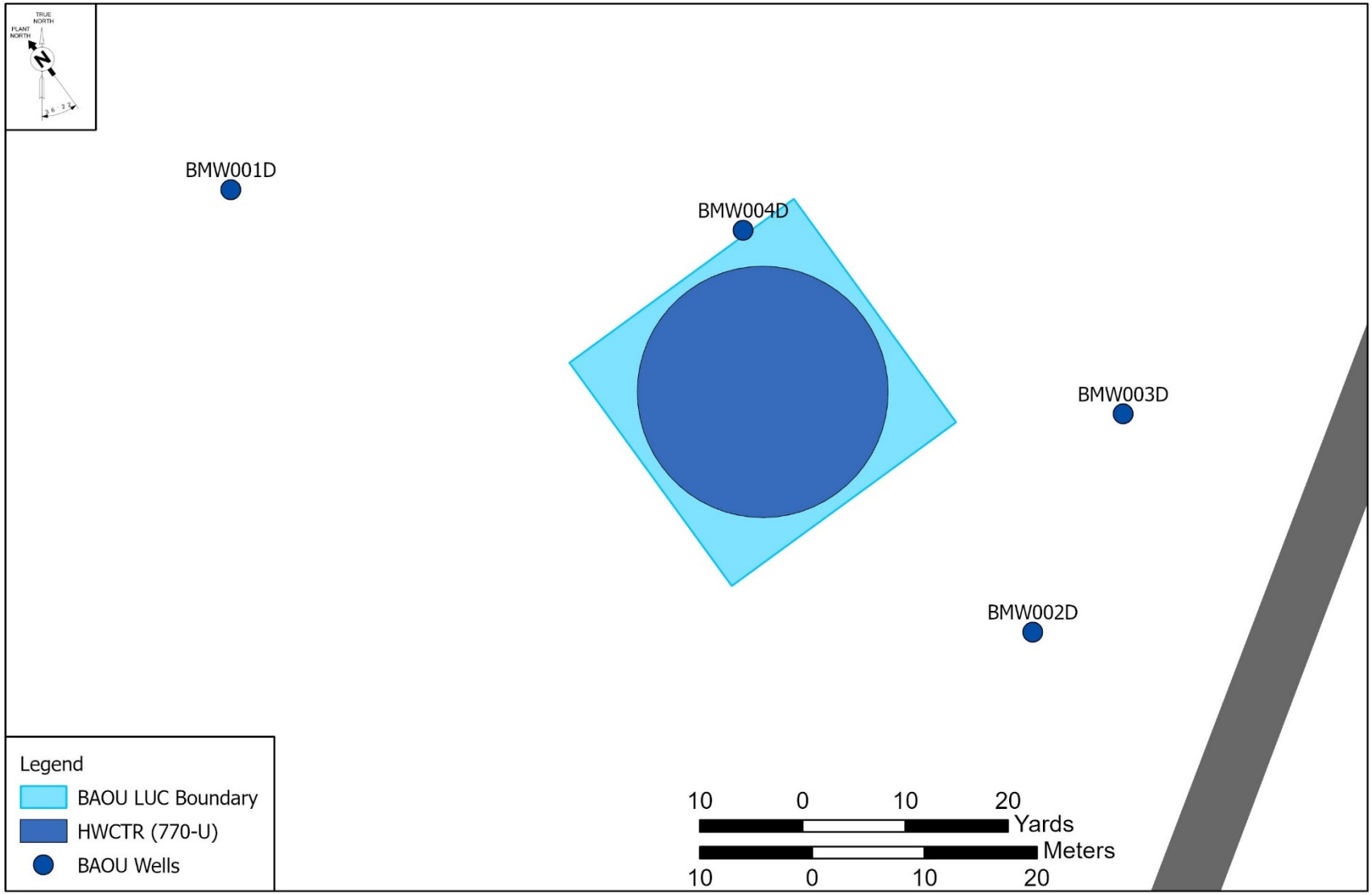

Figure C-5. Location of Groundwater Sampling Wells at HWCTR

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Table C-1. Chronology of OU Events

Event	Date
BAOU Field Start	January 11, 2010
HWTCR Removal Action Start	April 14, 2010
ECODS B-3 and B-5 Removal Action Start	July 23, 2010
HWTCR Field Complete	June 27, 2011*
ROD Issuance	April 16, 2013
Remedial Action Start	April 9, 2014
Previous Five-Year Reviews Issuance	March 27, 2018

* Core Team agreed at the completion of the walk down that the HWCTR decommissioning, and construction field activities have been completed. Only deficiency noted was with the wording on the access control signs. The wording was corrected, and the signs were installed (SRNS 2015).

Table C-2. Comparison of Actual vs. Estimated O&M

	FY2017	FY2018	FY2019	FY2020	FY2021	Five-Year Total
Total O&M Actual Costs ($)	17,843	6,722	7,789	7,477	13,366	53,197
Total ROD Estimated Direct O&M Costs* ($)	23,000	5,500	5,500	5,500	5,500	45,000

* Costs for preparation of the Fifth Five-Year Remedy Review were accounted for in FY2017.

Table C-3. BAOU Groundwater Sampling Results, 2021/2022 Compared to 2010 and 2016

Contaminant	MCL/RSL	Well	2010 Results	2016 Max Results	2021 Results*	2022 Results*	Unit
Aroclor 1254	7.8E-03	BMW001D	ND	ND	ND	ND	µg/L
		BMW002D	ND	ND	ND	ND	µg/L
		BMW003D	ND	ND	ND	ND	µg/L
		BMW004D	ND	ND	ND	ND	µg/L
Aroclor 1260	7.8E-03	BMW001D	ND	ND	ND	ND	µg/L
		BMW002D	ND	ND	ND	ND	µg/L
		BMW003D	ND	ND	ND	ND	µg/L
		BMW004D	ND	ND	ND	ND	µg/L
Lead	1.5E+01	BMW001D	ND	1.6E+00	5.0E-01	8.9E-01	µg/L
		BMW002D	1.9E+01	1.4E+01	1.2E+00	ND	µg/L
		BMW003D	5.9E+00	3.4E+00	2.5E+00	7.4E-01	µg/L
		BMW004D	3.6E+01	8.8E+00	7.0E+00	1.6E+00	µg/L
Iodine-129	2.3E-01	BMW001D	ND	ND	ND	ND	ρCi/L
		BMW002D	ND	ND	ND	ND	ρCi/L
		BMW003D	ND	ND	ND	ND	ρCi/L
		BMW004D	ND	ND	ND	ND	ρCi/L
Tritium	2.0E+01	BMW001D	5.9E-01	5.7E-01	ND	ND	ρCi/mL
		BMW002D	8.6E-01	6.6E-01	6.2E-01	ND	ρCi/mL
		BMW003D	1.1E+00	5.2E-01	ND	ND	ρCi/mL
		BMW004D	1.1E+00	7.4E-01	5.6E-01	ND	ρCi/mL
Gross Alpha	1.5E+01	BMW001D	8.5E+00	5.9E+00	2.6E+00	5.6E+00	ρCi/L
		BMW002D	2.5E+01	1.0E+02	2.6E+01	2.2E+00	ρCi/L
		BMW003D	1.7E+01	2.2E+02	7.6E+01	4.8E+00	ρCi/L
		BMW004D	5.3E+01	6.9E+01	6.9E+01	9.5E+00	ρCi/L
Nonvolatile Beta	5.0E+01	BMW001D	6.5E+00	5.3E+00	2.4E+00	3.3E+00	ρCi/L
		BMW002D	2.5E+01	5.3E+01	3.3E+01	2.5E+00	ρCi/L
		BMW003D	1.4E+01	6.1E+01	3.1E+01	3.9E+00	ρCi/L
		BMW004D	4.4E+01	2.8E+01	1.2E+01	7.6E+00	ρCi/L
Turbidity	N/A	BMW001D	57.7	56	2.2	1.2	NTU
		BMW002D	1000	1000	421	54.9	NTU
		BMW003D	119	161	124	103	NTU
		BMW004D	1000	451	62.9	28.3	NTU

~~* Well development, as required by the fifth five-year remedy review (SRNS 2018), was inadvertently delayed until after submittal of the Revision 0 of this document. Once redevelopment is completed, new groundwater samples will be collected.~~

Shading indicates concentration is greater than the MCL/RSL.

ND = non-detect; NTU = nephelometric turbidity unit

~~Table C-4. Recommendations and Follow-up Actions for the B-Area Operable Unit~~

~~Issues~~	~~Recommendations / Follow-up Actions~~	~~Party Responsible~~	~~Oversight Agency~~	~~Milestone Date~~	~~Follow-up Actions: Affects Protectiveness (Y/N)~~	
					~~Current~~	~~Future~~
~~Elevated gross alpha concentrations in groundwater samples are likely related to high turbidity in the BMW wells.~~	~~Redevelop the BMW wells to decrease turbidity in the wells prior to the next sampling event. Filter samples from redeveloped wells and perform speciation, as needed, for radionuclides. Report results in the Sixth Five Year Remedy Review Report.~~	~~USDOE~~	~~USEPA/ SCDHEC~~	~~4Q 2021~~	~~N~~	~~N~~

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V. Progress since Last Review

The previous protectiveness statement concluded that the remedy of soil stabilization and a low permeability cover system with institutional controls (i.e., LUCs) at the CRSB OU is protective of human health and the environment.

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

Data Review

Review of maintenance inspection reports conducted from FY2017 through FY2021 and a visual inspection of the CRSB OU indicate the structural integrity of the cover system is intact and providing protection to human and ecological receptors. Groundwater associated with the CRSBs will be addressed as part of the C-Area Groundwater OU.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 26, 2021 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The CRSB OU was inspected by SRNS personnel on July 14, 2021. No issues were identified for the CRSB OU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on November 30, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual site inspections conducted from FY2017 through FY2021 identified signs that needed to be replaced, active ant mounds, overgrown vegetation, and hog damage. These findings were documented on the field inspection checklist, listed in the Section XII, and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The cover system and soil stabilization are effective in preventing human and ecological receptor exposure to contaminated basin soils (PTSM). The cover system maintenance program and LUCs have been effective in maintaining the integrity of the cover system. The annual inspection reports indicate no visible signs of erosion, signs are legible, and administrative controls are in place.

The Land Use Control Implementation Plan for the CRSB OU is located in Appendix A of the Post Construction Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement (WSRC 2003). All LUC objectives are being met.

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

The exposure assumptions, toxicity data, and cleanup levels used at the time of final remedy selection are still valid. There have been no changes in physical conditions at the CRSB 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 CRSB OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perflurorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. 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 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 currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The remedy at the CRSB 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 media. All threats to contaminated soil at the CRSB OU have been addressed through in situ soil stabilization, implementation of the soil cover, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the CRSB OU for industrial use only, OU-specific perimeter fencing and warning signs, and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

Du Pont, 1987. *Environmental Information Document – Reactor Seepage Basins*, DPST-85-707, E.I. Du Pont Nemours & Co., Savannah River Site, Aiken, SC

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

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

USDOE, 1998. Letter B.T Hennessey to J.L. Crane and K.A. Collingsworth, dated December 17, 1998, *Fiscal Year 1998 Removal Action Report*, OD-99-127, U.S Department of Energy – Savannah River Office, Savannah River Site, Aiken, SC

WSRC, 1997. *Removal Site Evaluation Report for the C-Reactor Seepage Basins (904-066, -067 and -68G) (U)*, WSRC-RP-97-132, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998. *ASCAD™ RI Work Plan for the C-Reactor Seepage basins (904-66G, 904-67G, and 904-68G) (U)*, WSRC-RP-97-431, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

WSRC, 1999b. *Plug-In Record of Decision for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)*, WSRC-RP-98-4099, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000a. *Explanation of Significant Difference (ESD) for the Plug-In ROD for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil – C-Area Reactor Seepage Basin (U)*, WSRC-RP-2000-4032, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000b. *Unit-Specific Plug-In Technical Evaluation Report for the C-Reactor Seepage Basins (904-66G, 904-67G, and 904-68G) Operable Unit (U)*, WSRC-RP-2000-4008, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Unit-Specific Plug-In Record of Decision Amendment for the C-Area Reactor Seepage Basin (904-67G) and L-Area Reactor Seepage Basin (904-64G) (U)*, WSRC-RP-2002-4063, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Post-Construction Report (PCR)/Final Remediation Report (FRR) for the C-Area Reactor Seepage Basin (904-66G, -67G, and -68G) Operable Unit (U)*, WSRC-

RP-2002-4149, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist C-Reactor Seepage Basins (904-66G, 904-67G, 904-68G) (U)*, ER-IDS-019-013, Inspection period 2017 through 2021 (annually)

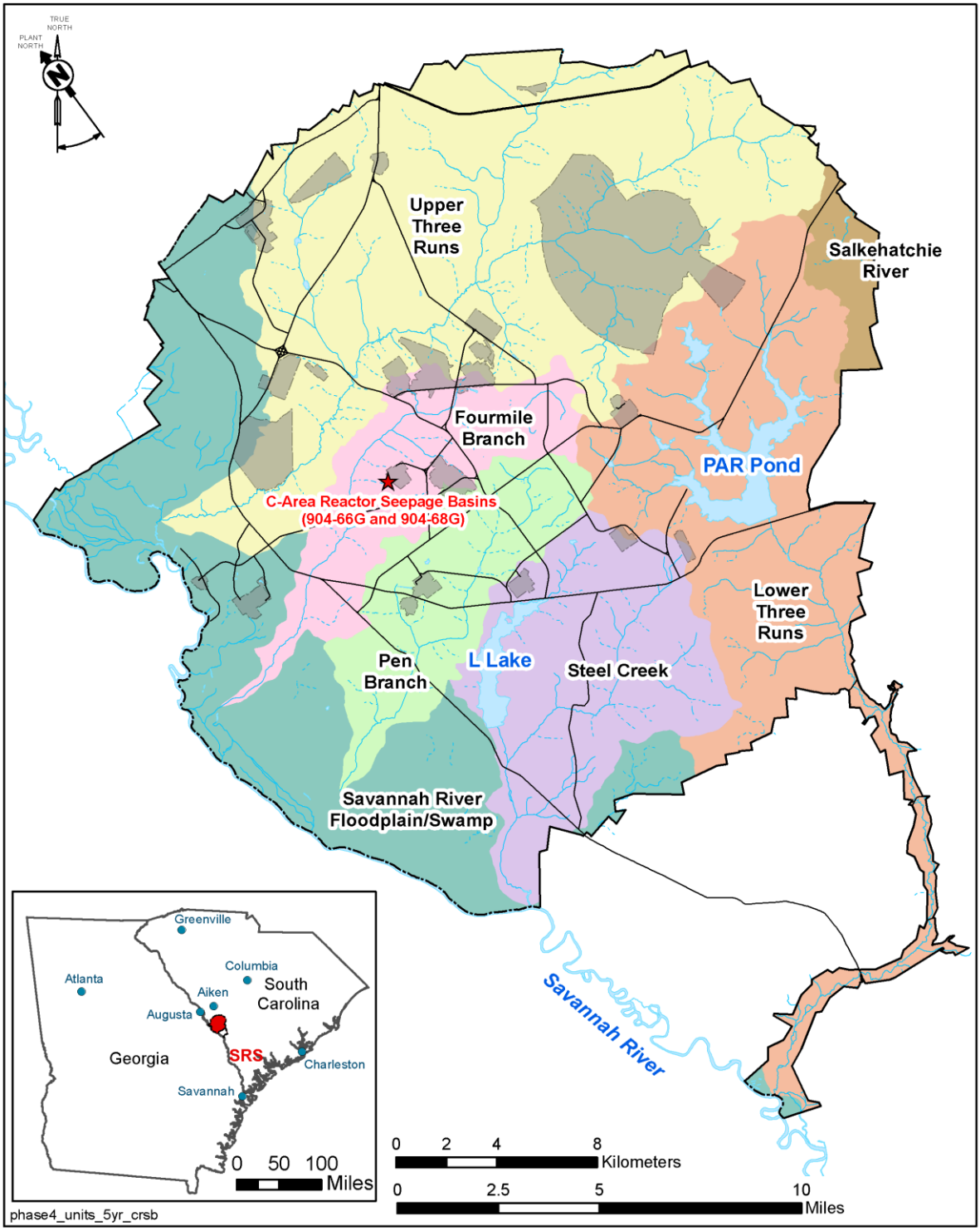

Figure D-1. Location of the C-Area Reactor Seepage Basins OU at SRS

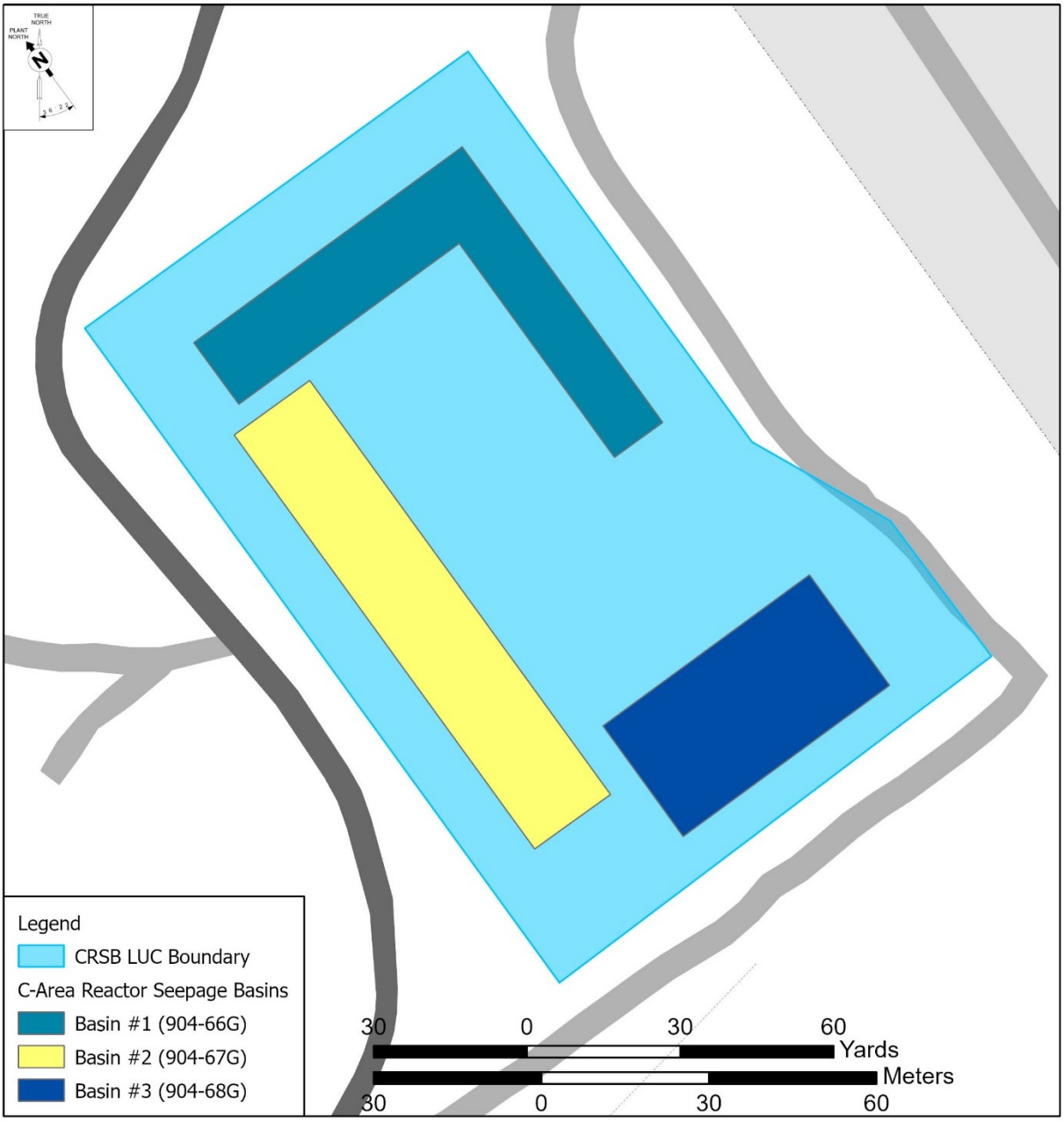

Figure D-2. C-Area Reactor Seepage Basins OU

V. Progress since Last Review

The previous protectiveness statement concluded that the remedy (i.e., excavation and removal of contaminated media, backfilling excavated areas, and implementing institutional controls [i.e., LUCs] to prevent exposure to or ingestion of contaminated soil and sediment) at the DEXOU is protective of human health and the environment.

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

VI. Five-Year Review Process

The following tasks were performed as part of the five-year 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 E-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

~~Confirmatory sampling of soils associated with the removal of the PCB contaminated soils was conducted on March 7, 2006. The results of the two samples collected indicated that only Aroclor 1254 was detected at concentrations well below the RG of 1 mg/kg (0.081 and 0.045 mg/kg).~~ The main D-Area groundwater metals plume originates from the D-Area Coal Storage Area (DCSA) and D-Area Coal Pile Runoff Basin (489-D CPRB) (Figure E-5). This was caused by decades of coal storage and runoff from the coal which caused acidic leachate to infiltrate to the shallow groundwater. Subsequently, this caused dissolution of coal related elements as well as natural aquifer sediments. The metals plume downgradient of the 488-D Ash Basin is associated with the plume that emanates from the DCSA/489-D CPRB. Concentrations are higher upgradient from the 488-D Ash Basin. The DRP metals plume was caused by previous storage of coal rejects and material which

has been removed. The small metals plume originating from the DRP has not increased in size and will eventually diminish since the source has been removed.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 26, 2021 at the O&M organization offices. No issues were identified as an outcome of these interviews.

The DEXOU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) on July 14, 2021. No issues were identified for the DEXOU during this inspection

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on November 30, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual site inspections conducted from FY2017 through FY2021 have identified overgrown vegetation, active ant mounds, and hog damage. These findings were documented on the field inspection checklists, listed in Section XII, and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

The removal actions for the DRP and 488-DAB exterior subunit, as well as the cover system maintenance program and LUCs for the 488-DAB interior subunit, are effective in preventing exposure of industrial workers and ecological receptors because the actions have broken the pathway to the receptors.

The Land Use Control Implementation Plan for the DEXOU governs LUC implementation, maintenance, monitoring, reporting, and enforcement (WSRC 2005). All LUC objectives are being met.

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

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in physical conditions at the DEXOU 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 DEXOU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perflurorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances

(PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. 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 associated with the protectiveness of this OU

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for this OU. Monitoring of the groundwater continues as part of the D-Area Groundwater OU.

X. Protectiveness Statements

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

Exposure pathways that could result in unacceptable risks are being controlled by excavation and removal of contaminated media, backfilling excavated areas, and implementing institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated soil and sediment. All threats to contaminated soil and sediment at the DEXOU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the DEXOU 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 Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

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

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

WSRC, 1998. *RCRA Facility Investigation/Remedial Investigation Work Plan for the 488-D Ash Basin and D-Area Coal Pile Runoff Basin Operable Unit*, WSRC-RP-97-440, 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, 2001. *RCRA Facility Investigation/Remedial Investigation Work Plan Addendum for the D-Area Expanded Operable Unit*, WSRC-RP-99-4067, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment for the D-Area Expanded Operable Unit (DEXOU) (U)*, WSRC-RP-2001-4162, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004a. *Record of Decision Remedial Alternative Selection for the D-Area Expanded Operable Unit (U)*, WSRC-RP-2004-4007, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004b. *Monitoring Work Plan for the D-Area Groundwater Operable Unit (U)*; WSRC-RP-2003-4150, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005. *Land Use Control Implementation Plan (LUCIP) for the D-Area Expanded Operable Unit (DEXOU) (U)*, WSRC-RP-2004-4065, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Post-Construction Report/Corrective Measures Implementation Report/Remedial Action Completion Report for the D-Area Expanded Operable Unit (U)*, WSRC-RP-2007-4041, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, D-Area Rubble Pit (431-2D) (U)*, ER-IDS-019-038, Inspection period 2017 through 2021 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, D-Area Ash Basin (488-D) (U)*, ER-IDS-019-041, Inspection period 2017 through 2021 (annually)

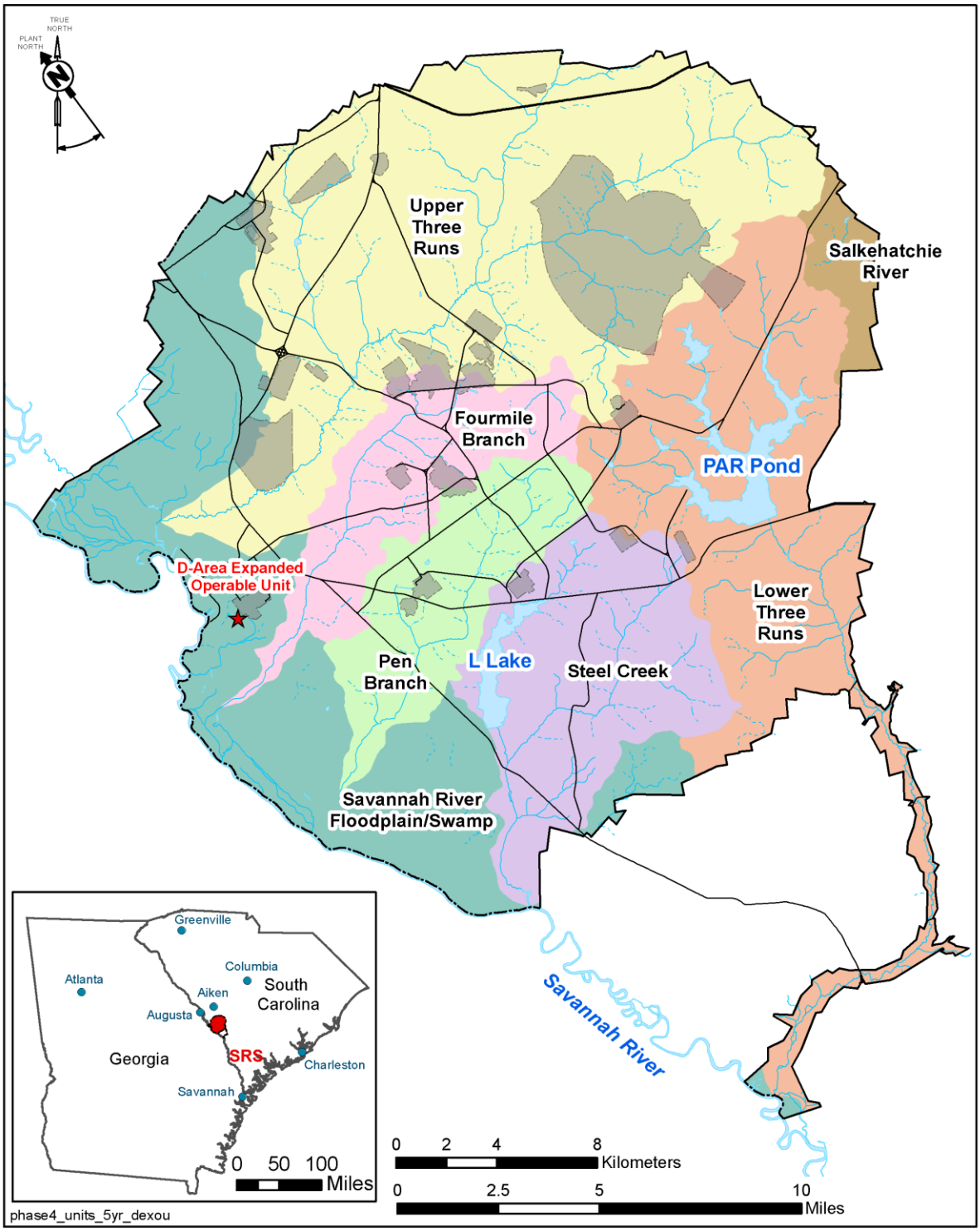

Figure E-1. Location of the DEXOU within the SRS

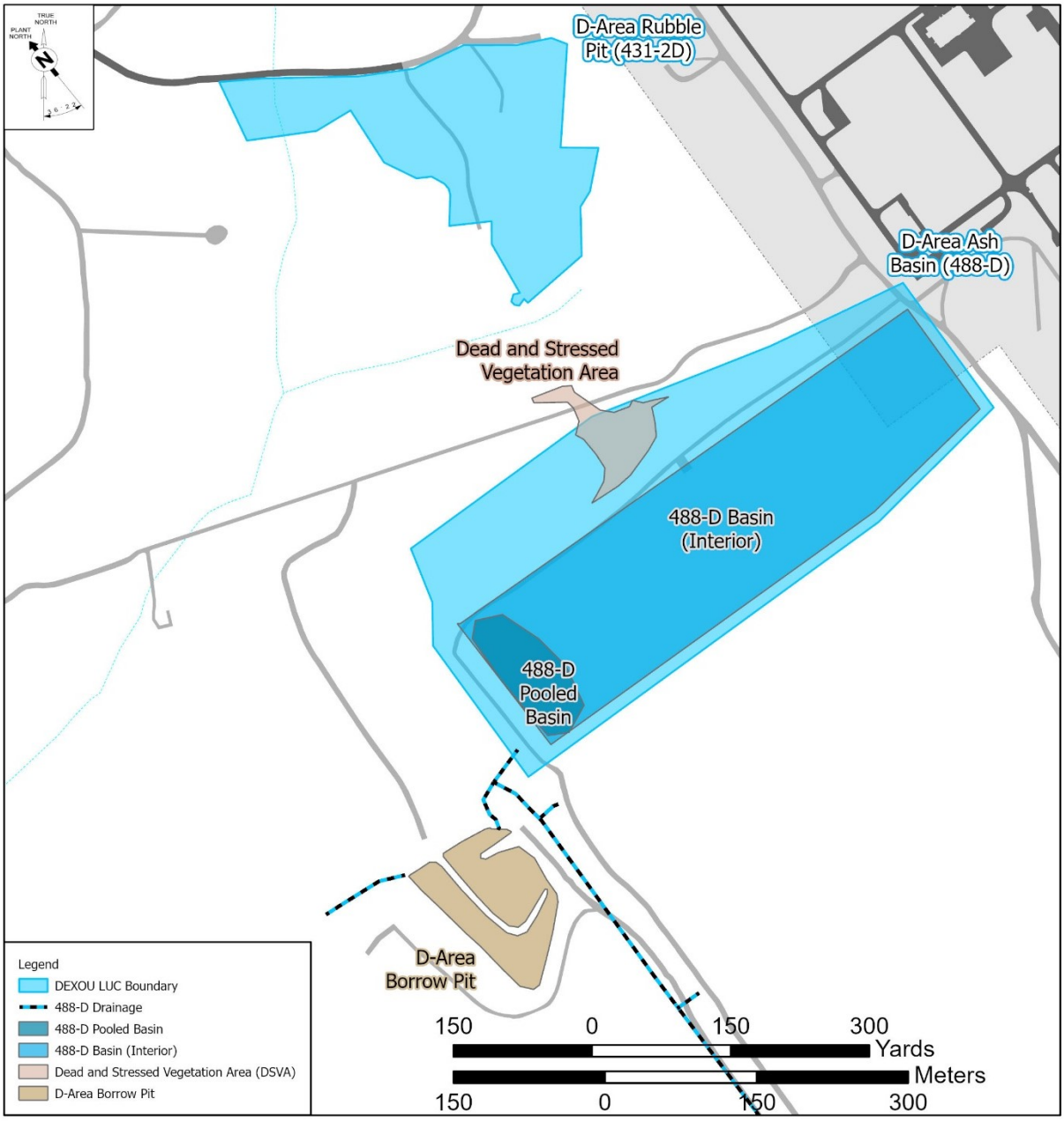

Figure E-2. Layout ofthe DEXOU within D Area

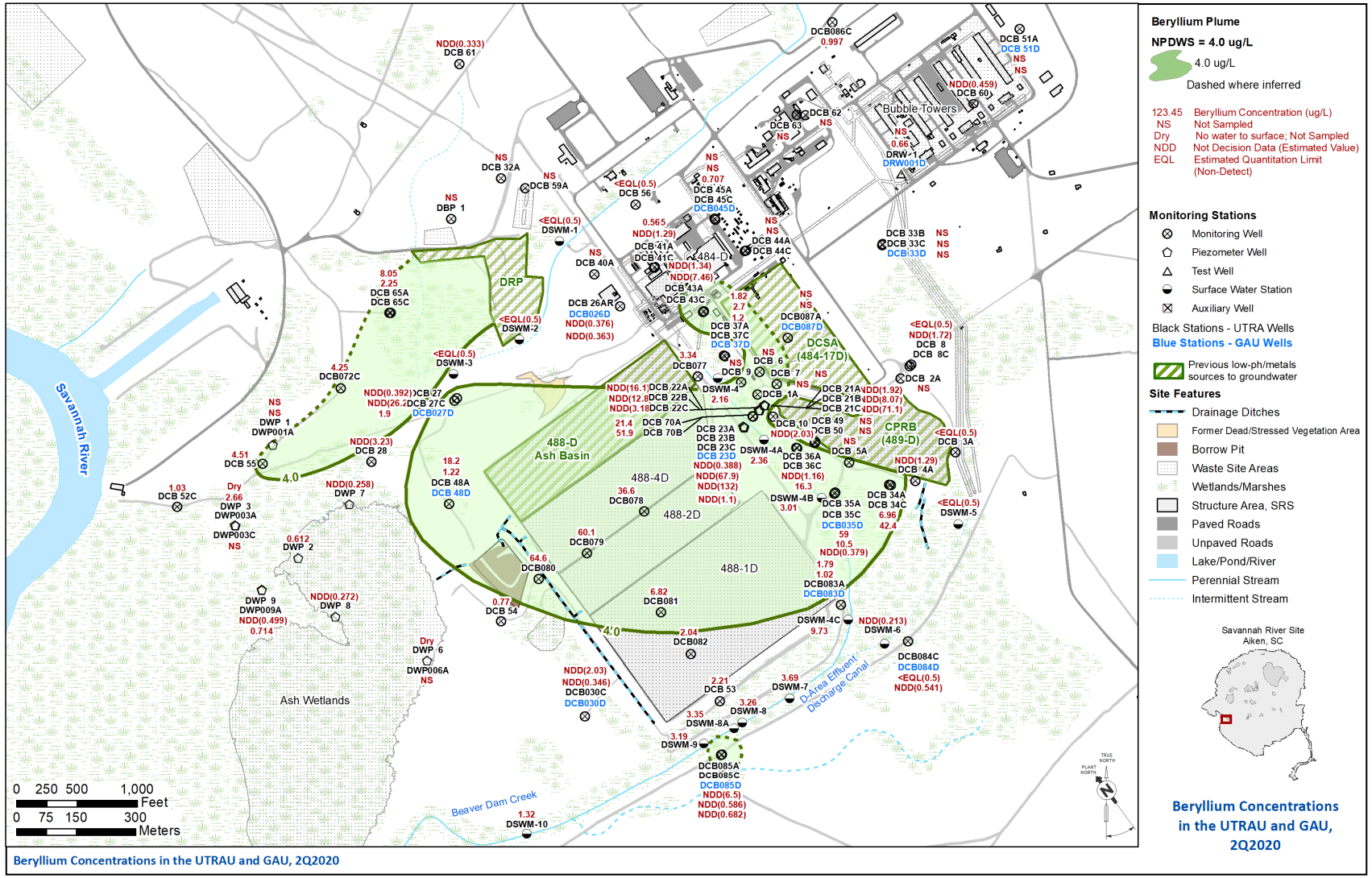

Figure E-5. Beryllium Concentrations Associated with D-Area Groundwater OU

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the future O&M costs are expected to be significantly higher than originally estimated based on the anticipated condition of the stormwater runoff covers and the soil and material beneath the covers.

V. Progress since Last Review

The previous protectiveness statement concluded that the interim remedy at the E-Area LLWF (Slit Trench Disposal Units 1 – 5) is protective of human health and the environment. The interim remedy enhances the protective measures currently in place and reduces storm water infiltration through the Slit Trench Disposal Units 1 – 5. Because the E-Area LLWF is currently in the operational phase, unit specific LUCs have been deferred until final closure of the entire E-Area LLWF. However, access is controlled by SRS facility security and administrative controls.

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 interim remedial action;
- Evaluated the effectiveness of the interim remedial action;
- Inspected the E-Area LLWF (Slit Trench Disposal Units 1 – 5), conducted site interviews, and documented the results on the Inspection Checklist provided in Attachment F-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Based on the FY2020 PA Annual Review (SRNL 2021), operations, disposal activities and vadose zone monitoring results indicate that the conclusions of the PA remain valid with

reasonable expectation that the E-Area LLWF will meet the performance objectives delineated in DOE Order 435.1.

Summary of Inspections and Interviews

Interviews were conducted with Ira Stewart, Solid Waste Management (SWM) Engineering, and Sam McGill, SWM Engineering, on August 26, 2021 at the SWM Facility. No issues were identified for the E-Area LLWF during these interviews.

The E-Area LLWF was inspected by Savannah River Nuclear Solutions, LLC (SRNS) personnel on July 21, 2021. No issues were identified for the E-Area LLWF (Slit Trench Disposal Units 1 – 5) during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Quarterly site inspections conducted during FY2017 and FY2021 noted two depressions in the surface of the E-Area LLWF (Slit Trench Disposal Units 4 and 5) cover that were also noted in the Fourth and Fifth Five-Year Remedy Review Report (SRNS 2014, SRNS 2018). Surface depressions at E-Area LLWF are not unexpected, and these subsidence areas are monitored to verify the cover is not compromised. Additionally, the release of the cover anchor strip fasteners has been observed on occasion. The anchor strips remained intact, and the fasteners are replaced as needed. These findings were documented on the field inspection checklists listed in Section XII.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

The stormwater runoff covers (intact though localized subsidence is noted as discussed in Section VIII) are operating as designed to effectively drain stormwater runoff away from the buried trench material significantly reducing infiltration. Based on the FY2020 PA Annual Review (SRNL 2021), vadose zone monitoring indicates that migration of radionuclides remains within the PA predictions and continue to meet the performance objectives.

The E-Area LLWF is currently in the operational phase and access is controlled by SRS facility security and administrative controls. OU-specific LUCs have been deferred until final closure of the entire E-Area LLWF.

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

Because of ongoing operations, a CERCLA risk assessment has not been conducted at the E-Area LLWF and is not required to support the interim action. In accordance with USDOE Order 435.1 requirements, the expected migration of radionuclides is evaluated in the PA to ensure protection of groundwater resources. There have been no changes in cleanup levels, standards, or to-be-considered guidance that would alter the conclusions of the PA that call into question the protectiveness of the interim remedy.

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

The following information should be considered in the overall protectiveness of the strategy:

- The E-Area LLWF PA, as required by USDOE Order 435.1, evaluates the migration of radionuclides and determines the potential impacts to groundwater resources. The E-Area LLWF PA determines acceptable disposal limits for radioactive low-level

waste based on key inputs and assumptions associated with the conditions of the waste and disposal facility, including expected releases of radionuclides from the disposal units. The acceptable disposal limits are set at levels that ensure protection of human health and the environment. The annual review of the PA for the E-Area LLWF documents the full assessment of the E-Area LLWF O&M activities. Based on the FY2020 PA (SRNL 2021), vadose zone monitoring indicates that migration of radionuclides is within the PA predictions and is not expected to exceed the drinking water standards beyond a 100-m (328-ft) buffer zone surrounding the disposed waste (USDOE Order 435.1 point of compliance).

- Installation of stormwater runoff covers over the Slit Trench Disposal Units 1 – 5 was not analyzed in the E-Area LLWF 2008 PA (WSRC 2008). Subsequent analysis (SRNS 2011) indicated that use of the stormwater runoff covers over the Slit Trench Disposal Units 1 – 5 would allow significantly (over two orders of magnitude) greater tritium disposal limits for the Slit Trench Disposal Units. Tritium is highly mobile with a relatively short half-life. The increase in the tritium disposal limit is due to the reduction in the anticipated controlled release of tritium from the disposal unit prior to placement of the interim closure cover (i.e., the tritium is held up in the waste zone and decays significantly before the assumed failure of the final cover).
- Since infiltration is significantly reduced with the stormwater runoff covers, long-lived radionuclides, and their daughter products are expected to buildup beneath the cover. This buildup of long-lived radionuclides is expected to result in an increase in the total projected long-term doses to the off-SRS resident; however, the doses are still below the performance objectives of USDOE Order 435.1. The increase in dose is due to the eventual flushing of long-lived parents and their daughters (all held up initially by the stormwater runoff cover, then by the interim and final covers), that get flushed out with the eventual failure of the final cover.

VIII. Issues

The following issues have been identified during this remedy review:

- Maintenance of the stormwater runoff covers continues to be problematic. Since the only mechanical compaction that the placed soil and disposed waste receives is from bulldozer usage and other heavy equipment moving over the top of a completely backfilled trench, significant subsidence as soil settles in and around waste containers is expected during subsequent years after placement of the soil cover. Placing the stormwater runoff covers immediately upon reaching design capacity does not allow for the early settlement to be backfilled. Subsidence beneath the stormwater runoff covers and water pooling in these locations was observed and reported in the Fourth Five-Year Remedy Review (SRNS 2014). The FY2021 inspections determined that depressions have not changed in size and depth. The covers were still intact with no fatigue issues above the depressions (Figures F-7 and F-8). The observed subsidence has not compromised the integrity of the covers, but it is anticipated that substantial rework of the soil beneath the covers will be required if positive drainage off the disposal units is to be maintained. No corrective actions are required at this time.
- During wind events, the covers have been observed to lift substantially, resulting in mechanical stresses to the cover materials. Sandbags were placed as needed on the covers during high winds to mitigate damage. Sandbags were replaced with Quikrete blocks due to same performance and less maintenance. The lower amount of maintenance required also lowered the amount of foot traffic on the cover.
- Subsidence and weathering of the stormwater runoff covers is anticipated to result in significant repairs prior to the end of the design life of the covers. Use of a vegetated soil cover was initially planned since the anticipated subsidence would be readily accessible for maintenance. This cost-effective option was considered in the PA to be adequate for meeting the PA objectives.

IX. Recommendations and Follow-up Actions

The recommendation from the Fourth Five-Year Remedy Review Report (SRNS 2014) identified the need for further discussion with the USEPA and SCDHEC on the installation and maintenance activities for stormwater runoff covers. A meeting and field walkdown

were held on December 6, 2013 with the USDOE, USEPA, and SCDHEC to discuss the maintenance issues and a path forward for installation of future stormwater runoff covers. USDOE recommended that the need for stormwater runoff covers be evaluated on an as-needed basis depending on the waste type or curie content. In lieu of a low permeability membrane, USDOE recommended that soil covers and/or vegetative covers that are graded for positive flow or other low permeability materials with less maintenance issues be considered. No new slit trench disposal units have been operationally closed since issuance of the previous five-year remedy review report (SRNS 2018). Table F-3 presents the recommendation and follow-up actions for the E-Area LLWF Slit Trench Disposal Units 1-5.

X. Protectiveness Statement(s)

The interim remedy at the E-Area LLWF (Slit Trench Disposal Units 1 – 5) is currently protective of human health and the environment because access is controlled by SRS facility security and administrative controls.

The interim remedy enhances the current protective measures required by USDOE Order 435.1 and reduces stormwater infiltration through the Slit Trench Disposal Units 1 – 5. Because the E-Area LLWF is in the operational phase, unit specific LUCs have been deferred until final closure of the entire E-Area LLWF. The final ROD for E-Area LLWF is scheduled for issuance in March 2063.

~~SRS facility security and administrative controls that restrict unauthorized access to the E-Area LLWF are not part of the interim remedy and therefore not recognized as long-term protective. SRS included the E-Area LLWF in the FFA Annual Progress Report to demonstrate long-term protectiveness through the SRS facility security and administrative controls.~~ The FFA Annual Progress Report list of LUC Units includes the closed portions of the E-Area LLWF to recognize the long-term protectiveness provided through the SRS facility security and administrative controls that restrict unauthorized access to the OU. The report is required by the FFA and includes an annual certification by the USDOE SRS Manager that the listed OUs are in compliance with land use requirements.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

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

SRNL, 2021. *FY2020 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility*, SRNL-STI-2020-00588, Revision 0, Savannah River National Laboratory, Savannah River Site, Aiken, SC

SRNS, 2009. *Interim Record of Decision Remedial Alternative Selection for the E-Area Low-Level Waste Facility, 643-26E (Slit Trench Disposal Units 1 and 2)*, SRNS-RP-2009-00538, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010a. *Explanation of Significant Differences (ESD) for the Revision 1 Interim Record of Decision Remedial Alternative Selection for the E-Area Low-Level Waste Facility, 643-26E (Slit Trench Disposal Units 1 and 2)*, SRNS-RP-2009-01128, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010b. *Interim Remedial Action Implementation Plan for the E-Area Low-Level Waste Facility, 643-26E (Slit Trench Disposal Units 1 - 5)*, SRNS-RP-2009-01213, Revision 1, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2011. *FY 2010 Annual Review - E-Area Low-Level Waste Facility Performance Assessment and Composite Analysis*, SRNS-STI-2011-00024, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Interim Post-Construction Report (IPCR) for the E-Area Low-Level Waste Facility, 643-26E (Slit Trench Disposal Units 1 – 5)*, SRNS-RP-2011-00996, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

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

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

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

WSRC 2008. *E-Area Low-Level Waste Facility USDOE 435.1 Performance Assessment*, WSRC-STI-2007-00306, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various – SWMF E-Area Inspections – *Quarterly Slit Trench Water Barrier Cover Inspection,* Manual SW15, Procedure SW15.6-INP-SWF-03, Inspection period 2017 through 2021 (quarterly)

Thus, the selected remedy of in situ stabilization and cover system is effective in preventing human exposure to COCs and preventing or mitigating leaching of PTSM to groundwater at levels that will cause the groundwater to exceed its MCL.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 26, 2021 at the O&M Organization Offices. No issues were identified as an outcome of these interviews.

The FRB OU was inspected by SRNS personnel on July 14, 2021. No issues were identified for the FRB OU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual site inspections conducted from 2017 to 2021 identified active ant mounds and a non-visible concrete marker in the southwest corner. These findings were documented on the field inspection checklists, listed in Section XII, and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

Review of documents, applicable or relevant and appropriate requirements, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD. Placement and maintenance of a protective low permeability cover over the FRB OU breaks the contaminant migration pathway to the groundwater; thus, facilitating meeting the RAOs to prevent physical exposure to the contaminants and to mitigate further migration of contaminants to the groundwater.

O&M of the cover system has been effective. Review of the annual inspection reports for the period 2017 through 2021 indicate the in-place remedy is functioning properly. Review of the inspection reports indicates the maintenance is operating effectively and efficiently.

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

The Land Use Control Implementation Plan for the FRB OU is located in Appendix A of the CMIR/PCR/FRR and governs LUC implementation, maintenance, monitoring, reporting, and enforcement (WSRC 2001). 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 physical conditions at the FRB OU that would affect the protectiveness of the remedy. The remedy of grouting the pipeline and excavating soils with disposition in the basin followed by grouting basin soils with placement of a low permeability cover has eliminated the exposure pathway associated

with soils and continues to provide protectiveness to humans by eliminating the exposure pathway.

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

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. 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 new information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues for this OU.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

All threats posed by soil contamination at the FRB OU have been addressed through in situ stabilization, a low permeability soil cover, pipeline grouting, and institutional controls (i.e., LUCs) to maintain industrial land use. LUCs include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain this site for industrial use only (SRS is a secured government facility with land use restrictions), 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 Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

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

SRNS, 2018. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, FINAL, September 2018, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

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

SRNS, 2021. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, FINAL, November 2021, 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, 1997a. *Groundwater Sampling Report with Residential Risk Assessment for the F-Area Retention Basin (281-3F) (U)*, WSRC-RP-96-00905, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997b. *Remedial Investigation Report with the Baseline Risk Assessment for the F-Area Retention Basin (281-3F) (U)*, WSRC-RP-96-356, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 1998. *Record of Decision for the F-Area Retention Basin (281-3F) (U)*, WSRC-RP-97-145, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

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

WSRC, 2000. *Explanation of Significant Difference (ESD) to the Revision 1.1 Record of Decision (ROD) for the F-Area Retention Basin (281-3F) (U)*, WSRC-RP-2000-4079, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2001. *Corrective Measures Implementation Report/Post-Construction Report/ Final Remediation Report (CMIR/PCR/FRR) for F-Area Retention Basin (FRB) (Building 281-3F) (U)*, WSRC-RP-2001-4049, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

Various - *Inspection Data Sheets – Field Inspection Checklist, F-Area Retention Basin Bldg 381-3F (U)*, ER-IDS-019-009, Inspection period 2017 through 2021 (annually)

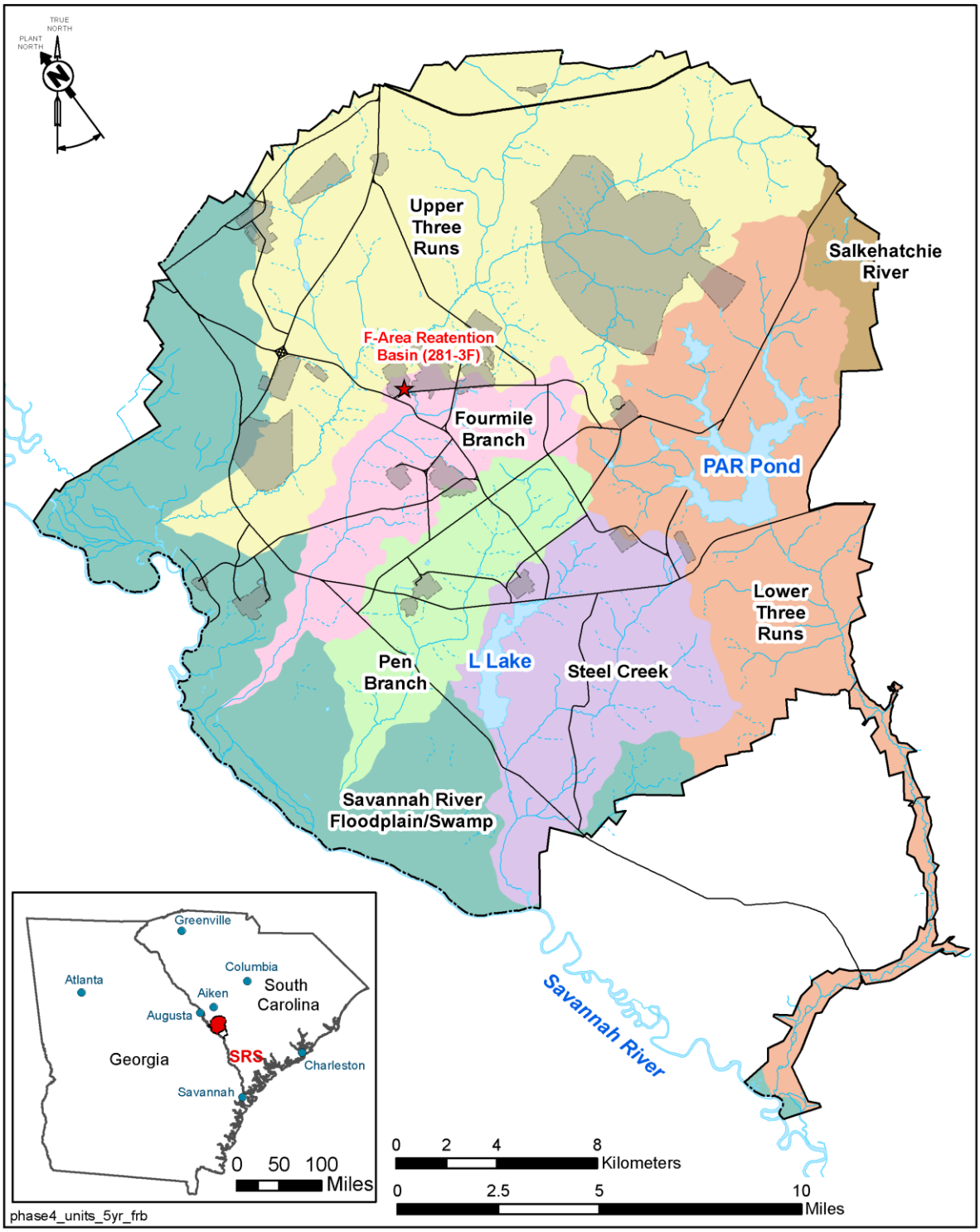

Figure G-1. Location of the F-Area Retention Basin (281-3F) OU at SRS

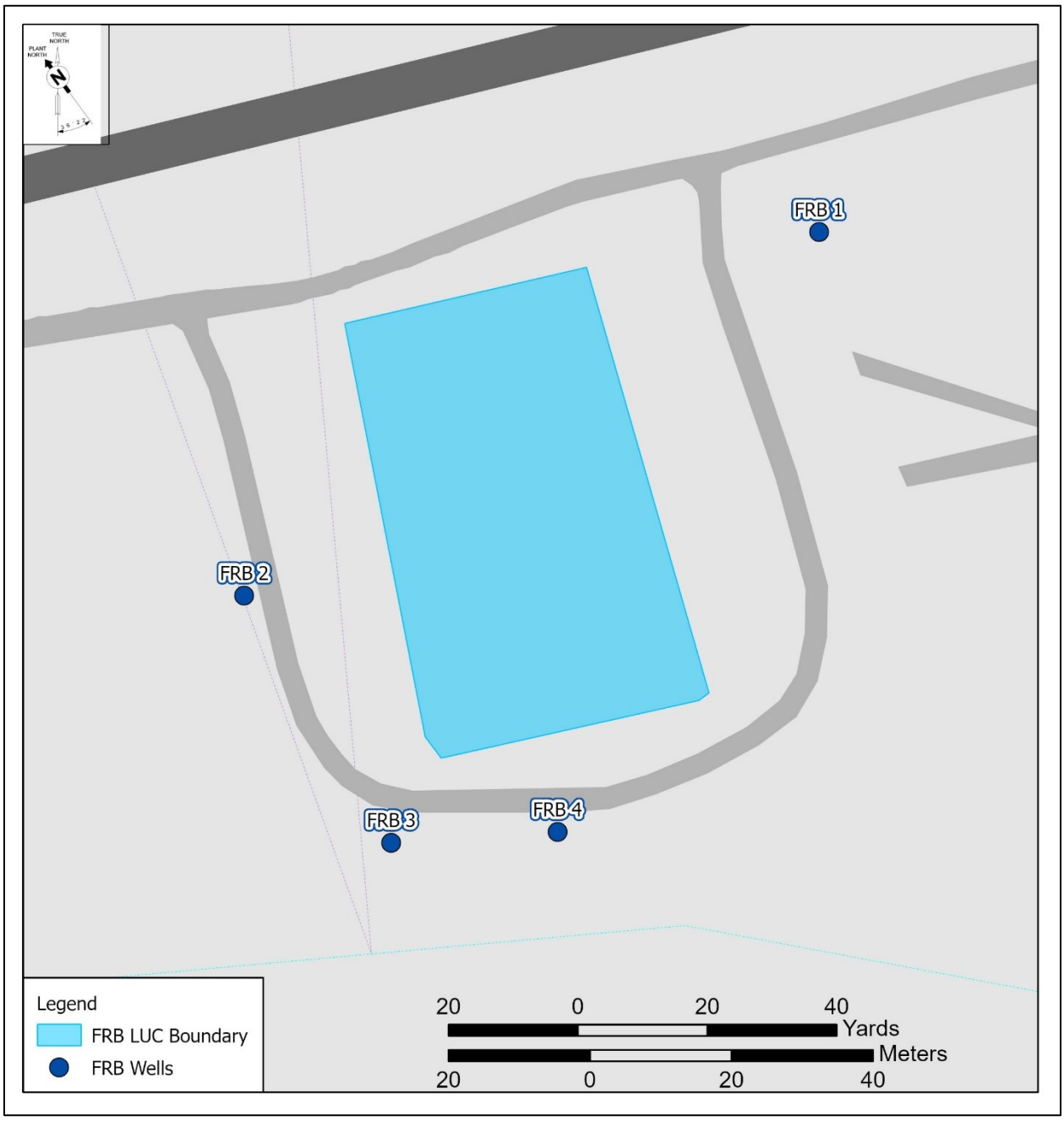

Figure G-2. ~~Location of the~~ F-Area Retention Basin OU ~~within the F-Area at SRS (the basin and monitoring wells are located within the green box)~~

tank-specific Closure Module (SRR 2011, SRR 2012a). Waste Tanks 5 and 6 were operationally closed and removed from service in December 2013 in accordance with the approved General Closure Plan applicable at that time and tank-specific Closure Module (SRR 2011, SRR 2013b). No ancillary structures were included in the removal from service of FTF Waste Tanks 5, 6, 18 and 19. ESDs for FTF Waste Tanks 18 and 19 (SRR 2013a) and FTF Waste Tanks 5 and 6 (SRR 2014) were issued in September 2013 and September 2014, respectively. The ESDs served to incorporate FTF Waste Tanks 5, 6, 18, and 19 into the interim remedy selected in the IROD for Waste Tanks 17 and 20.

The tanks were isolated from the remaining operating facility and filled with grout. Some equipment installed in the tanks or used in the closure activities (e.g., slurry pumps, transfer jet, thermowells) were filled with grout to the extent practical and entombed in the grout as part of the stabilization process. The tank-specific Closure Modules describe the waste removal, characterization of residuals, associated risk, and stabilization of the waste tanks in more detail.

The IROD does not include the groundwater beneath the FTF or the soils surrounding the waste tanks. An FTF Groundwater Monitoring Plan (SRNS 2012), which describes the monitoring of the groundwater exiting the FTF in accordance with the Consolidated General Closure Plan (SRR 2017), supports both the operations and operational closure of the FTF waste tanks and includes requirements for reporting the monitoring results. Groundwater and the soils surrounding the tanks will be addressed in the final ROD for the FTF OU.

IV. Remedial Actions

Remedy Selection

The interim remedial action objective (RAO) established by the IROD (SRR 2012b) and ESDs (SRR 2013a, SRR 2014) is as follows:

- Conduct annual visible engineered barriers inspections and maintenance of the waste tanks that have been operationally closed and removed from service.

Remedy Implementation

The selected interim remedial action was implemented to meet the interim RAO and includes the following activities (SRR 2012b):

- Annual inspection of the engineered barriers (i.e., visible grout) for physical integrity;
- Annual visible inspection of the area for excessive water accumulation that may cause premature degradation of the engineered barriers associated with stabilization of the waste tanks; and
- Perform maintenance deemed necessary from the annual inspections from the time of removal of a waste tank or associated ancillary structure from service until a final ROD for the FTF OU is issued.

An aerial photo of the FTF is provided in Figure H-6.

System Operations/Operations and Maintenance

There were no operational systems installed as part of the interim remedial action. Therefore, there are no system operational requirements.

The following maintenance activities are ongoing:

  - Annual visual inspections of the engineered barriers (i.e., visible grout) for physical integrity and ineffective drainage (i.e., excessive water accumulation); and
  - Necessary maintenance identified from the annual inspections.

- Table H-2 compares the actual operation and maintenance (O&M) costs since annual visible inspections began in Fiscal Year (FY) 2013 to the estimated direct O&M costs from the IROD (SRR 2012b). The estimated O&M cost for FY2017 to FY2021 was $35,000 for visible annual inspections and maintenance. Actual O&M costs for maintaining the covers are not available. However, there have been no repairs performed on the F-Area Tank Farm covers from FY2017 to FY2021. The predominate actual cost factor is preparing the Five-Year Remedy Review Report. The actual O&M cost for preparing the Five-Year Remedy Review Reports from FY2017 to FY2021 is $~~19,566~~10,623. The estimated costs are considered fairly accurate estimates for the

actual costs.

- As required by the Consolidated General Closure Plan (SRR 2017), annual visible inspections are conducted to identify unsatisfactory conditions that would lead to loss of integrity or long-term structural strength of the closed waste tanks that would compromise stabilization and containment of residual waste. If evidence of premature degradation is found, appropriate action, including any necessary maintenance or repairs, will be taken.
- Prior to the implementation of the interim remedial action, inspections were conducted in accordance with the respective waste tank closure modules. Annual visible inspections began in FY2013 for Waste Tanks 17, 18, 19, and 20. In FY2014, Waste Tanks 5 and 6 were added to the annual inspections. Annual inspections for FY2017 through FY2021 have been completed. There were no unsatisfactory conditions observed for FTF Waste Tanks 5, 6, 17, 18, 19, and 20 during the FY2017 through FY2021 annual inspections.

V. Progress since Last Review

The previous protectiveness statement concluded that the remedy (i.e., annual visible engineered barriers inspection and maintenance) at the FTF OU is protective of human health and the environment.

There are no previous recommendations or follow-up actions.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XI. Documents Reviewed;
- Confirmed the implementation of the interim remedial action;
- Evaluated the effectiveness of the interim remedial action; and

- Conducted visual inspection of FTF Waste Tanks 5, 6, 17, 18, 19 and 20, conducted site interviews, and documented the results on the Inspection Checklist provided in Attachment H-1 with the purpose of assessing the protectiveness of the remedy.

Data Review

A review of data is not part of the interim remedy review because the interim action (i.e., visual inspections and maintenance) does not require the cleanup of contaminated media. The PA for the FTF determined that exposure to stabilized residual material in the tanks is unlikely during the interim period (SRR 2010).

Summary of Inspections and Interviews

Interviews were conducted with Bruce Martin, SRR Waste Disposal Authority, on July 21, 2021, at FTF. No issues warranting any corrective actions were identified for the FTF Waste Tanks 5, 6, 17, 18, 19 and 20 during these interviews.

Scheduled annual site inspections conducted from FY2017 through FY2021 identified the following for Tanks 17 through 20. Tank 17 had the northeast riser northeast corner appear recoated and the center riser top irregularities were unchanged. Tank 18 low depression north of east riser was unchanged. Tank 19 three cracks in the northwest riser and c riser degradation both were unchanged, but in 2019 three cracks were noted in the east, west, and south sides. Tank 20 areas of west riser appeared recoated, and the northwest riser was unchanged. These conditions were documented on the field inspection forms, listed in Section XII and are deemed satisfactory but are being monitored to verify that the conditions do not worsen to an extent that would compromise the stabilization and containment of residual waste in the tanks.

The FTF Waste Tanks 5, 6, 17, 18, 19, and 20 were inspected by Savannah River Nuclear Solutions, LLC (SRNS) personnel on July 21, 2021. No issues were identified for the FTF Waste Tanks 5, 6, 17, 18, 19, and 20 during this inspection and interview.

A site inspection was conducted by SRNS Environmental Compliance and Area Completion Project and USDOE personnel December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The interim remedy is functioning as intended as demonstrated below:

- The interim remedy that includes annual inspections of the engineered barriers (i.e., visible grout) for physical integrity and inspection for excessive water accumulation is functioning as intended. Annual inspections serve to detect any conditions of the FTF waste tanks and ancillary structures, which have been operationally closed and removed from service, that would compromise stabilization and containment of residual waste and require maintenance actions during the interim period. Annual inspections began in FY2013 for FTF Waste Tanks 17, 18, 19, and 20 and in FY2014 for FTF Waste Tanks 5 and 6 and have been completed through FY2021.
- The FTF OU is currently in the operational phase and access is controlled by SRS facility security and administrative controls. OU-specific LUCs have been deferred until final closure of the entire FTF OU.

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

The FTF is currently in an operational phase. Because of ongoing operations, a CERCLA risk assessment has not been conducted and is not required to support this interim action. Pursuant to USDOE Order 435.1, a PA was prepared and determined that exposure to stabilized residual material in the waste tanks is unlikely during the interim period (SRR 2010). The potential risk lies in the premature degradation of the engineered barriers, which could increase the likelihood of exposure. Therefore, the interim RAO to conduct annual engineered barriers inspections and maintenance for the waste tanks that have been operationally closed and removed from service is still valid.

Following removal from service of all FTF waste tanks and ancillary structures, an evaluation will be conducted for all media (e.g., soils, structures, equipment) in the FTF OU and additional RAOs, as appropriate, will be established at that time.

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

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

VIII. Issues

There are no issues for this OU.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The interim remedy at the FTF Waste Tanks 5, 6, 17, 18, 19, and 20 is currently protective of human health and the environment because access is controlled by SRS facility security and administrative controls.

Waste tanks and ancillary structures removed from service are cleaned and stabilized with grout to reduce the risk of a leak to the environment and to provide a stable waste form. Currently, annual visible inspections are conducted to ensure that the integrity of the stabilization actions for the closed tanks is protected from significant damage or deterioration during the interim period. The FTF PA (SRR 2010) determined that exposure to stabilized residual material in the waste tanks is unlikely during the interim period from the time the individual waste tanks are removed from service until final closure of the entire FTF OU under a final ROD. The final ROD for the FTF OU is scheduled for issuance in January 2040.

The land use for the FTF is industrial with USDOE maintaining control of the land. The FTF is currently in the operational phase and unit-specific LUCs are not part of the interim action. A LUCIP will be deferred until final closure of the entire FTF OU.

~~SRS facility security and administrative controls that restrict unauthorized access to the FTF OU are not part of the interim remedy and therefore not recognized as long-term protective. SRS included the FTF OU in the FFA Annual Progress Report to demonstrate long-term protectiveness through SRS facility security and administrative controls.~~The FFA Annual Progress Report list of LUC Units includes the closed portions of the FTF OU to recognize the long-term protectiveness provided through the SRS facility security and administrative controls that restrict unauthorized access to the OU. The report is required by the FFA and includes an annual certification by the USDOE SRS Manager that the listed OUs are in compliance with land use requirements.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

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, 1993. *Construction Permit #17,424-IW, SRS F/H-Area, Aiken and Barnwell County,* South Carolina Department of Health and Environmental Control, Columbia, SC

SRNS, 2012. *F-Area Tank Farm Groundwater Monitoring Plan*, SRNS-RP-2011-00995, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRR, 1997a. *Industrial Wastewater Closure Module for the High-Level Waste Tank 20 System*, PIT-MISC-0002, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 1997b. *Industrial Wastewater Closure Module for the High-Level Waste Tank 17 System*, PIT-MISC-0004, Revision 2, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC.

SRR, 2010. *Performance Assessment for the F-Tank Farm at the Savannah River Site*, SRS-REG-2007-00002, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2011. *Industrial Wastewater General Closure Plan for F-Area Waste Tank Systems*, LWO-RIP-2009-00009, Revision 3, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2012a. *Industrial Wastewater Closure Module for the Liquid Waste Tanks 18 and 19,* SRR-CWDA-2010-00003, Revision 2, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2012b. *Interim Record of Decision Remedial Alternative Selection for the F-Area Tank Farm, Waste Tanks 17 and 20,* SRR-CWDA-2012-00111, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2013a. *Explanation of Significant Difference (ESD) for Incorporating Tanks 18 and 19 in the Revision 1 Interim Record of Decision Remedial Alternative Selection for the F-Area Tank Farm, Waste Tanks 17 and 20,* SRR-CWDA-2013-00007, Revision 1.1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2013b. *Industrial Wastewater Closure Module for the Liquid Waste Tanks 5F and 6F F-Area Tank Farm, Savannah River Site,* SRR-CWDA-2012-00071, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2014. *Explanation of Significant Difference (ESD) for Incorporating Tanks 5 and 6 in the Revision 1 Interim Record of Decision Remedial Alternative Selection for the F-Area Tank Farm, Waste Tanks 17 and 20,* SRR-CWDA-2014-00008, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2017. *Consolidated General Closure Plan for F-Area and H-Area Waste Tank Systems*, SRR-CWDA-2017-00015, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

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

USDOE, 1996b. *Industrial Wastewater Closure Plan for F- and H- Area High Level Waste Tank Systems,* U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 1996c. *High-Level Waste Tank Closure Program Plan*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 2002a. *Savannah River Site High-Level Waste Tank Closure Final Environmental Impact Statement,* May 2002*,* DOE-EIS-0303, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 2002b. *Record of Decision for High-Level Waste Tank Closure at the Savannah Site,* August 2002*,* DOE-EIS-0303-ROD, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 2012a. *Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site,* DOE/SRS-WD-2012-001, Revision 0, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC.

USDOE, 2012b. *Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site,* DOE-WD-2012-001, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC.

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

Various – Inspection Data Sheets – *FTF Annual Closed Waste Tank Inspections*, Inspection periods 2017 through 2021 (annually)

Table H-1. Chronology of OU Events

Event	Date
IROD Issuance (Waste Tanks 17 and 20)	April 30, 2013
ESD Issuance (added Waste Tanks 18 and 19)	September 23, 2013
ESD Issuance (added Waste Tanks 5 and 6)	September 11, 2014
Interim Remedial Action Start/Complete (Waste Tanks 17, 18, 19, and 20)	March 20, 2014 / April 24, 2014
Interim Remedial Action Start/Complete (Waste Tanks 5 and 6)	September 17, 2014 / April 15, 2015
Previous Five-Year Review Issuance	March 27, 2018

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

	FY2017	FY2018	FY2019	FY2020	FY2021	Five-Year Total
Total Actual O&M Costs ($)[1]	~~17,050~~ 8,107	1,125	0	0	1,391	~~19,566~~ 10,623
Total IROD Estimated Direct O&M Costs ($)[2]	19,000	4,000	4,000	4,000	4,000	35,000

1 Actual O&M costs for maintaining the covers are not available. Costs shown represent the actual cost of preparing the Fifth (FY2017 and FY2018) and Sixth (FY2021) Five-Year Remedy Review during the specific fiscal year.
2 Estimated costs for preparation of the Fifth Five-Year Remedy Review were accounted for in FY2017.

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The GSACU OU was inspected by SRNS personnel on July 14, 2021. No issues were identified for the GSACU OU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual inspections conducted from Fiscal Year (FY) 2017 through FY2021 for the HP-52 Pond identified active ant mounds, overgrown vegetation, and erosion around the drainage channel on the north and south side. Site inspections (annually) conducted from FY2017 through FY2021 for the HRB identified active ant mounds. Annual site inspections conducted from FY2017 through FY2021 for the ORWBG have identified overgrown vegetation on the access road, tree limbs blocking warning sign, active ant mounds, holes under fence caused by burrowing animal. Site inspections (annually) conducted from FY2017 through FY2021 for Warner's Pond identified active ant mounds, and overgrown vegetation blocking warning sign and in drainage ditch outlet. These findings were documented for all these units on the field inspection checklists, listed in Section XII, and were resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The removal of media contaminated at PTSM levels, consolidating residual contaminated materials with the ORWBG and placing a protective soil cover over them

has eliminated the exposure pathway for human or ecological receptors and controls migration of strontium-90 from soils to groundwater.

- Annual field inspections of the cover systems are being performed and indicate the integrity of each is intact and no problems have occurred. The most prevalent finding for all subunits is active ant mounds which are addressed on the spot. There also have been sporadic events of minor soil erosion on the side slopes of the cover systems which have been addressed prior to the next inspection.

- Institutional controls (i.e., LUCs) are in place and being implemented to provide access control and prevent exposure as designed. The Land Use Control Implementation Plan for GSACU OU is included as Appendix A of the Corrective Measures Implementation / Remedial Action Implementation Plan and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2003). All LUC objectives are being met.

- The low permeability cap has significantly reduced the tritium migration from the ORWBG vadose zone to the Southwest Plume of the MWMF. This has resulted in a tritium reduction within the plume of approximately 40% (SRNS 2021). The low permeability cap appears to have impacted the other plumes associated with the ORWBG (Northwest and Southeast Plumes) to a lesser extent. The groundwater associated with the ORWBG is managed under the MWMF RCRA Permit Renewal.

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

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in the physical conditions of the site 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 GSACU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. 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 and follow-up actions concerning GSACU OU

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are controlled by the institutional controls (i.e., LUCs), environmental monitoring, site inspections and maintenance. All threats to contaminated media at the GSACU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain this site for industrial use only, OU-

specific perimeter fencing and warning signs, and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

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, 2021. *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*, SRNS-RP-2021-00513, 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, 1996. *Interim Record of Decision Remedial Alternative Selection for the Old Radioactive Waste Burial Ground (643-E) (U)*, WSRC-RP-96-102, Rev. 0, March 1996, 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, 2001. *Interim Record of Decision for the Old Solvent Tanks at the Old Radioactive Waste Burial Ground*, WSRC-RP-2000-4193, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Record of Decision Remedial Alternatives Selection for the General Separations Area Consolidated Unit*, WSRC-RP-2002-4002, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Corrective Measures Implementation/Remedial Action Implementation*

Plan (CMI/RAIP) for the General Separations Area Consolidation Unit (U), WSRC-RP-2003-4053, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Post-Construction Report (PCR)/Corrective Measures Implementation Report (CMIR)/Remedial Action Completion Report (RACR) for the General Separations Area Consolidated Unit (GSACU) (U)*, WSRC-RP-2006-4067, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various – *Inspection Data Sheets - Field Inspection Checklist, H Area Retention Basin (U)*, ER-IDS-019-042, Inspection period 2017 through 2021 (annually)

Various – *Inspection Data Sheets* - F*ield Inspection Checklist, Warner's Pont (U)*, ER-IDS-019-043, Inspection period 2017 through 2021 (annually)

Various – *Inspection Data Sheets - Field Inspection Checklist, HP-52 (U)*, ER-IDS-019-044, Inspection period 2017 through 2021 (annually)

Various – *Inspection Data Sheets - Field Inspection Checklist for Old Radioactive Waste Burial Ground Bldg. 643-E (U)*, ER-IDS-019-027, Inspection period 2017 through 2021 (annually)

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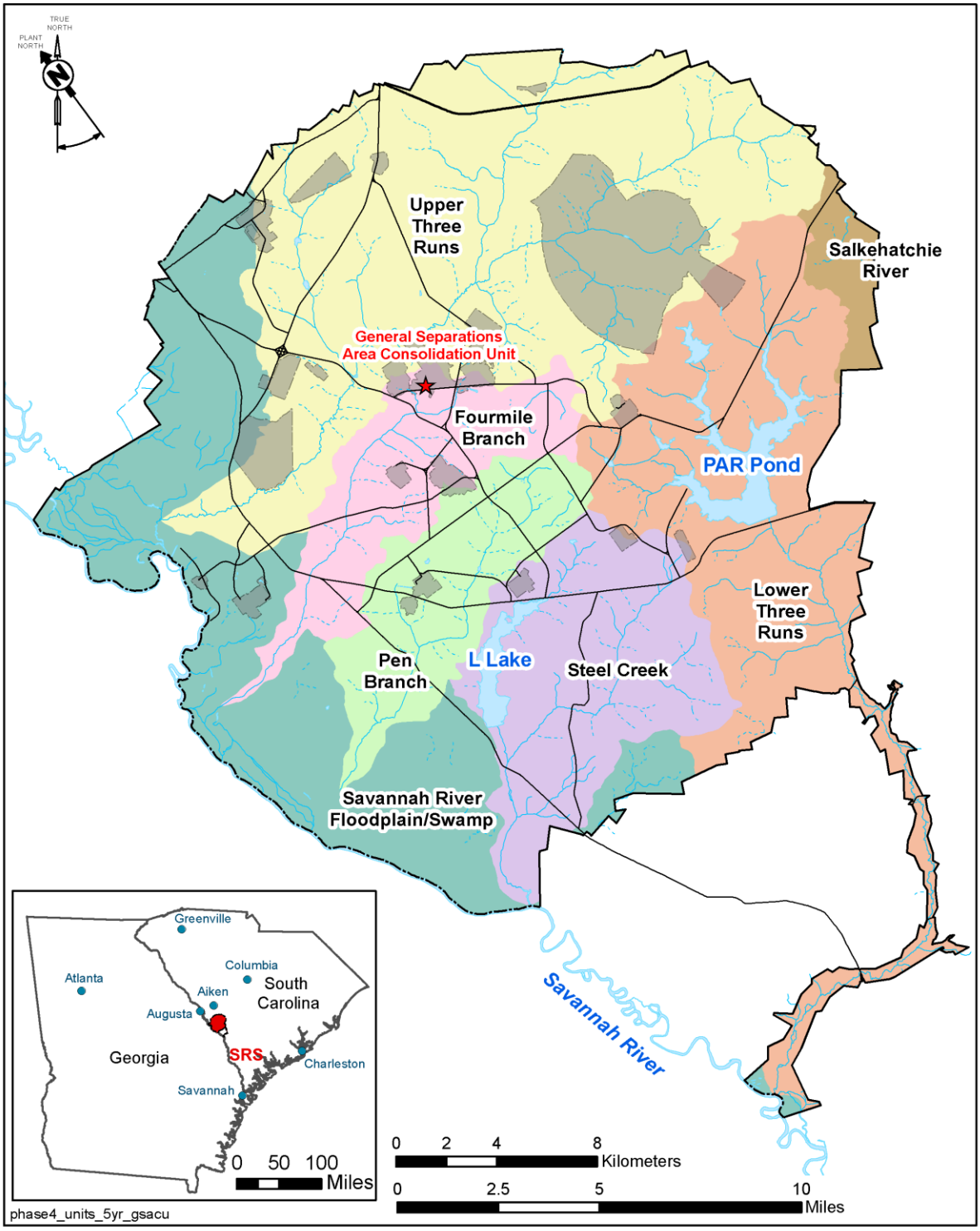

Figure I-1. Location of the General Separations Area Consolidation Unit at SRS

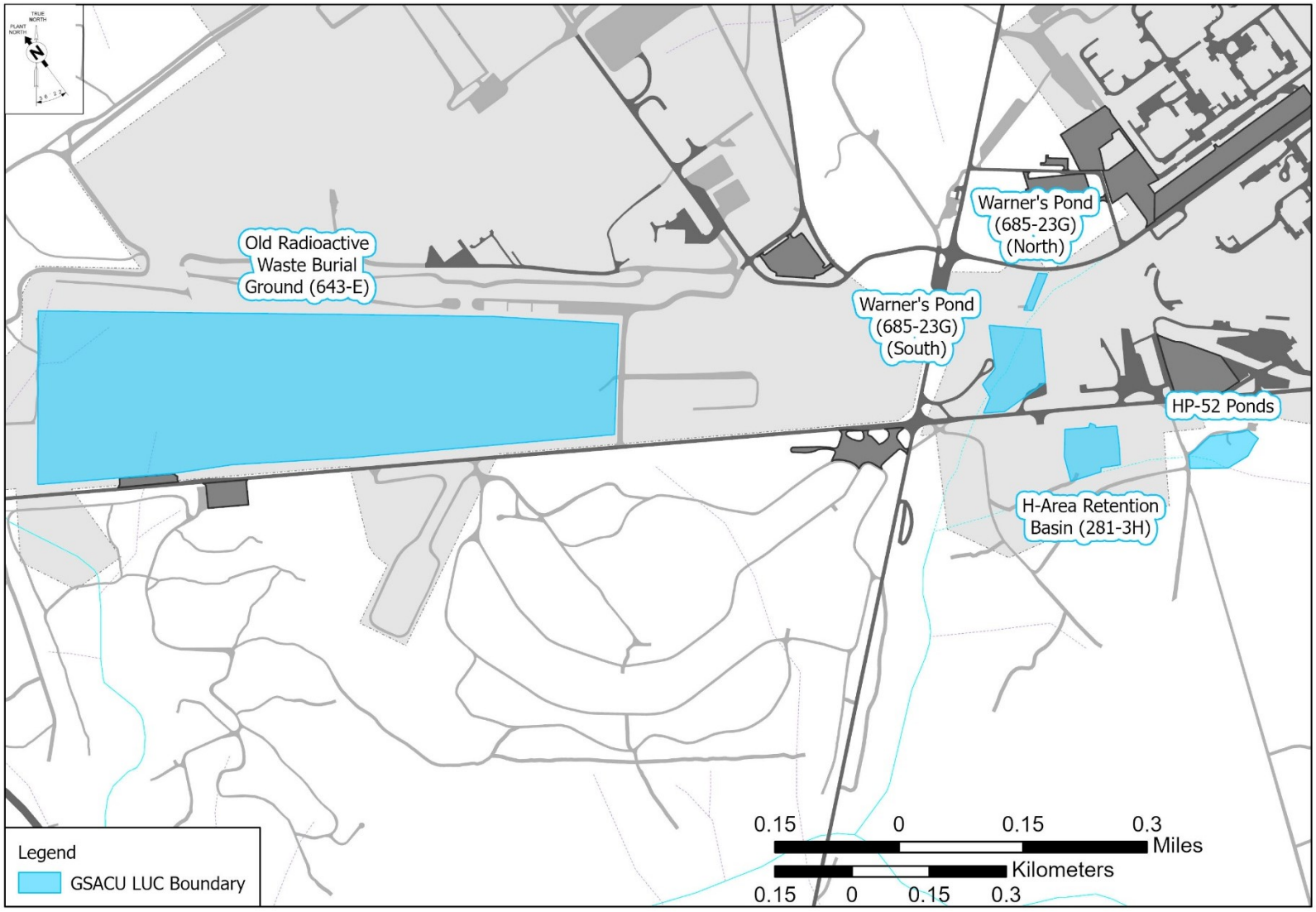

Figure I-2. General Separations Area Consolidation Unit Four Primary Subunits

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Confirmed the implementation of the interim remedial action;
- Evaluated the effectiveness of the interim remedial action; and
- Conducted visual inspection of HTF Waste Tanks 12 and 16, conducted site interviews, and documented the results on the Inspection Checklist provided in Attachment J-1 with the purpose of assessing the protectiveness of the remedy.

Data Review

A review of data is not part of the interim remedy review because the interim action (i.e., visual inspections and maintenance) does not require the cleanup of contaminated media. The PA for the HTF determined that exposure to stabilized residual material in the tanks is unlikely during the interim period (SRR 2012b).

Summary of Inspections and Interviews

Interviews were conducted with Bruce Martin, SRR Waste Disposal Authority, on July 21, 2021, at HTF. No issues warranting any corrective actions were identified for the HTF Waste Tanks 12 and 16 during these interviews.

HTF Waste Tanks 12 and 16 were inspected by Savannah River Nuclear Solutions, LLC (SRNS) personnel on July 21, 2021. No issues were identified for the HTF Waste Tanks 12 and 16 during this inspection and interview.

A site inspection was conducted by SRNS Environmental Compliance and Area Completion Project and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and

elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual site inspections conducted from FY2017 through FY2021 identified that Tank 12 had minor vegetation at risers 2, 6, East, West, and South and it was resolved shortly after discovered. These conditions are deemed satisfactory but are being monitored to verify that the conditions do not worsen to an extent that would compromise the stabilization and containment of residual waste in the tanks.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The interim remedy is functioning as intended as demonstrated below:

- The interim remedy that includes annual inspections of the engineered barriers (i.e., visible grout) for physical integrity and inspection for excessive water accumulation is functioning as intended. Annual inspections serve to detect any conditions of the HTF waste tanks and ancillary structures, which have been operationally closed and removed from service, that would compromise stabilization and containment of residual waste and require maintenance actions during the interim period. Annual inspections began in FY2017 for HTF Waste Tanks 12 and 16 and have been completed through FY2021.
- The HTF OU is currently in the operational phase and access is controlled by SRS facility security and administrative controls. OU-specific LUCs have been deferred until final closure of the entire HTF OU.

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

The HTF is currently in an operational phase. Because of ongoing operations, a CERCLA risk assessment has not been conducted and is not required to support this interim action.

Pursuant to USDOE Order 435.1, a PA was prepared and determined that exposure to stabilized residual material in the waste tanks is unlikely during the interim period (SRR 2012b). The potential risk lies in the premature degradation of the engineered barriers, which could increase the likelihood of exposure. Therefore, the interim RAO to conduct annual engineered barriers inspections and maintenance for the waste tanks that have been operationally closed and removed from service is still valid.

Following removal from service of all HTF waste tanks and ancillary structures, an evaluation will be conducted for all media (e.g., soils, structures, equipment) in the HTF OU and additional RAOs, as appropriate, will be established at that time.

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

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

VIII. Issues

There are no issues for this OU.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The interim remedy at the HTF Waste Tanks 12 and 16 is currently protective of human health and the environment because access is controlled by SRS facility security and administrative controls.

Waste tanks and ancillary structures removed from service are cleaned and stabilized with grout to reduce the risk of a leak to the environment and to provide a stable waste form. Currently, annual visible inspections are conducted to ensure that the integrity of the stabilization actions for the closed tanks is protected from significant damage or

deterioration during the interim period. The HTF PA (SRR 2012b) determined that exposure to stabilized residual material in the waste tanks is unlikely during the interim period from the time the individual waste tanks are removed from service until final closure of the entire HTF OU under a final ROD. The final ROD for the HTF OU is scheduled for issuance in February 2045.

The land use for the HTF is industrial with USDOE maintaining control of the land. The HTF is currently in the operational phase and unit-specific LUCs are not part of the interim action. A LUCIP will be deferred until final closure of the entire HTF OU.

~~SRS facility security and administrative controls that restrict unauthorized access to the HTF OU are not part of the interim remedy and therefore not recognized as long-term protective. SRS included the HTF OU in the FFA Annual Progress Report to demonstrate long-term protectiveness through SRS facility security and administrative controls.~~The FFA Annual Progress Report list of LUC Units includes the closed portions of the HTF OU to recognize the long-term protectiveness provided through the SRS facility security and administrative controls that restrict unauthorized access to the OU. The report is required by the FFA and includes an annual certification by the USDOE SRS Manager that the listed OUs are in compliance with land use requirements.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

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, 1993. *Construction Permit #17,424-IW, SRS F/H-Area, Aiken and Barnwell County,* South Carolina Department of Health and Environmental Control, Columbia, SC

SRNS, 2012. *H-Area Tank Farm Groundwater Monitoring Plan and Sampling and Analysis Plan*, SRNS-RP-2012-00146, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRR, 2012a. *Industrial Wastewater General Closure Plan for H-Area Waste Tank Systems*, SRR-CWDA-2011-00022, Revision 0, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2012b. *Performance Assessment for the H-Tank Farm at the Savannah River Site*, SRR-CWDA--2010-00128, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2015a. *Industrial Wastewater Closure Module for the Liquid Waste Tank 12H,* SRR-CWDA-2014-00086, Revision 0, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2015b. *Addendum to the Industrial Wastewater Closure Module for the Liquid Waste Tank 12H H-Area Tank Farm, Savannah River Site, SRR-CWDA-2014-00086, Revision 0, May 2015,* SRR-CWDA-2015-00074, Revision 0, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2015c. *Industrial Wastewater Closure Module for the Liquid Waste Tank 16H,* SRR-CWDA-2013-00091, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2016a. *Interim Record of Decision Remedial Alternative Selection for the H-Area Tank Farm, Waste Tank 16,* SRR-CWDA-2015-00157, Revision 1, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2016b. *Explanation of Significant Difference (ESD) for Incorporating Tank 12 into the Revision 1 Interim Record of Decision Remedial Alternative Selection for the H-Area Tank Farm, Waste Tanks 16,* SRR-CWDA-2016-00107, Revision 0, Savannah River Remediation, LLC, Savannah River Site, Aiken, SC

SRR, 2017. *Consolidated General Closure Plan for F-Area and H-Area Waste Tank Systems*, SRR-CWDA-2017-00015, Revision 1, Savannah River Remediation, 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, 2002a. *Savannah River Site High-Level Waste Tank Closure Final Environmental Impact Statement,* May 2002*,* DOE-EIS-0303, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 2002b. *Record of Decision for High-Level Waste Tank Closure at the Savannah Site,* August 2002*,* DOE-EIS-0303-ROD, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 2014a. *Basis for Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site,* DOE/SRS-WD-2014-001, Revision 0, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC.

USDOE, 2014b. *Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site,* DOE-WD-2014-001, Revision 0, U.S. Department of Energy, Washington, DC.

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

Various – Inspection Data Sheets – *HTF Annual Closed Waste Tank Inspections*, Inspection periods 2017 through 2021 (annually)

seepage basin soils: cesium-137, strontium-90, plutonium-239/240, americium-241, and cobalt-60. Carbon-14 and strontium-90 were retained as final contaminant migration (CM) COCs as these contaminants were predicted to leach to groundwater and exceed maximum contaminant levels (MCLs) within 1,000 years. The human health and contaminant migration COCs and remedial goals (RGs) as developed in the RI/BRA for KRSB OU (WSRC 1998) are shown in Table K-2.

Tritium, gross alpha, and total radium were detected in groundwater near the KRSB OU at concentrations above MCLs from 1992 to 1996. The groundwater has been identified as a separate OU and is, therefore, considered outside the scope of the KRSB OU remedial action. The groundwater will be investigated as part of the K-Area Groundwater OU.

IV. Remedial Actions

Remedy Selection

The plug-in Record of Decision (ROD) process was designed to present a common remedy for high-risk radioactively contaminated OUs at SRS with similarities in history of use, contaminants, risk, and location within current industrial areas. For radiologically contaminated soil that represents principal threat source material (PTSM), in situ stabilization was selected as the common remedy for open reactor seepage basin candidates in the *Plug-in Record of Decision for In Situ Stabilization With Low Permeability Soil Cover for Radiological Contaminants in Soil* approved in October 1999 (WSRC 1999b). A Technical Evaluation Report (TER) (WSRC 1999d) was prepared and verified that cesium-137 was present at high enough levels that the basin soils were considered PTSM and that KRSB OU met the plug-in ROD criteria. PTSM for the plug-in ROD remedy was defined as soil that poses a radiological (or cancer) risk to the future industrial worker equal to or greater than 1E-03.

In lieu of Proposed Plan and ROD documents, an Explanation of Significant Difference (ESD) document was submitted and was approved in March 2000 (WSRC 2000). The

approved ESD is the document that amends the approved plug-in ROD to include the KRSB OU.

As detailed in the Plug-In ROD, the remedial action objectives (RAOs) for the KRSB OU are as follows:

- Prevent human exposure to highly contaminated basin soils (PTSM) by performing stabilization treatment to the extent practicable and filling the basin. Reduce risks to the future worker from surface soils (0 to 0.3 m [0 to 1 ft]) outside the basin by establishing RGs for COCs at concentrations equivalent to 1E-06 for carcinogens and a hazard quotient of 1 for noncarcinogens or background (where background levels of COCs exceed 1E-06).
- Prevent the release of COCs in the soil to groundwater beneath the unit above MCLs or risk-based concentrations (when MCLs are not available). The soil RGs are back calculated based on these values.
- Protect the ecological receptors indigenous to the area by preventing or limiting contact with contaminated basin soil/pipelines and preventing plants and animals from bringing contaminants up toward the surface.

Because the KRSB OU meets the plug-in ROD criteria, the remedy of in situ stabilization with a low permeability soil cover system was the selected remedy for the KRSB OUs. As described in the ESD, the selected remedy consisted of the following components:

- In situ stabilization through grouting to treat PTSM soil in the basin;
- Low permeability soil cover system over the in situ stabilized soil to reduce infiltration and prevent exposure to radionuclides in the stabilized soil;
- Grouting the pipeline to prevent exposure to borrowing animals; and
- Land use controls (LUCs) to prevent disturbance of the cover system and prohibit residential or agricultural use of the area.

The regulatory approved KRSB plug-in decision document (WSRC 1999c) did not require groundwater monitoring as part of the selected remedy in order to meet the RAOs.

Groundwater is not part of the KRSB OU and will be investigated under the K-Area Groundwater OU.

Remedy Implementation

Implementation of the selected remedy included the following:

- Grouted remaining portion of the pipeline from K-Reactor Disassembly Basin to the KRSB where feasible. An obstruction encountered during pipeline grouting, required approximately 12.3 m (41 ft) of process piping to be excavated. The excavated pipe was encapsulated in a grouted waste trench adjacent to the KRSB. This waste trench was encompassed within the footprint of the soil cover system. The excavated areas were backfilled to grade and re-vegetated. Approximately 1.5 m^3 (2 yd^3) of soil from the pipeline excavation was mixed with the KRSB soil prior stabilization activities.
- In situ grouted approximately 446 m^3 (583 yd^3) of PTSM in KSRB basin bottom to a depth of 0.9 m (3 ft).
- Installed a 0.08-hectare (0.20-acre) low permeability soil cover system consisting of three layers (total minimum thickness of 1.8 m [6 ft]) - grading fill, 0.6-m (2-ft) minimum thick low permeability soil and 45-cm (18-in) minimum thick layer consisting of vegetation, common fill, and topsoil. The low-permeability layer was designed to qualitatively meet the 1E-05 cm/s minimum hydraulic conductivity criteria.
- Implemented LUCs for 0.3 hectares (0.74 acres) and posted warning signs at the perimeter of the KRSB OU. LUCs also included physical access controls at the SRS boundaries (fences, guards, security patrols, etc.), site use restrictions via the SRS Site Use/Site Clearance Program, and long-term administrative controls such as deed restrictions to maintain future industrial use only (preventing residential or agricultural use).

Figures K-3 and K-4 present photographs of the KRSB OU before and during remediation and in the current condition.

System Operations/Operation and Maintenance

There are no system operational requirements.

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

- Site inspections for evidence of damage to the soil cover due to erosion or intrusion by burrowing animals will be performed annually as a minimum. The inspection also addresses upkeep of the vegetative cover and access control barriers (e.g., warning signs).
- Site maintenance (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) will be performed when required.
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit).

Table K-3 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 1999b). The estimated O&M cost for Fiscal Year (FY) 2017 to FY2021 was $131,060 for inspections and maintenance and access controls. The actual O&M cost for FY2017 to FY2021 is $48,030. The actual O&M costs are lower than expected because no cover repairs were necessary.

V. Progress since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at KRSB OU are protective, the site is protective of human health and the environment. This remedy is protective because receptors will not be exposed to contamination above the appropriate remedial goals. Exposure pathways that

could result in unacceptable risks to receptors are controlled by the soil stabilization, the low permeability cover system, and the institutional controls (i.e., LUCs).

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

~~***Data Review***~~

~~The KRSB plug-in decision document (WSRC 1999c) did not require groundwater monitoring as part of the selected remedy in order to meet the remedial action objectives. Groundwater is not part of the KRSB OU and will be investigated under the K-Area Groundwater OU. A core team meeting was held on April 22, 2015 to discuss current groundwater conditions at K-Area and discuss what activities should be undertaken prior to the current FFA field start of 2042. As a result of the meeting, six wells and seven surface water locations are sampled annually for known groundwater contaminants (tritium, tetrachloroethylene, trichloroethylene, and associated degradation products). The data is reported every five years in a data summary letter. The first letter was submitted by September 29, 2020.~~

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-

Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 26, 2021, at the O&M organization offices. No issues were identified as an outcome of these interviews.

The KRSB OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) personnel on July 14, 2021. No issues were identified for the KRSB OU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual site inspections conducted from FY2017 through FY2021 identified active ant mounds and evidence of hog damage. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The soil solidification/stabilization followed by a low permeability soil cover with institutional controls is effective in preventing human exposure and ecological receptors to contaminated media. A review of the Post-Construction Report/Final Remediation Report (PCR/FRR) provided evidence that the PTSM associated with the KRSB soil was effectively treated to eliminate potential human exposure to

PTSM. In order to prevent human exposure to PTSM, soil and portions of the process sewer line were consolidated in the basin and grouted, and a low permeability cover system was installed over the entire basin. Grouting reduces the mobility (leaching to groundwater and mobilization by burrowing animals) of the PTSM contamination. A low permeability cover system consisting of fill material to bring the basin to grade, 0.6 m (2 ft) of low permeability soil and a 45 cm (18 in) soil/vegetative cover was constructed over the entire basin. The soil cover system was adequately sloped to reduce infiltration and prevent ponding/subsidence. The combination of the grout and constructed cover system effectively provides a barrier to human exposure to the PTSM.

- The soil solidification/stabilization and installation of a low permeability soil cover are designed to protect the groundwater from future contamination from KRSB OU by immobilizing the CM COCs (strontium-90 and carbon-14) and mitigating infiltration through the contaminated media. Results from the cores collected after grouting are reported in the PCR/FRR and show that the leachability index met the test objective for all tests.
- Review of the cover system annual inspection records indicate that the cap is being maintained and continues to prevent human and ecological exposure to contaminants.
- A review of the PCR/FRR determined that the solidification of the process sewer pipeline from the KRSB to the K-Reactor Disassembly Basin and removal of 12.3 linear m (41 linear ft) of the grouted pipeline was adequate to prevent ecological receptors from coming into contact with internal contamination. External soil contamination was found to be below the 1E-06 risk threshold; therefore, removal of this soil was not warranted. Some soil excavated to gain access to the process sewer pipeline was consolidated within the KRSB. The pipeline was cut into manageable pieces and grouted in a trench within the basin. The cover system over the basin provides an additional barrier to exposure, and

annual inspection of this cover system provides verification that ecological receptors are not in contact with the contaminated process sewer line.

The Land Use Control Implementation Plan for the KRSB OU is located in Appendix A of the PCR/FRR and governs LUC implementation, maintenance, monitoring, reporting, and enforcement (WSRC 2002). All LUC objectives are being met.

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

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in physical conditions at the KRSB OU that would affect the protectiveness of the remedy. Because the contaminants have been stabilized and exposure to the contaminated soil has been mitigated via the placement of a low permeability cover, changes in soil standards or to-be-considered guidance would not impact the risks associated with the KRSB 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 KRSB OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perflurorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. 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 this OU.

X. Protectiveness Statement(s)

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

All threats associated with exposure to contaminated soil at the KRSB OU have been addressed through soil stabilization, implementation of a low permeability cover system, and LUCs. LUCs include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the KRSB OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

Because any groundwater contamination potentially associated with the KRSB OU is comingled with contamination from other sources, the groundwater remediation is being addressed as a separate OU. The groundwater plumes associated with the K-Area source units are contained within the SRS boundaries. SRS controls are in place to prevent exposure to or ingestion of contaminated groundwater.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

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

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

WSRC, 1994. *Phase II Remedial Investigation Work Plan for the K-Area Reactor Seepage Basin,* WSRC-RP-92-16, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998. *Remedial Investigation Report and Baseline Risk Assessment for the K-Reactor Seepage Basin (904-65G) (U)*, WSRC-RP-96-871, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

WSRC, 1999b, *Plug-In Record of Decision for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)*, WSRC-RP-98-4099, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999c, *Unit Specific Plug-In Decision Document for K-Area Reactor Seepage Basin Operable Unit (U)*, WSRC-RP-98-4165, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999d, *Unit-Specific Plug-In Technical Evaluation Report for the K-Area Reactor Seepage Basin Operable Unit (U),* WSRC-RP-99-4205, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000. *Explanation of Significant Difference (ESD) for the Plug-In ROD In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil- K-Area Reactor Seepage Basin (U),* WSRC-RP-99-4200, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Post-Construction Report (PCR) / Final Remediation Report (FRR) for the K-Area Reactor Seepage Basin (904-65G) Operable Unit (U),* WSRC-RP-2002-4030, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist K-Area Reactor Seepage Basin (Bldg 904-65G) (U)*, ER-IDS-019-012, Inspection period 2017 through 2021 (annually)

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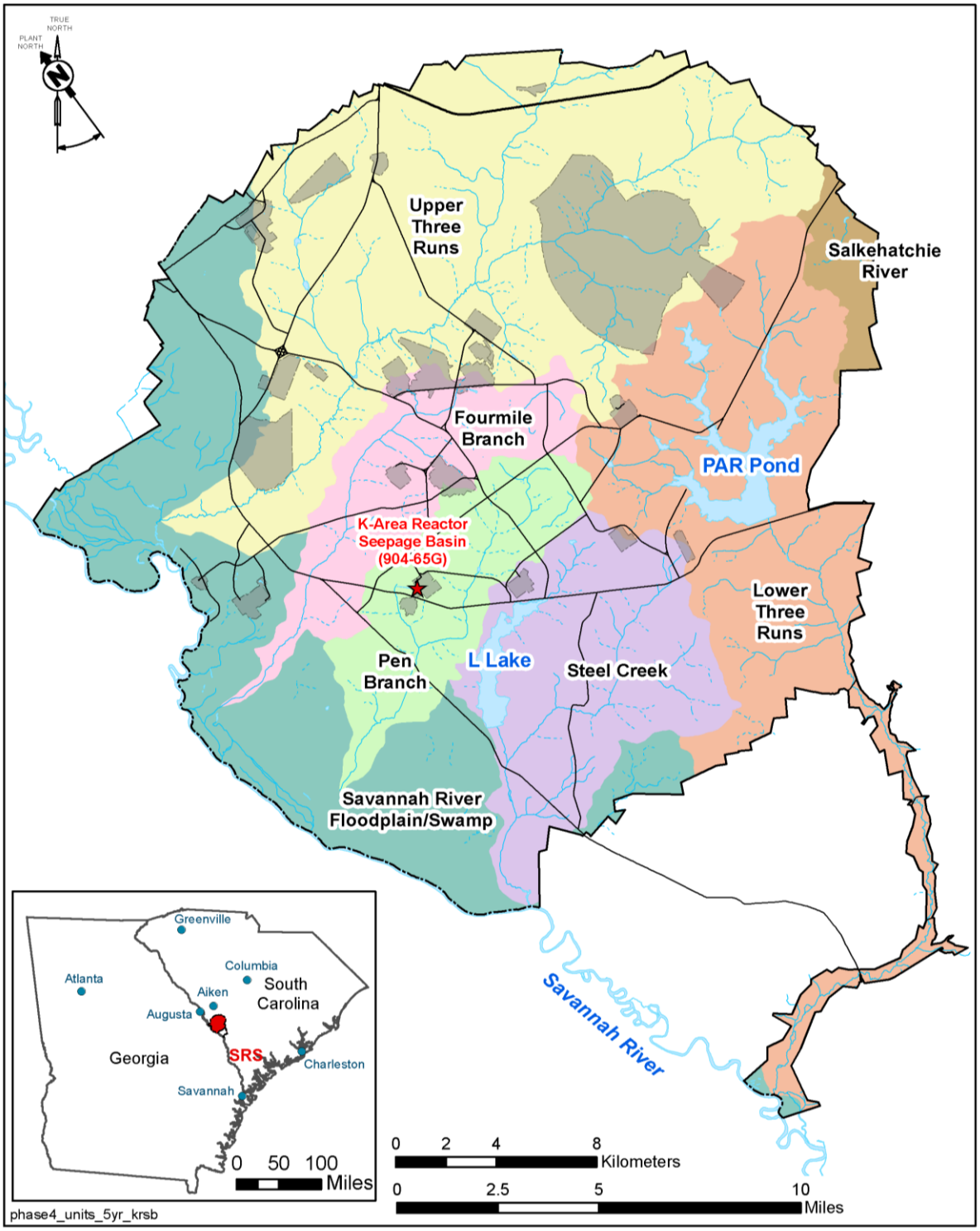

Figure K-1. Location of K-Area Reactor Seepage Basin OU at SRS

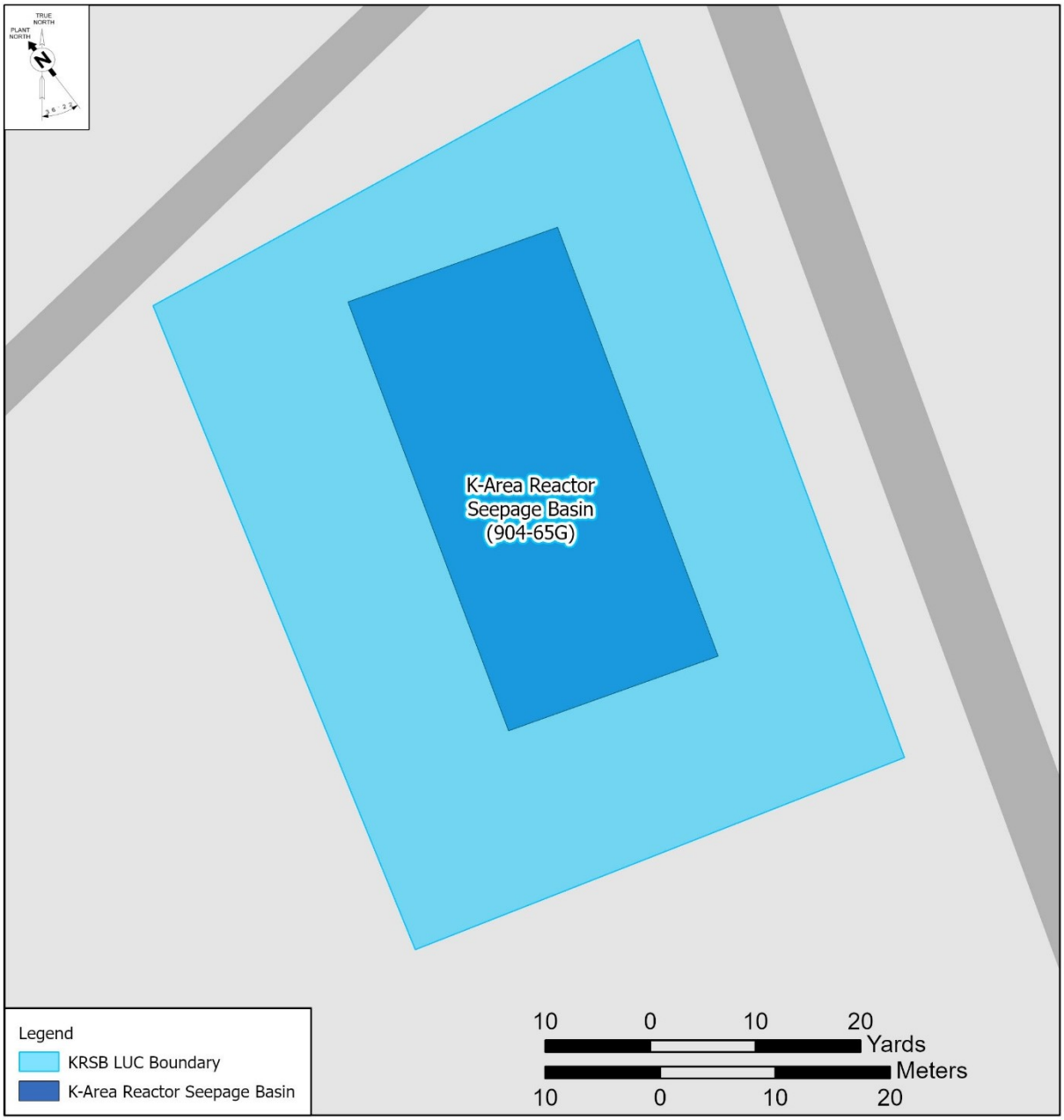

Figure K-2. ~~Site~~ Layout for K-Area Reactor Seepage Basin

year remedy review. All results for both wells were either non-detect or below U.S. Environmental Protection Agency (USEPA) preliminary remediation goals (PRGs)/ maximum contaminant levels (MCLs) and are consistent with historical levels. The 2020 results are listed in Table L-4. These results indicate that the well abandonment and soil stabilization in LAOCB are preventing the migration and leaching of COCs to the groundwater.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, 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 26, 2021 at the O&M organization offices. No issues were identified during this interview.

The LAOCB OU was inspected by SRNS personnel on July 14, 2021. No issues were identified for the LAOCB OU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No problems regarding protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual site inspections conducted from FY2017 through FY2021 identified active ant mounds and missing OU signs. These findings were documented on the field inspections checklists and resolved soon after discovery. Hog fencing, which is not part of the selected remedy, was installed in 2015 as a SRS maintenance action (i.e., OU-

specific fencing is not required per the ROD or other FFA regulatory documents) and has been successful in reducing/minimizing the damage caused by feral hogs.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The selected remedy of In situ Stabilization and Capping of the LAOCB soil and In situ Stabilization and Disposal of the LAOCB pipeline are effective in preventing exposure of human and ecological receptors to radiological constituents in the soil. Annual inspection and maintenance data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk. Review of the site inspection reports from FY2017 through FY2021 identified active ant mounds~~,~~ and missing OU signs~~, and evidence of hog damage~~. These findings were resolved soon after discovery.

- Consolidation of contaminated soil in the in situ grouted mass under a cover system is effective in eliminating the inhalation, ingestion, and direct exposure pathways associated with the LAOCB soils. Leachability and unconfined compressive strength (UCS) tests were performed on the stabilized material during the remedial action. The results as reported in the Post Construction Report (PCR) / Final Remediation Report (FRR) for the LAOCB, met the acceptance criteria (UCS $\geq$ 50 psi and leachability index $\geq$ 6.0) (WSRC 2001). As reported in the PCR, the low-permeability soil cover test results met the acceptance criteria for hydraulic conductivity (< 1.0E-05 cm/s).

- The selected remedy of In situ Stabilization and Capping of the LAOCB soil and In situ Stabilization and Disposal of the LAOCB pipeline are effective in preventing the leaching and migration of COCs to the groundwater. Stabilization of the contaminated soil and the presence of a positive drainage soil cover over the stabilized soil reduce infiltration within the area of LAOCB and mitigate the potential for contaminants to migrate to the groundwater. Monitoring wells that were suspected of providing a

conduit for contaminant transfer to the groundwater were appropriately abandoned during the remedial action.

- Monitoring the effectiveness of the soil stabilization and soil cover over LAOCB with respect to groundwater concentrations is being addressed in the LASG OU Monitored Natural Attenuation remedial action. The technical evaluation of the groundwater data indicates that the well abandonment and soil stabilization in LAOCB are preventing the migration and leaching of COCs to the groundwater (SRNS 2010, SRNS 2012).

The Land Use Control Implementation Plan for LAOCB OU is located in Appendix A of the PCR/FRR and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2001). All LUC objectives are being met.

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

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. There have been no changes in physical conditions at the LAOCB OU that would affect the protectiveness of the remedy. Because the contaminants have been stabilized and exposure to the contaminated soil has been mitigated via the placement of a low permeability cover, exposure pathways have been eliminated and the selected remedy continues to be protective. Based on this assessment and review of exposure assumptions, the RAOs used at the time of remedy selection are still valid.

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

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-

dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. 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 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 currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by stabilization and capping of contaminated soil, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions), and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

Groundwater contamination associated with the LAOCB is co-mingled with contamination from other sources; therefore, the groundwater remediation is being addressed by the

LASG OU and controls are in place to prevent exposure to or ingestion of contaminated groundwater.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

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

SRNS, 2010. *Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the L-Area Southern Groundwater (LASG) Operable Unit (OU)(U), 2008 through 2009*, SRNS-RP-2010-00989, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Biennial Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the L-Area Southern Groundwater (LASG) Operable Unit (OU)(U), 2010 through 2011*, SRNS-RP-2012-00169, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

WSRC, 1997. *Record of Decision Remedial Alternative Selection for the L-Area Oil and Chemical Basin (904-83G) and L-Area Acid/Caustic Basin (904-79G) (U)*, WSRC-RP-97-143, 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, 2001. *Post-Construction Report (PCR)/Final Remediation Report (FRR) for the L-Area Oil and Chemical Basin Operable Unit (Bldg. 904-83G) (U)*, WSRC-RP-2001-4078, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist L-Area Oil Chemical Basin (904-83G), (U)*, ER-IDS-019-007, Inspection period 2017 through 2021 (annually)

Figure L-3. Photograph of the Remediated LAOCB OU (2021)

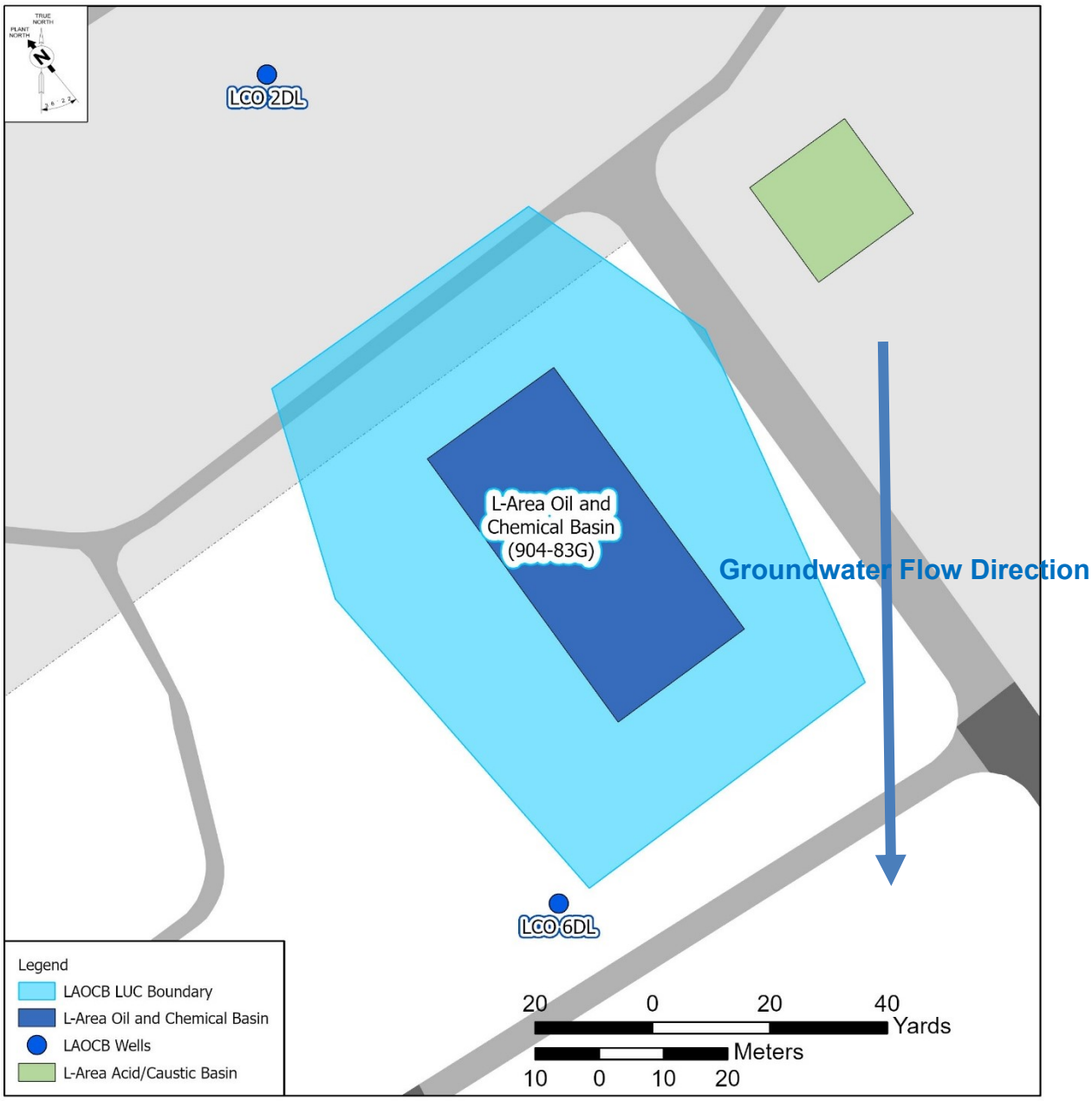

Figure L-4. Locations of the LAOCB Monitoring Wells

Attachment L-1. Five-Year Review Site Inspection Checklist – L-Area Oil and Chemical Basin (904-83G) and L-Area Acid/Caustic Basin (904-79G) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

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

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

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

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | DOE Program Manager (Title) | 12/02/2021 (Date) | 803-952-9333 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks: Survey monuments were located and in good condition.

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment L-1. Five-Year Review Site Inspection Checklist – L-Area Oil and Chemical Basin (904-83G) and L-Area Acid/Caustic Basin (904-79G) Operable Unit *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks: For inspections performed at the LAOCB from FY2017 through FY2021 (annually), the following issues were identified: active ant mounds~~,~~ and missing waste unit signs~~, and hog damage~~. These findings were resolved soon after discovery.
VII. LANDFILL COVER/CONTAINMENT ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent Depth Remarks:
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths Widths Depths Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent Depth Remarks:
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent Depth Remarks:
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress Areal extent Depth Remarks: Vegetation mowed routinely.

has radioactively decayed to levels that no longer pose a 1E-03 risk to future industrial workers. In accordance with the Remedial Action Implementation Plan for the LRSB (WSRC 2002a), risk to the future industrial workers will remain above 1E-06 beyond the year 2033. Strontium-90 was identified as a CM COC at LRSB; therefore, remedial actions intended to prevent the release of strontium-90 to the groundwater above MCLs is still applicable.

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 remedial action start;
- Inspected the OUs, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment M-1 with the purpose of assessing the protectiveness of the remedy and functionality of the controls;
- Reviewed groundwater monitoring data associated with the LRSB; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Groundwater monitoring well LSB-4 is sampled once every five years for strontium-90 to assess the effectiveness of the LRSB cover system in preventing contaminants from migrating to the groundwater above MCLs. The strontium-90 data is reported in this five-year remedy review report. LSB-4 was sampled and analyzed for strontium-90 in the fourth quarter of 2016 and 2020 and the results are presented in Table M-4. The strontium-90 result was below the detection limit. The absence of strontium-90 in LSB-4 indicates that the installation of a low permeability cover over the LRSB is preventing release of COCs in the soil to groundwater beneath the unit above MCLs. There were no CM COCs associated with the CRSB OU.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, 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 26, 2021, at the O&M organization offices. No issues were identified as an outcome of these interviews.

The LRSB was inspected by SRNS personnel on July 14, 2021. Discussions pertaining to the CRSBs inspections are included in Appendix D. No issues were identified for the LRSB during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy as implemented for these OUs are expected to be identified during the inspection.

Scheduled annual site inspections conducted from FY2017 through FY2021 identified active ant mounds, overgrown vegetation, and broken barbed wire fencing for CRSB OU. Scheduled annual site inspections conducted from FY2017 through FY2021 identified active ant mounds, a broken support post, and overgrown vegetation for LRSB. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The low permeability soil covers with LUCs is effective in preventing human exposure and ecological receptors to contaminated media. LRSB and CRSB Basin 2 were initially identified to have PTSM based on the concentrations of cobalt-60 and cesium-137, respectively. The risk from PTSM was expected to be reduced over time due to radioactive decay to below 1E-03 by the year 2006 for LRSB and 2002 for CRSB Basin 2. The low permeability soil covers with institutional controls (i.e., LUCs) are still effective in preventing human exposure that could result in risk of 1E-06 to a future industrial worker. A review of the inspection records for CRSB and LRSB indicate that the soil covers are in good condition with no evidence of erosion or subsidence. Active ant mounds are frequently observed and are treated upon discovery.

- The low permeability soil cover is effective in preventing the release of COCs in the soil to groundwater beneath the unit above MCLs or RBCs. A review of the Post Construction Report (PCR) / Final Remediation Report (FRR) for LRSB (WSRC 2004) provided evidence that the cover system met the low permeability performance requirements as follows: (1) minimum soil cover thickness is 1.8 m (6 ft) including a 0.6-m (2-ft) thick low permeability soil layer; (2) a 45 cm (18 inch) vegetative layer; and (3) a minimum slope of 3% to reduce infiltration.

- There were no CM COCs associated with the CRSB OU; therefore, periodic groundwater monitoring for the effectiveness of the soil cover as part of the C-Area Groundwater OU is not required.

- Groundwater monitoring data with respect to the performance of the cover system for the LRSB OU is collected as part of the L-Area Southern Groundwater OU monitoring program. The CM COC, strontium-90, remains non-detect in monitoring well LSB 4 during the third quarter 2016 sampling, demonstrating the effectiveness of the cover system in preventing migration of contaminants to the groundwater.

The Land Use Control Implementation Plan (LUCIP) for LRSB OU is located in Appendix A of the PCR/FRR for the LRSB OU (WSRC 2004), and the LUCIP for the CRSB Basin 2 is located in Appendix A of the PCR/FRR for the CRSB OU (WSRC 2003). Both LUCIPs govern LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs. All LUC objectives are being met.

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

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in physical conditions at the LRSB OU or CRSB Basin 2 that call into question 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 LRSB OU and CRSB Basin 2 were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. 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 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 currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The remedy at the LRSB and CRSB Basin 2 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 media. All threats associated with exposure to contaminated soil have been addressed with the placement of a low permeability cover system, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the LRSB and CRSB Basin 2 for industrial use only, OU-specific perimeter fencing and warning signs, and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

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

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

WSRC, 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. *Plug-In Record of Decision for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)*, WSRC-RP-98-4099, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000a. *Explanation of Significant Difference (ESD) for the Plug-In ROD for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil – C-Area Reactor Seepage Basin (U)*, WSRC-RP-2000-4032, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000b. *Unit-Specific Plug-In Technical Evaluation Report for the C-Reactor Seepage Basins (904-66G, 904-67G, and 904-68G) Operable Unit (U)*, WSRC-RP-2000-4008, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC 2001a. *Addendum for the Unit Specific Plug-In Technical Evaluation Report for the C-Reactor Seepage Basin (904-67G) Operable Unit (U)*, WSRC-RP-2001-4224, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001b. *Remedial Action Implementation Plan (RAIP) for the C-Area Reactor Seepage Basin (U)*, WSRC-RP-99-4213, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001c. *Unit Specific Plug-In Technical Evaluation Report for the L-Reactor Seepage Basin (904-64G) Operable Unit (U)*, WSRC-RP-2000-4130, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002a. *Remedial Action Implementation Plain (RAIP) for the L-Area Reactor Seepage Basin (LRSB) (904-64G) (U)*, WSRC-RP-2002-4117, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002b. *Unit-Specific Plug-In Record of Decision Amendment for the C-Area Reactor Seepage Basin (904-67G) and L-Area Reactor Seepage Basin (904-64G) (U)*, WSRC-RP-2002-4063, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Post-Construction Report (PCR)/Final Remediation Report (FRR) for the C-Area Reactor Seepage Basin (904-66G, -67G, and -68G) Operable Unit (U)*, WSRC-RP-2002-4149, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Post Construction Report (PCR)/Final Remediation Report (FRR) for the L-Area Reactor Seepage Basin (LRSB) (904-64G)*, WSRC-RP-2003-4118, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist for C-Reactor Seepage Basin (904-66G, 904-67G, 904-68G) (U)*, ER-IDS-019-013, Inspection Period 2007 through 2011 (annually)

Various - Inspection Data Sheets – Field Inspection Checklist for L-Reactor Seepage Basin (904-64G) (U), ER-IDS-019-025, Inspection Period 2017 through 2021 (annually)

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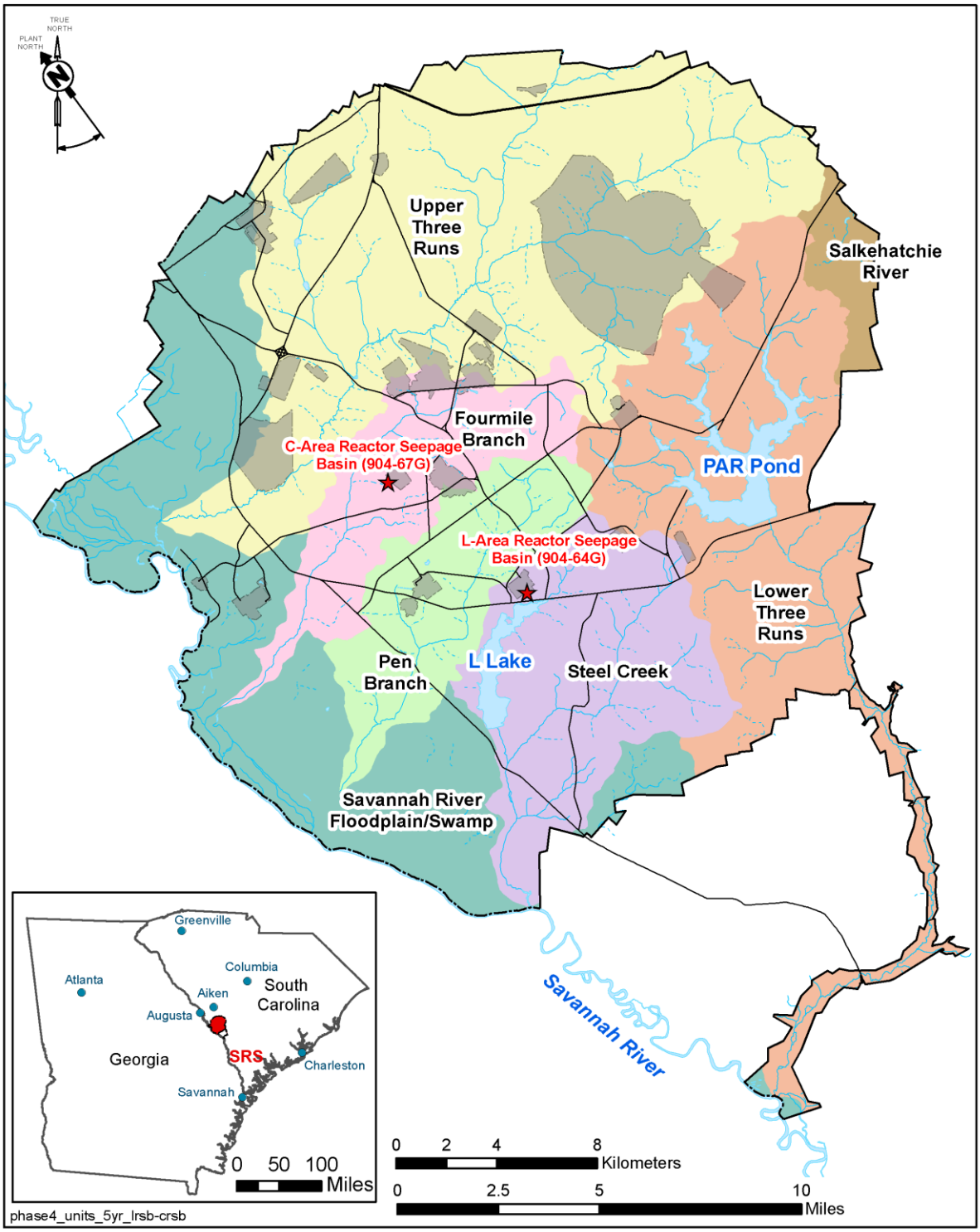

Figure M-1. Location of C & L Reactor Seepage Basins OUs at SRS

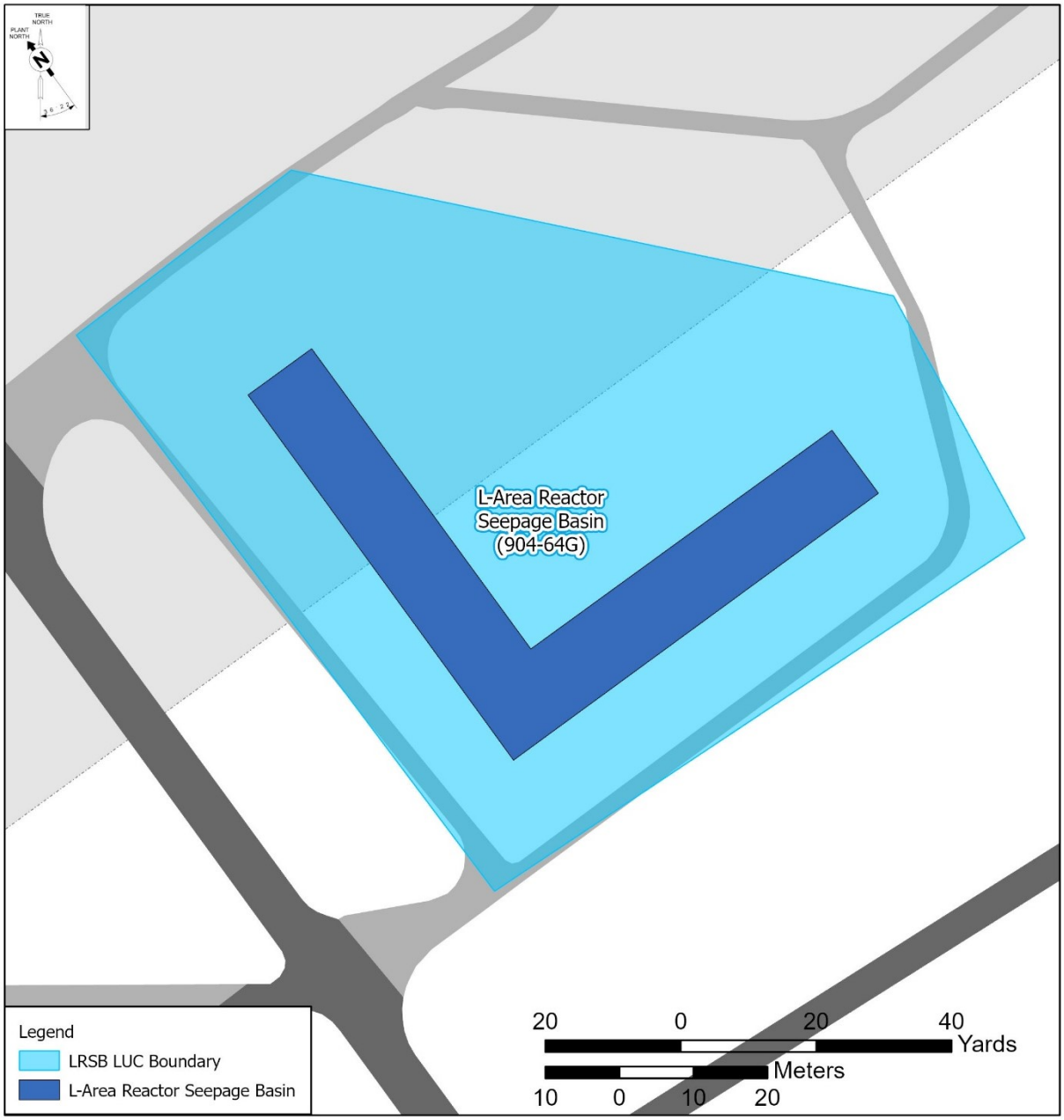

Figure M-2. Layout of the LRSB OU

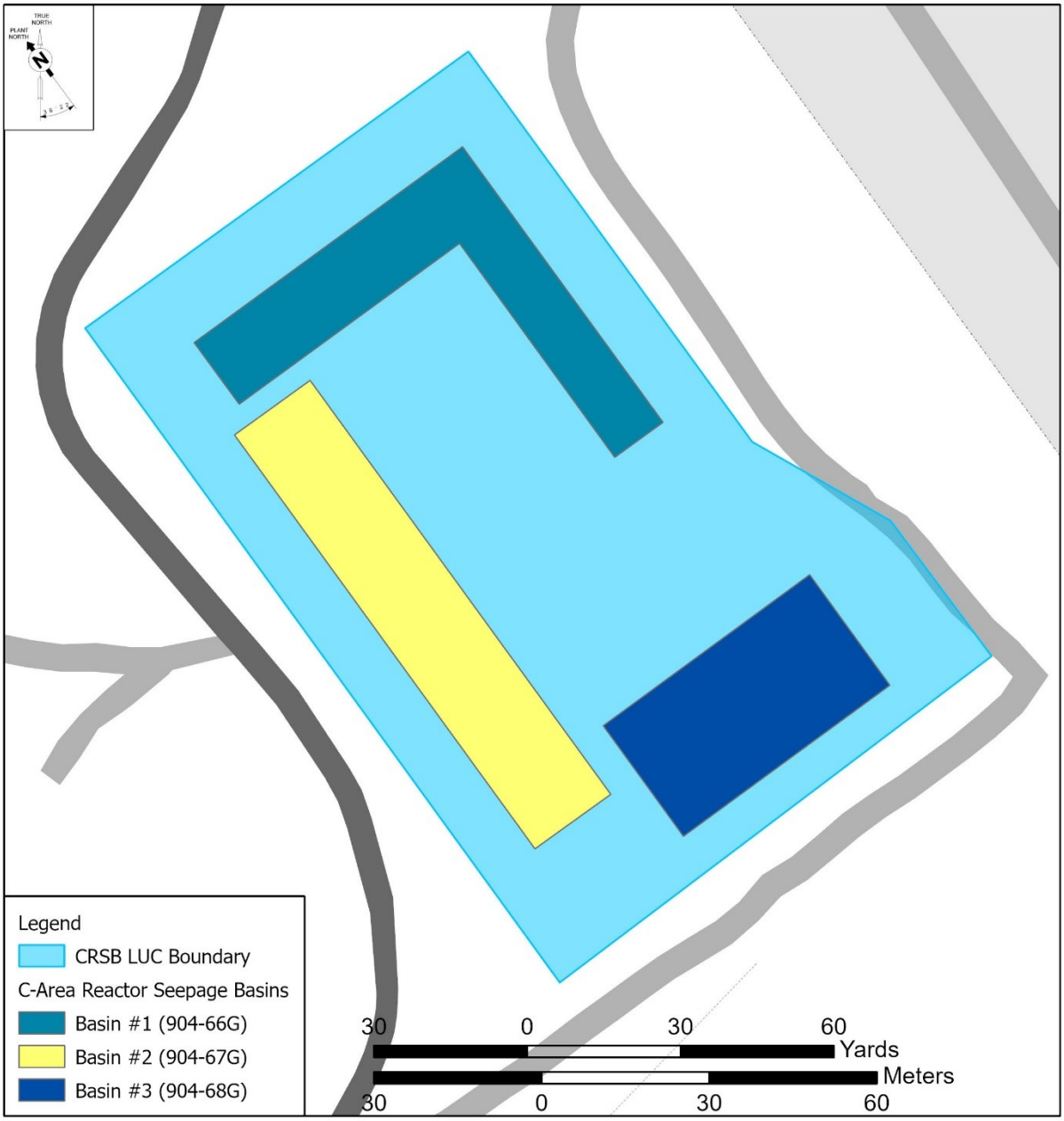

Figure M-3. Layout of the CRSB OU

Figure M-4. Before, During, and After Remedial Action at LRSB OU

Table M-1. Chronology of OU Events

Event	Date
Remedial Investigation Start/Complete	July 1998 / February 13, 2002
Time-Critical Removal Action Start/Complete	1997 / 1997
Plug-in ROD Issuance	November 29, 1999
CRSB ESD Issuance	October 18, 2000
CRSB and LRSB ROD Amendment	December 5, 2002
CRSB Remedial Action Start/Complete	February 5, 2001 / June 12, 2002
LRSB Remedial Action Start/Complete	October 30, 2002 / April 22, 2003
Previous Five-Year Reviews Issuance	January 29, 2009 / February 4, 2014 / March 27, 2018

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Table M-2. Risk Drivers in LRSB and CRSB Basin 2OUs Soils

Basin	Radionuclide Risk Drivers in Basin Soils	Discussion
LRSB (904-64G)	• Cobalt-60 (primary driver) • Cesium-137 • Strontium-90 • Promethium-147	Tritium was the predominant radionuclide released to LRSB, but cobalt-60 is the main contaminant remaining in the basin soils. Concentrations of cobalt-60 in the LRSB soils were considered PTSM with cancer risk to industrial workers of 3E-03. Radionuclides in the soil were expected to decay below PTSM level (risk >1E-03) by 2006 but will still be above human health limits (1E-06) for many years. A low permeability soil cover and institutional controls can effectively protect human receptors.
CRSB Basin 2 (904-67G)	• Cesium-137 (64%, Main driver) • Strontium-90 (12%) • Carbon-14 (8%) • Nickel-63 (3%) • Naturally occurring radionuclides such as Potassium-40 and Radium-228 (11%)	Tritium was the predominant radionuclide released to the CRSBs (56,000 Ci), but cesium-137 is the main contaminant remaining in the basin soils. Concentrations of cesium-137 in the CRSB soils were considered PTSM with cancer risk to industrial workers of 2E-03. The radionuclides in the soil were expected to decay below PTSM level (risk >1E-03) by 2002 but will still be above human health limits (1E-06) for many years. A low permeability soil cover and institutional controls can effectively protect human receptors.

Table M-3. Comparison of Actual vs. Estimated O&M Costs for the LRSB OU

	FY2017	FY2018	FY2019	FY2020	FY2021	Five-Year Total
Total Actual O&M Costs ($)	10,557	4,511	3,489	3,279	6,527	28,363
Total ROD Estimated Direct O&M Costs* ($)	23,450	23,450	23,450	23,450	23,450	117,250

* Costs for preparation of the Fifth Five-Year Remedy Review were not accounted for in the original estimate.

Table M-4. Comparison of Actual vs. Estimated O&M Costs for the LRSB OU

	Strontium-90	
Well Name	**2016**	**2020**
LSB-4	**ND**	**ND**

ND = nondetect

Attachment M-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) 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: Groundwater monitoring to confirm the soil cover effectiveness for the LRSB is addressed as part of the L-Area Southern Groundwater OU. Review of groundwater monitoring records for the L-Area Southern Groundwater OU are reported in the Five-Year Remedy Review Report for SRS OUs with Groundwater Remedies.			
8. Leachate Extraction Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
9. Discharge Compliance Records:			
☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
10. Daily Access/Security Logs:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			

Attachment M-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) 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
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached

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

Describe costs and reasons: __________

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

A. Fencing

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

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

B. Signs

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

Remarks: Signs are in good condition.

maximum values of 10.1 ρCi/L, 11.9 ρCi/L, and 5.8 ρCi/mL, respectively. Review of the plume maps generated as part of the GSA Western Groundwater OU annual reporting (SRNS 2017, SRNS 2018, SRNS 2019, and SRNS 2020) suggests that the OFASB is only one of several potential sources contributing to these contaminant plumes (Figure N-4). Time trends of iodine-129, strontium-90, and tritium over the period 2000 through June 2021 show concentrations in the wells closest to the OFASB are decreasing, indicating any potential impact to groundwater from the basin is decreasing.

Well FNB2 is the closest downgradient well to the OFASB. In order to understand the impact of the stabilization and capping of the basin on the groundwater, a decay curve was calculated using the maximum concentration of tritium detected at this well after the cap was installed (Figure N-5). While the time period cannot be definitively identified, there would have been a span of time after the stabilization/capping occurred for the system to return to steady state, as there would have been a reduction in flux of water through the basin. It can be assumed that period of time is represented by the steeper decrease in concentrations from the period 2001 through September 2004. As can be seen from the trend line associated with the measured data, upon reaching the new steady state the concentrations are decreasing at a rate consistent with the decay curve. A similar time trend was developed for the iodine-129 data (Figure N-6). As the half-life for iodine-129 is 1.57E+07 years, decay has no impact on the time trend of this contaminant. Thus, the overall decreasing time trend for iodine-129 would indicate the stabilization/capping has had a positive impact (decrease in mass) on the release of contaminants from the OFASB to the groundwater. Recent sampling results show an increase in iodine-129. It is uncertain whether the 2021 iodine-129 result represents an actual increase in concentrations at the OFASB due to laboratory analysis criteria falling outside quality control limits. SRS will continue to monitor for iodine-129 at the OFASB in accordance with the GSA Western Groundwater OU monitoring program.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, 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 26, 2021, at the O&M organization offices. No issues were identified during these interviews.

The OFASB OU was inspected by SRNS personnel on July 14, 2021. No issues will be identified for the OFASB OU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled inspections conducted at the OFASB from FY2017 to FY2021 identified active ant mounds, brush around underground piping signs that needed to be cut, 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 review of documents, applicable or relevant and appropriate requirements, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD. Placement and maintenance of a protective multi-layer cover system over the basin is effective in meeting the RAOs of preventing physical exposure, inhalation, and ingestion of contaminants. Based on the above review, the stabilization and capping of the OFASB has had a positive impact on the release of contaminants from the OFASB to the groundwater.

Maintenance and inspection of the cover system has been effective. Review of the annual inspection reports for the period 2017 through 2021 indicate the in-place remedy is functioning properly. The prevalent findings were active ant mounds and vegetation in drainage ditches in need of mowing which were addressed in an expedient manner. Review of the inspection reports indicates the maintenance is operating effectively and efficiently.

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

The Land Use Control Implementation Plan for the OFASB OU is located in Appendix A of the Post-Construction Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement (WSRC 2001). 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 physical conditions of the OFASB that would affect the protectiveness of the remedy. The remedy remains protective as the exposure pathways have been eliminated through in situ grouting of the contaminated materials (soil and vegetation) in the basin followed by placement of a low-permeability cover system.

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

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perflurorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. None of the listed emerging contaminants were identified as applicable to this OU.

Due to widespread usage of chlorinated solvents at SRS and the use of 1,4-dioxane as a stabilizer in chlorinated solvents, paint strippers, greases, and waxes, SRS began sampling for 1,4-dioxane at OFASB as part of the GSA Western Groundwater OU groundwater evaluation in 2010. Fifty-one records were reviewed from 2010 through February 2012 representing five sampling events of five monitoring wells, three seepline piezometers, and two surface water locations. SRS continues to monitor 1,4-dioxane at OFASB, by sampling annually according to the GSA Western groundwater OU monitoring program. 1,4-dioxane continues to be non-detect at OFASB up to the most recent sampling in 2021.

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

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

VIII. Issues

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

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

All threats posed by contamination at the OU have been addressed through in situ stabilization of the contaminated materials, a low permeability cover system, and institutional controls (i.e., LUCs) to maintain industrial land use. Exposure pathways that could result in unacceptable risks are controlled through LUCs which include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain this site for industrial use only (SRS is a secured government facility with land use restrictions), 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 Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

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

SRNS, 2018. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, September 2018, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

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

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

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

WSRC, 1995a. *RCRA Facility Investigation/Remedial Investigation Report for the Old F-Area Seepage Basin*, WSRC-RP-94-942, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1995b. *Baseline Risk Assessment for the Old F-Area Seepage Basin (U)*, WSRC-RP-94-1174, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996a. *Statement of Basis/Proposed Plan for the Old F-Area Seepage Basin (904-49G) (U)*, WSRC-RP-95-1557, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996b. *Corrective Measures Study/Feasibility Study Report for the Old F-Area Seepage Basin (904-49G) (U)*, WSRC-RP-95-385, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997. *Record of Decision Remedial Alternative Selection for the Old F-Area Seepage Basin (904-49G) (U)*, WSRC-RP-96-872, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998. *Explanation of Significant Differences to the Revision 1.1 Record of Decision for the Old F-Area Seepage Basin* (U), WSRC-RP-98-4123, 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, 2001. *Post-Construction Report for the Old F-Area Seepage Basin (904-49G) (U)*, WSRC-RP-2000-4100, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Record of Decision Amendment for the Old F-Area Seepage Basin (904-49G)* (U), WSRC-RP-2003-4136, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Field Inspection Checklists for the Old F-Area Seepage Basin (904-49G)*, ER-IDS-019-008, Inspection Period 2017 through 2021 (annually)

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Figure N-3. Current Photograph of OFASB OU (2021)

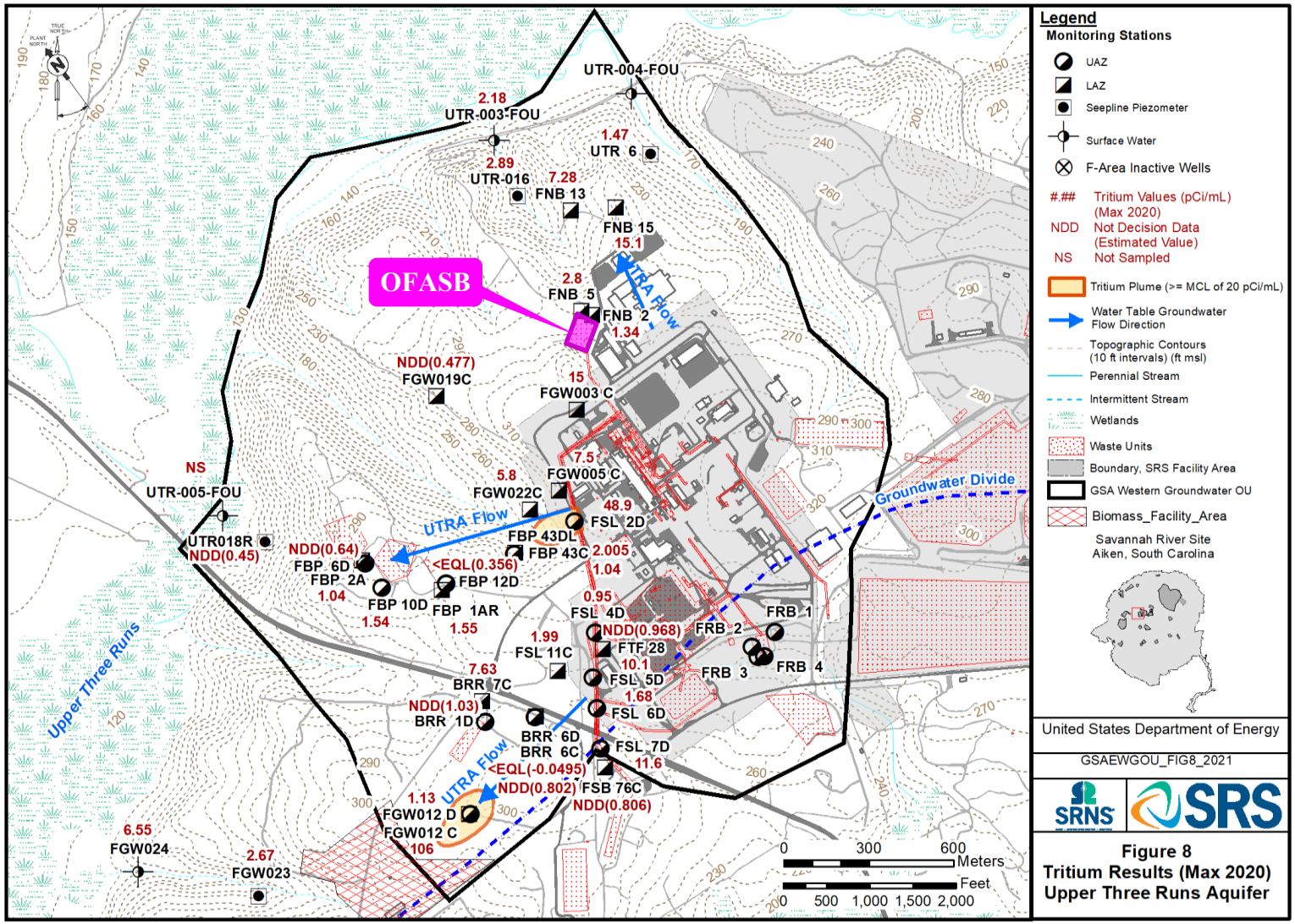

Figure N-4. Tritium Plume Map for the Western GSA Groundwater OU – 2020 (SRNS 2021)

five years to support review of the ISD early action remedy. Groundwater is addressed separately in the PAGW OU.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, on and Pill Carter, SRNS EC&ACP Post-Closure Lead, on August 26, 2021 at the O&M organization offices. No issues were identified during these interviews.

The PAOU was inspected by SRNS personnel on July 14, 2021. No issues were identified for the PAOU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

The annual site inspection confirmed that the roof structure and the P-Reactor Disassembly Basin covers are functioning properly, the doors are sealed, the P-Area Ash Basin (188-P) cover is in good condition, and the LUCs are preventing human health exposure.

In May 2017, SRNS Personnel observed a flaw on the southeast corner of the 105-P Actuator Tower concrete roof slab (Figure O-6). Additional investigation and review of annual aerial photography taken after roof construction showed that the flaw was present

within one year after the roof slab placement in 2011. This finding was reported in the previous five-year review. The 105-P Actuator Tower Roof Cap Flaw continues to be evaluated for signs of degradation during the PAOU annual inspections.

Scheduled annual site inspections conducted from FY2017 to FY2021 identified overgrown vegetation and evidence of hog damage. These findings were documented on the field inspections checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedies selected from the PAOU are functioning as expected as described below:

PSA 3A and 3B

Based on the soil sampling results, vadose zone soil concentrations are below the RG (0.53 mg/~~L~~kg) for trichloroethylene (TCE) and tetrachloroethylene (PCE) (SRNS 2013). Therefore, the operations associated with the MicroBlower™ and passive BaroBall™ systems at PSA 3A and 3B have been completed.

High Contamination Area (HCA) at the P-Area Cask Car Railroad Tracks

The removal action was completed and met the removal action objectives (SRNS 2010a). LUCs were required to prevent exposure to any potential residual contamination. Annual inspections have indicated that no disturbance has occurred in the area.

P-Area Ash Basin (188-P) (including Outfall P-007)

The removal action was completed and met the removal action objectives (SRNS 2012), of excavating cesium-137-contaminated soil/ash exceeding 10 ρCi/g, consolidating soil and ash into the P-Area Ash Basin, and installing a 0.6-m (2-ft) thick soil cover over P-Area Ash Basin (188-P) and Outfall P-007 to prevent exposure of the industrial worker to carcinogenic risk exceeding 1E-06. Annual inspections have indicated that the soil cover continues to be in good condition.

P-Area Process Sewer Lines As Abandoned (PSLs)

The dewatering of the P-Area PSLs (lines/structures), isolating/plugging of contaminated process sewer and storm water lines, grouting accessible openings to grade, including structures, manholes, catch basins, inlet pipes, outfalls, and other miscellaneous access points, installing concrete plugs in openings and/or placing concrete covers over entire structures, removing equipment associated with P-Area PSLs external to the P-Reactor Building (105-P); and sealing/plugging outfalls, prevents exposure of the industrial worker to carcinogenic risk exceeding 1E-06. Annual inspections have indicated that no disturbance has occurred in the area.

ISD of the P-Reactor Building (105-P) Complex

The activities and operations that have been completed for ISD of the P-Reactor Complex (SRNS 2012) prevent exposure to the industrial worker to carcinogenic risks exceeding 1E-06, and include the following:

- Leaving the P-Reactor Building (105-P) Complex (Process, Purification, and Assembly Areas) and the Actuator Tower in place;
- Dewatering and grouting of P-Reactor Disassembly Basin and placing a concrete cover over the grouted basin;
- Demolishing the above-grade structure of the Disassembly Area to grade-level;
- Grouting the below-grade portions of the P-Reactor Building (105-P);
- Removing the Stack above the plus 16.8-m (55-ft) elevations;
- Constructing a new partial roof over the shield door slots;
- Grouting the Reactor Vessel in place and placing a 1.2-m (4-ft) thick constructed concrete cover over the Reactor Vessel;
- Leaving the Process Room, an above-grade structure, in its current state;
- Monitoring the groundwater adjacent to the P-Reactor Building (105-P) Complex via eight monitoring in order to verify the effectiveness of the ISD remedy; and

- Placing LUCs on the 50 hectares (126 acres) comprising the PAOU.

The Land Use Control Implementation Plan for PAOU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (SRNS 2010b). All LUC objectives are being met.

Per the EMP (SRNS 2010c), groundwater monitoring will take place at eight wells located around the P-Reactor Building (105-P) (Figure O-5). Because the timeframe for groundwater impacts (if any) is over 1,000 years, groundwater sampling will occur every five years to support the remedy review analysis.

The sampling results for all contaminant migration constituents of concern (CMCOCs) are shown on Table O-4. In addition, a comparison of the 2019 results to the 2021 sampling results for lead and the 2020 results to the 2021 sampling results for tritium are included in Table O-4. All other radionuclides were non-detects. The maximum concentration of lead (13.5 µg/L) is below the maximum contaminant limit (MCL) (15 µg/L), as listed in the EMP (SRNS 2010c). Only one of the eight tritium samples collected in 2020 and 2021 each had a concentration exceeding the MCL (20 ρCi/ml) with the maximum concentration being 553 ρCi/ml (2020) and 606 ρCi/ml (2021) in well PDB 2. Since 2017, tritium concentrations in this well have significantly increased over previous years where observed concentrations were approximately 2-3x the MCL. The increase in tritium may be attributed to the release of residual tritium present in pore spaces within the unsaturated zone beneath the closed disassembly basin. As the shallow water table rises due increased rainfall, tritium that is present in the unsaturated zone becomes mobile.

Overall Technical Assessment

The early remedial actions, removal actions, and final remedial action are meeting the RGs established for the PAOU, as discussed in Section IV, by eliminating or controlling all routes of exposure to residual radioactive or chemical contamination to the industrial worker, eliminating water flow through the P-Area PSLs, preventing the migration of VOCs from the vadose zone to the groundwater, and preventing the exposure of contaminated media or structures to residential receptors.

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

The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection are still valid. There have been no changes in the physical conditions at the PAOU 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 PAOU 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.

With regard to the CCRTs and P-007 subunits, more stringent 2016 preliminary remediation goals (PRGs) / regional screening levels (RSLs) would not impact the protectiveness of the remedy because excavation of highly contaminated media followed by application of clean soil to grade eliminates exposure of human receptors to remaining soil contaminants left in place. Similarly, installation of a soil cover eliminates the human health exposure pathway at the P-Area Ash Basin (188-P) and Outfall P-007. Exposure to contamination left in place at the P-Reactor Building Complex has been eliminated by the ISD remedy as well as grouting the points of access at the PSL subunit. There have been no changes in the MCLs for TCE and PCE that would have impacted SVE operations in PSA 3A and PSA 3B vadose zones that were completed in 2013. Finally, more stringent PRGs/RSLs would not impact the LUCs that are in place to prevent exposure to contaminated media at the PAOU.

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perflurorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and

tungsten. 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 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 currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The remedy at PAOU is expected to be protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to contaminated soil at the PAOU have been addressed through implementation of soil covers, in situ decommissioning, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the PAOU 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 Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

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, 2009a. *Explanation of Significant Difference to the Revision 1.1 Early Action Record of Decision for the P-Area Operable Unit (U)*, SRNS-RP-2009-00704, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009b. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for the P-Area Ash Basin (including Outfall P-007) (188-P) and the R-Area Ash Basin (188-R) (U)*, SRNS-RP-2009-01064, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009c. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for the P-Area Process Sewer Lines As Abandoned (NBN) Subunit for the P-Area Operable Unit (U)*, SRNS-RP-2009-01046, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010a. *Early Action Post Construction Report for the P-Area Cask Car Railroad Tracks Subunits (U)*, SRNS-RP-2010-00796, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010b. *Land Use Control Implementation Plan for the P-Area Operable Unit (U)*, SRNS-RP-2010-00619, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010c. *P-Area Operable Unit Effectiveness Monitoring Plan*, SRNS-RP-2010-00894, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

SRNS, 2012. *Post Construction Report for the P-Area Operable Unit (U)*, SRNS-RP-2011-01582, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Performance Evaluation Report for the P-Area Operable Unit Potential Source Areas 3A and 3B Subunits*, SRNS-RP-2012-00335, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2019. *Addendum to the P-Area Operable Unit (PAOU) Effectiveness Monitoring Plan (U)*, SRNS-RP-2019-00241, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

WSRC, 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, 2008a. *Early Action Record of Decision Remedial Alternative Selection for the P-Area Operable Unit (U)*, WSRC-RP-2008-4037, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

Various – Inspection Data Sheets - *Field Inspection Checklist for P-Area Ash Basin and P-007 Outfall*, ER-IDS-019-061, Inspections Period 2017 through 2021 (annually)

Various – Inspection Data Sheets - *Field Inspection Checklist for P-Area Operable Unit*, ER-IDS-019-066, Inspections Period 2017 through 2021(annually)

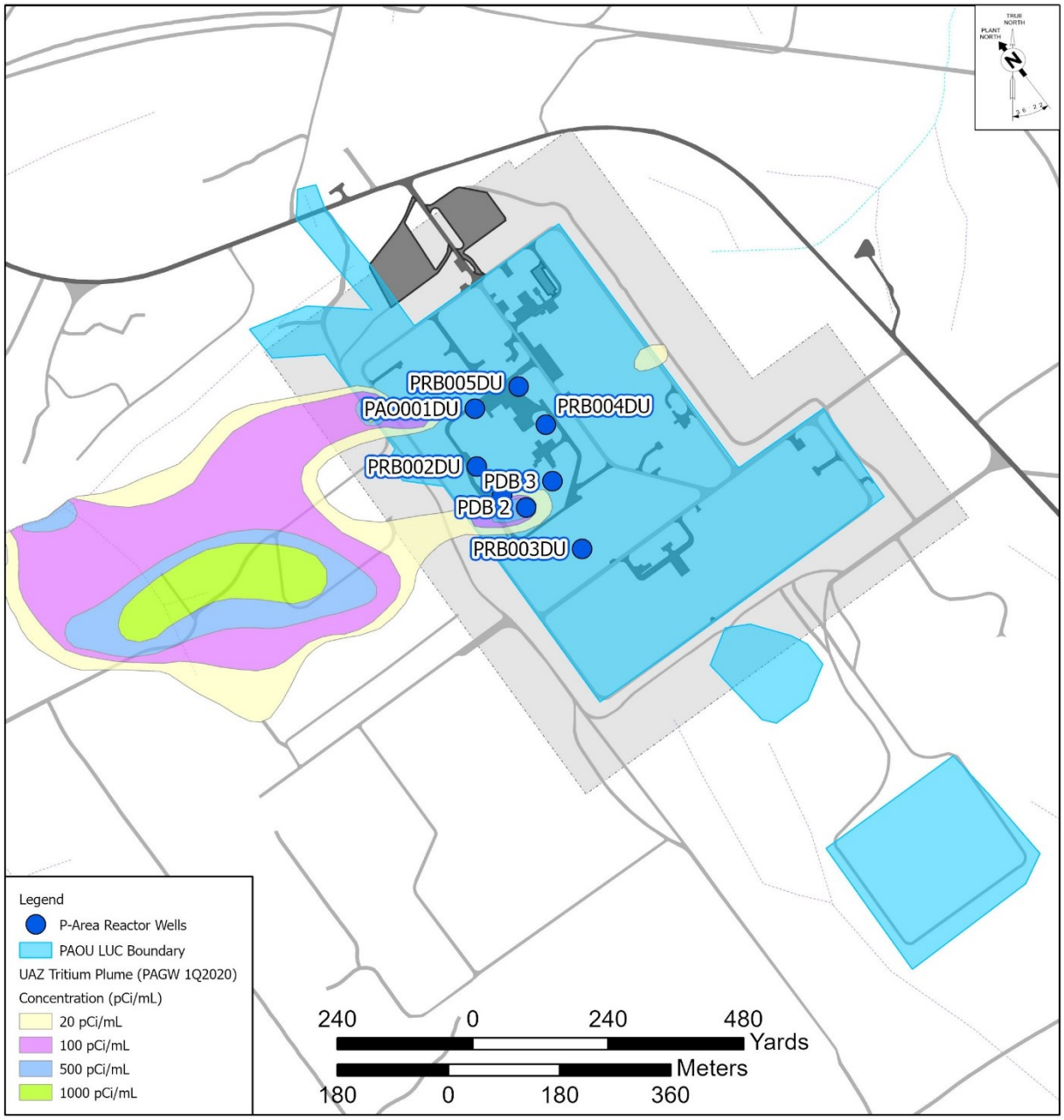

Figure O-5. Location of Groundwater Wells Monitoring the P-Reactor Building (105-P)

Figure O-6. View of 105-P Actuator Tower Roof Cap Flaw (2017)

The following maintenance activities are ongoing.

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

Table P-2 compares the actual operation and maintenance (O&M) costs for the five-year remedy review period to the estimated direct O&M costs from the ROD (WSRC 1999b). The estimated O&M cost for Fiscal Year (FY) 2017 to FY2021 was $117,250 for inspections and maintenance. The actual O&M cost for FY2017 to FY2021 is $39,909. The actual O&M costs are lower than expected because the PSA units were shutdown sooner than estimated.

V. Progress since Last Review

The previous protectiveness statement from the last Five-Year Remedy Review concluded that because the remedial actions at PRSB OU are protective, the site is protective of human health and the environment. This remedy is protective because receptors will not be exposed to contamination above the appropriate RGs. Exposure pathways that could result in unacceptable risks are controlled by the soil stabilization, low permeability cover system, and institutional controls (i.e., LUCs).

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII. Documents Reviewed;
- Inspected and photographed the PRSB OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment P-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 Post Construction Report (WSRC 2006) documents that contaminated soils in the SCA/URMA and associated with the IPSL were excavated and placed within the basins. The consolidation minimized the lateral extent of contaminated soils. The S/S of the soils within Basins 1 and 2 followed by placement of a low permeability cover resulted in eliminating the exposure pathway for humans or ecological receptors. Review of maintenance inspection reports and a visual inspection of the PRSB OU indicate the structural integrity of the cap is intact in providing protection to human and ecological receptors.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, 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 26, 2021, at the O&M organization offices. No issues were identified during this interview

The PRSB OU was inspected by SRNS and USDOE personnel on July 14, 2021. No issues were identified for the PRSB OU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, USEPA, and SCDHEC was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better

the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, data, applicable or relevant and appropriate requirements (ARARs), risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the plug-in ROD. The S/S of contaminated soils has achieved the RGs to minimize migration of contaminants to groundwater and to prevent human exposure to highly contaminated basin soils (PTSM).

O&M of the cover system has been effective. The main finding being active ant mounds on the soil cover that have been addressed on the spot.

LUCs, including institutional controls, as implemented and monitored via the annual inspections of this unit, and access controls are preventing human activities (such as excavation, disturbance of the cover system) that could result in exposure to contaminated soil. The Land Use Control Implementation Plan for PRSB OU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2004). All LUC objectives are being met.

The above remedial activities are meeting the RGs established for the PRSB OU by eliminating or controlling all routes of exposure to human health and ecological receptors.

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 physical conditions of the PRSB OU that would affect the protectiveness of the remedy.

The evaluation conducted in the Plug-In ROD (WSRC 1999b) concluded that the remedy of in situ stabilization with a low permeability soil cover for the radiological contaminants in the soil at reactor seepage basins would meets RAOs, prevent exposure, stabilize PTSM,

and be protective of human health and the environment. The OU remains within an industrial area with the remedial action taken making the potential for exposure to any residual contaminants negligible.

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

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. None of the listed emerging contaminants were identified as applicable to this OU.

As the remedial work has been completed, most ARARs for soil contamination cited in the plug-in ROD have been met. ARARs that still must be met at this time and that have been evaluated include the Safe Drinking Water Act (40 CFR 141 and SC R.61-58.5) related to maintaining quality of groundwater through source controls. Groundwater is evaluated under the PAGW OU.

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

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

VIII. Issues

There are no issues for this OU.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The remedy at the PRSB 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 media All threats to contaminated soil at the PRSB OU have been addressed through soil stabilization, implementation of the low permeability cover system, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the PRSB 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 Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

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

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

WSRC, 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. *Plug-In Record of Decision for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)*, WSRC-RP-98-4099, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003a. *Unit-Specific Plug-In Technical Evaluation Report for the P-Area Reactor Seepage Basin (904-61G, 904-62G, and 904-63G) Operable Unit (U)*, WSRC-RP-2002-4082, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003b. *Explanation of Significant Difference (ESD) for the Plug-In ROD for In Situ Stabilization with a Low Permeability Soil Cover System for Radiological Contaminants in Soil- P-Area Reactor Seepage Basin Operable Unit (U)*, WSRC-RP-2002-4105, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Land Use Control Implementation Plan (LUCIP) for P-Reactor Seepage Basins (904-61G, 904-62G, and 904-63G) OU (U)*, WSRC-RP-2003-4139, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006. *Post-Construction Report (PCR)/Final Remediation Report (FRR) for the P-Reactor Seepage Basins (U)*, WSRC-RP-2005-4088, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, P Reactor Seepage Basin Operable Unit (Bldgs. 904-61G, 904-62G, 904-63G) (U)*, ER-IDS-019-035, Inspection period 2017 through 2021 (annually)

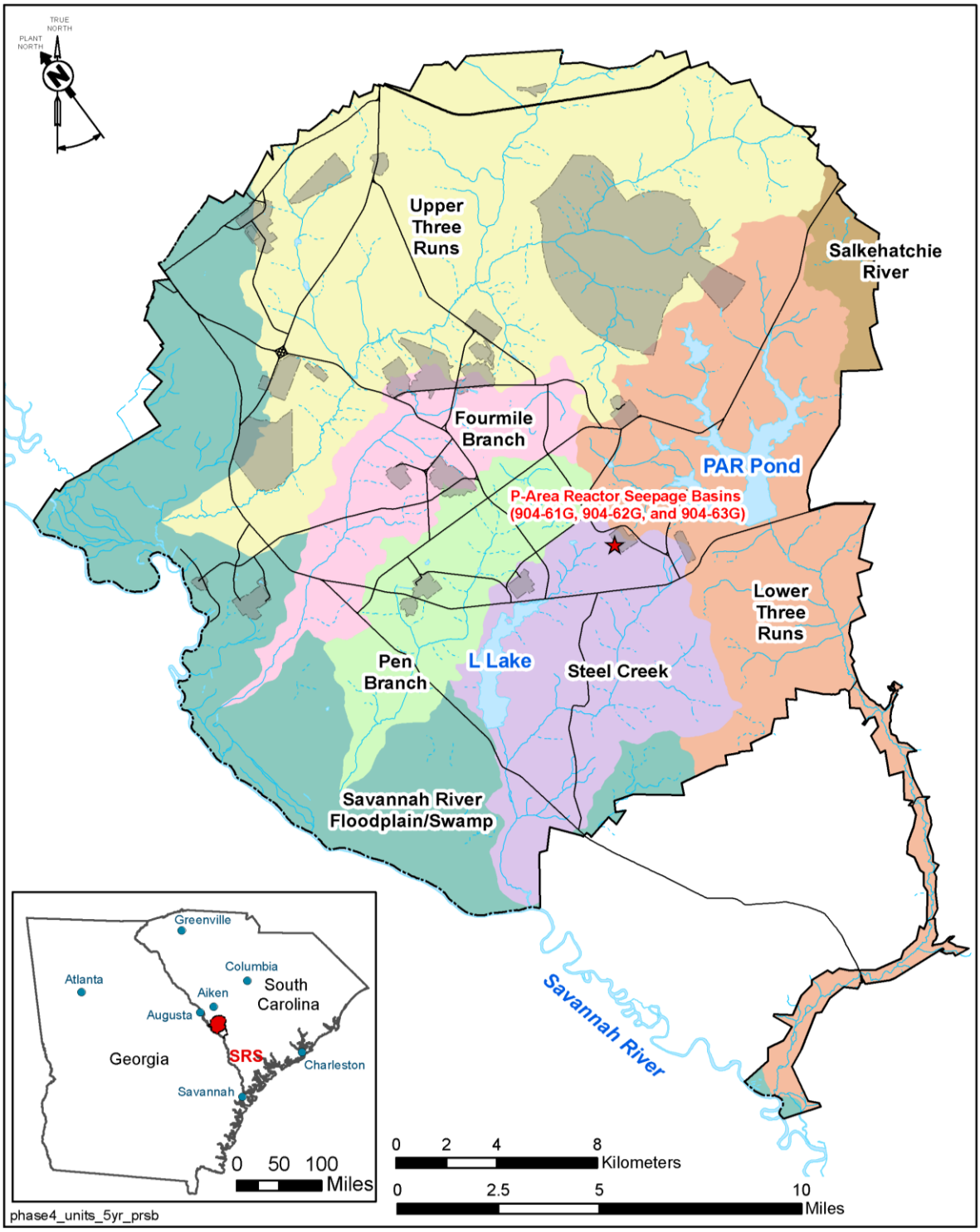

Figure P-1. Location of P-Area Reactor Seepage Basins at SRS

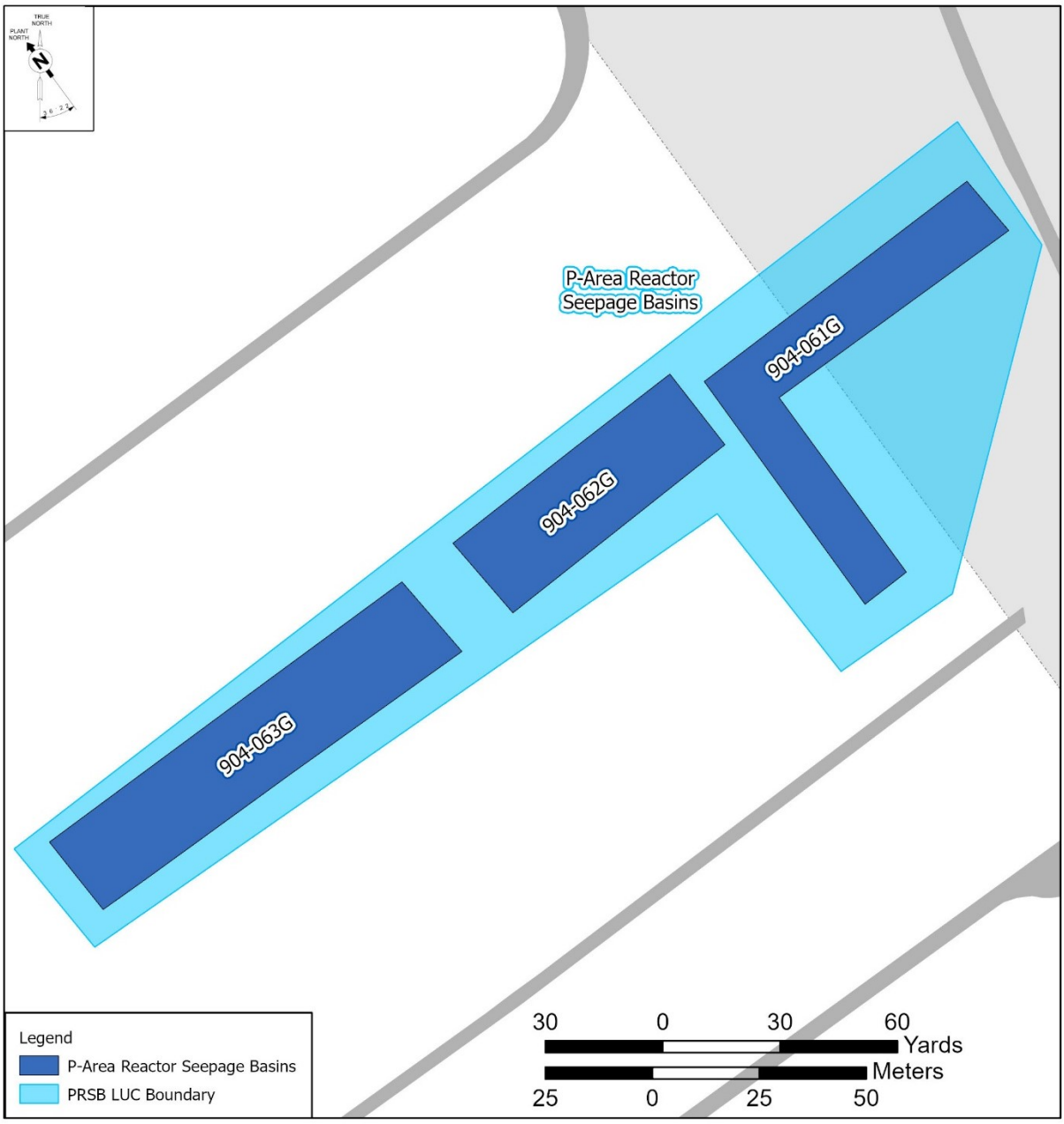

Figure P-2. Plan View of P-Area Reactor Seepage Basins

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 26, 2021, at the O&M organization offices. No issues were identified during this interview.

The RBRP/RRP OU was inspected by SRNS personnel on July 14, 2021. No issues were identified for the RBRP/RRP OU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual site inspections conducted at the RBRP/RRP OU from FY2017 through FY2021 identified active ant mounds, bare spots in the grass, and subsidence on cap. These findings were documented on the field inspection checklists and resolved soon after discovery.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended by the decision document as demonstrated below:

- Based on the data review, provided in Section VI, the cover system is protective, decreasing the potential for contaminant transport to groundwater. In addition, the cap is maintaining an acceptable level of protectiveness in terms of source contaminants leaching from the soil into the groundwater.
- The cover system maintenance program and LUCs have been effective in maintaining the integrity of the cover system and preventing human and ecological exposure. Review of the annual maintenance inspection reports and a visual inspection of the OU indicate the structural integrity of the cap is intact and is providing protection to ecological receptors, industrial workers, and future residents.

Land use controls include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the RBRP/RRP OU for industrial use only, and warning signs and site use restrictions via the SRS Site Use/Site Clearance Program for the RBRP/RRP OU. The Land Use Control Implementation Plan for RBRP/RRP OU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2005). All LUC objectives are being met.

The basis for exposure of human receptors, as well as ecological receptors, to the soil is contact with the soils. The implemented remedy removed hazardous materials from the RRP and shipped it off-site for treatment. Also, friable asbestos materials, as well as other miscellaneous construction debris, were excavated and transported off-site for proper disposal. Upon removal of these materials a low permeability cover system was installed; thus, breaking the exposure pathway. Review of the groundwater data and the annual inspection reports indicate the remedy is functioning properly, thus providing evidence that the exposure pathways to potential receptors remain broken.

Optimization of the frequency of sampling the wells associated with this OU was implemented during the five-year review period. The frequency of groundwater sampling was reduced without diminishing the overall protectiveness of the monitoring program, because concentrations of metals are low and consistent with natural background. PCE has

never been detected in wells RRP 3 or RRP 4, and the transport time for contaminants is very long due to the presence of the low-permeability cover.

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

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in physical conditions at the RBRP/RP OU that would affect the protectiveness of the remedy. Excavation of contaminated soil and debris at the RRP subunit followed by application of clean backfill to surface grade eliminates the human health and ecological exposure pathway. Similarly, installation of a soil cover at the RBRP subunit prevents exposure of human and ecological receptors to contaminants left in place. In addition, LUCs are in place to prevent exposure to contaminated media at the RBRP/RRP 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 RBRP/RRP OU were not significant, and the RAOs continue to be met by the remedial action. No new standards or to-be-considered guidance have been identified that call into question the protectiveness of the remedy.

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. None of the listed emerging contaminants were identified as applicable to this OU.

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

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

VIII. Issues

There are no issues for 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 RBRP/RRP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by land use controls to prevent exposure to or ingestion of contaminated soil. All threats to remaining contaminated soil have been addressed through removal of waste and backfill at the RRP, installation of the low permeability cover system at the RBRP, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the RBRP/RRP OU for industrial use only (SRS is a secured government facility with land use restrictions), 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 Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

XII. Documents Reviewed

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

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

WSRC, 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, 2003. *RCRA Facility Investigation/Remedial Investigation Work Plan Addendum Including Baseline Risk Assessment for the R-Area Burning/Rubble Pits (131-R and 131-1R) and Rubble Pile (631-25G) Operable Unit*, WSRC-RP-2002-4183, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. R*ecord of Decision Remedial Alternative Selection for the R-Area Burning/Rubble Pits (131-R and 131-1R) and Rubble Pile (631-25G) Operable Unit (U)*, WSRC-RP-2004-4004, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005. *Land Use Control Implementation (LUCIP) for R-Area Burning/Rubble Pits (131-R and 131-1R) and R-Area Rubble Pile (631-25G) Operable Unit (U)*, WSRC-RP-2004-4119, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006. *Post-Construction Report/Corrective Measures Implementation Report/ Final Remediation Report for the R-Area Burning/Rubble Pits (131-R And 131-1R) and R-Area Rubble Pile (631-25G) Operable Unit (U)*, WSRC-RP-2006-4002, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist, R-Area Burning Rubble Pits and Rubble Pile, Operable Pit Remediation (U)*, ER-IDS-019-036, Inspection period 2017 through 2021 (annually)

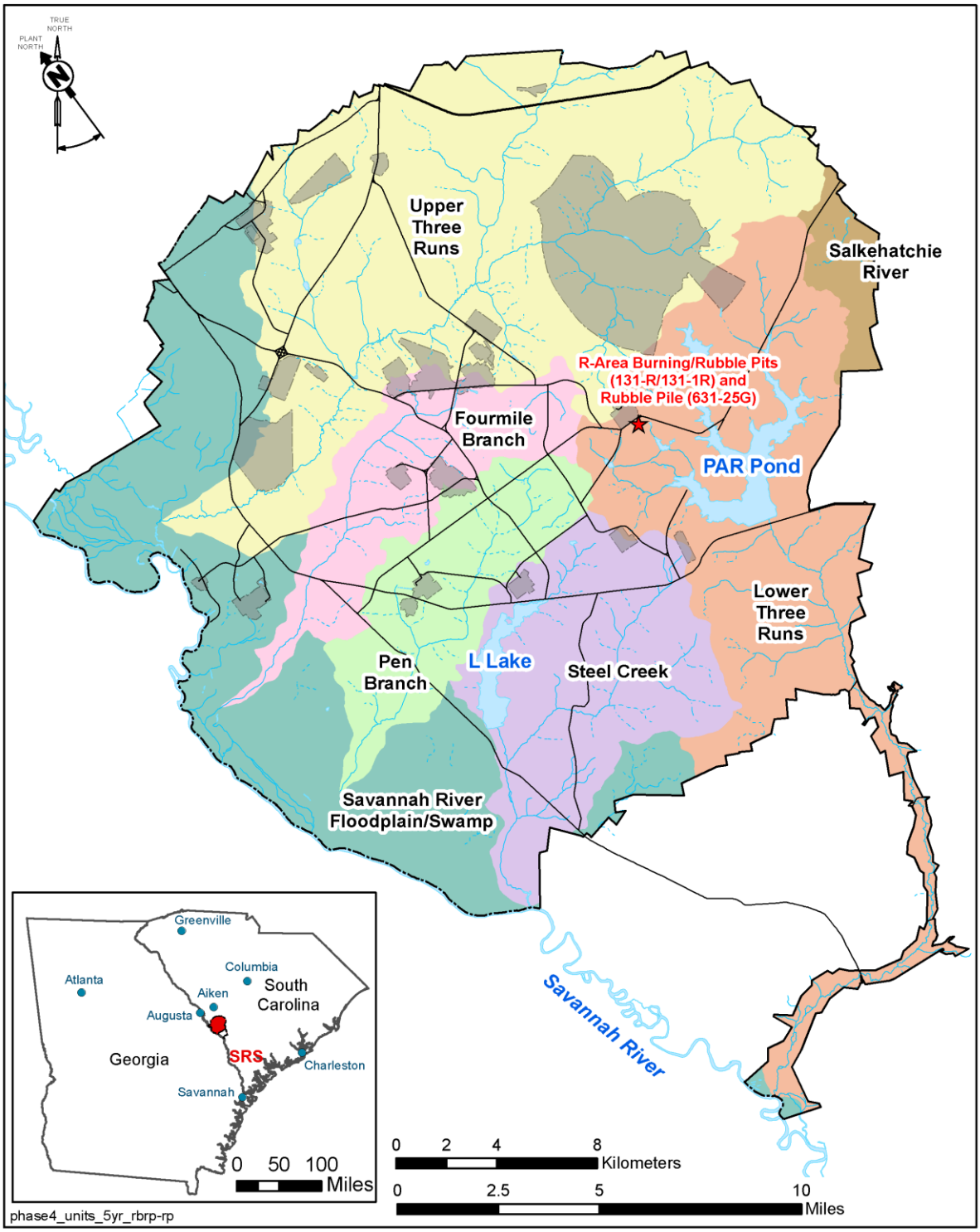

Figure Q-1. Location of the RBRP/RRP OU at SRS

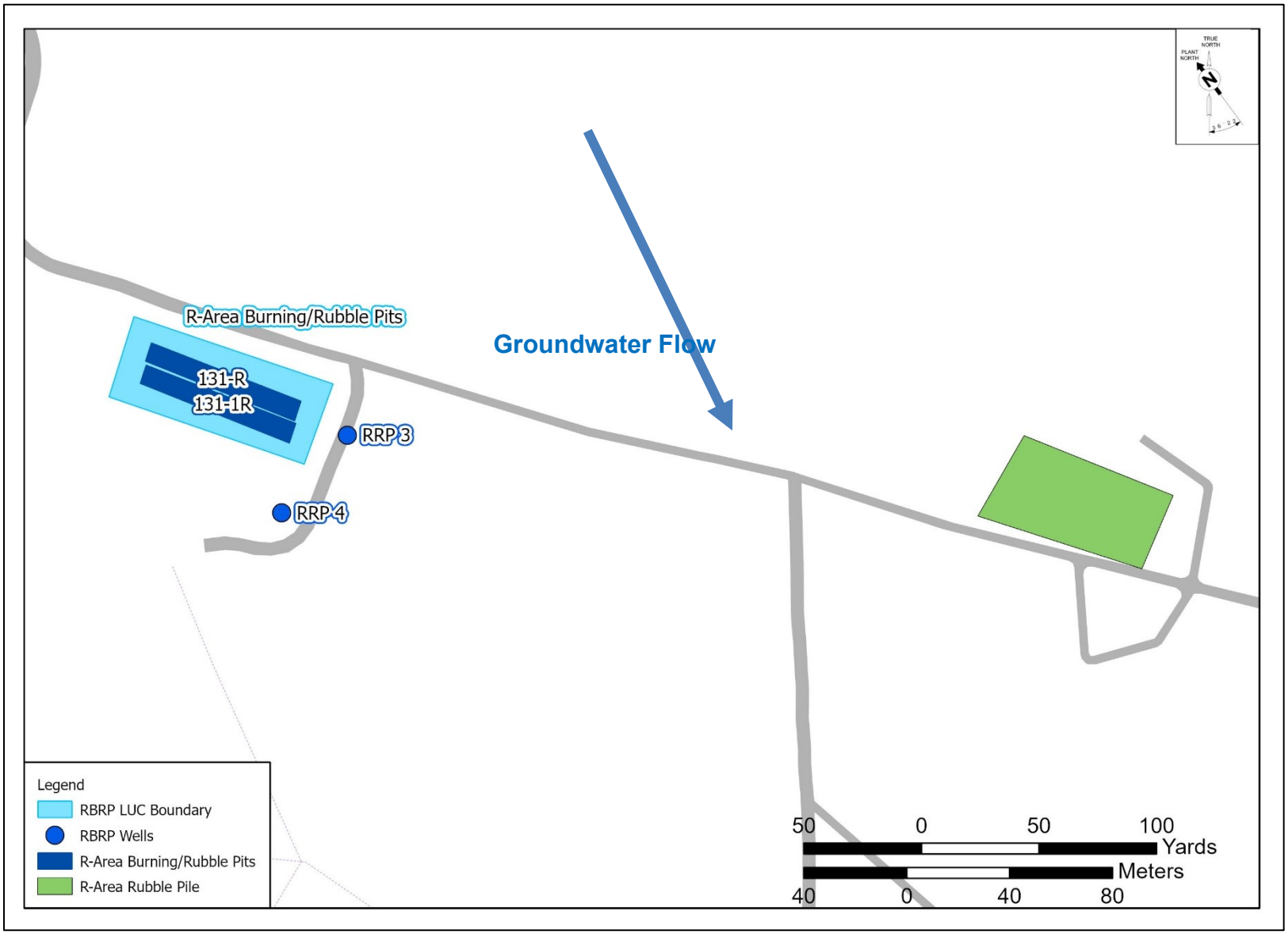

Figure Q-2. Layout of the RBRP/RRP OU

collected and can be used as indicator parameters to determine the presence of the RCOCs in groundwater. Aroclor 1260 is not sampled at the TNX OU monitoring wells and does not have an equivalent indicator parameter.

Table R-5 provides a summary of the number of detections above the MCL, total number of detections, the wells with detections above the MCL and the number of instances for mercury, uranium, gross alpha, and combined radium. Eight TNX OU monitoring wells (i.e., TBG 3, TBG 4, TBG 5, TCM 5, TIR 1U, TNX 24D, TNX 37D, and XSB006R) had concentrations of COCs greater than MCLs during the past 5 years. Five of these wells (i.e., TCM 5, TIR 1U, TNX 24D, TNX 37D, and XSB006R) are located in the Outfall Delta/Inner Swamp, outside of the industrial area for the TAOU (Figure R-5). The COCs that have exceeded the MCL at TIR 1U, TNX 24D, and TNX 37D are sporadic. TCM 5 is the exception as it has exceeded the MCL for uranium and gross alpha consistently between 2017 and 2021. The exceedances that have occurred in the Outfall Delta/Inner Swamp are likely caused by a fluctuating water table surface through fluvial aquifer sediments and do not represent a discernable groundwater plume. The remaining three wells (i.e., TBG 3, TBG 4, and TBG 5) in Table R-5 are located within the industrial portion of this OU (Figure R-5). Within the industrial portion of this OU nitric acid disposal has lowered the pH of the groundwater causing metals and radionuclides to leach out of the aquifer sediments. The concentrations exceeding an MCL within the industrial portion of the TAOU are typically sporadic in nature and do not represent a discernable plume.

Summary of Inspections and Interviews

Interviews were conducted with Donald Sahm, Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Project (EC&ACP) Post-Closure Lead, and Phil Carter, SRNS EC&ACP Post-Closure Lead, on August 26, 2021 at the O&M organization offices. No issues were identified during these interviews.

The TAOU was inspected by SRNS personnel on July 14, 2021. No issues were identified for the TAOU during this inspection.

A site inspection was conducted by SRNS EC&ACP and USDOE personnel on December 2, 2021. No issues were identified during this inspection.

~~A site inspection will be conducted by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control personnel, accompanied by USDOE and SRNS personnel, before submittal of the Revision 1 of this document.~~ A regulatory field inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) was held on March 28, 2022. During the meeting, the participants viewed drone video of each OU and were provided an opportunity to walk down the individual OUs. The USEPA and SCDHEC elected not to walk down the OUs because the drone video provided them better views of the OUs. No significant problems regarding the protection of the remedy for this OU as implemented are expected to be identified during the inspection.

Scheduled annual site inspections conducted from FY2017 through FY2021 identified minor erosion on slide slopes, active ant mounds, overgrown vegetation, bare spots, evidence of hog damage, cracked French drain clean out plug, and debris in drainage ditches. 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 review of documents, applicable or relevant and appropriate requirements (ARARs), risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD. The selected remedy of a low permeability geosynthetic cover in the industrial portion of the TAOU is effective in preventing exposure of human and ecological receptors to contaminants that exceed target risk levels and contaminants from leaching to groundwater and impacting groundwater above MCLs. Likewise, the selected remedy of placing soil amendments in the Outfall Delta/ Inner Swamp is effective in preventing exposure of human and ecological receptor to

contaminants that exceed target risk levels and contaminants from leaching to groundwater and impacting groundwater above MCLs.

The effective implementation of LUCs has prevented exposure to or ingestion of contaminated soils and ensuring the land use is restricted to industrial/industrial buffer zone use. LUCs include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the TAOU for industrial use only, and warning signs and site use restrictions via the SRS Site Use/Site Clearance Program for the TAOU. The Land Use Control Implementation Plan for TAOU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2006). All LUC objectives are being met.

O&M of the cover system has been effective. Activities that have been documented on the annual inspection reports for the timeframe 2017 through 2021 and documented corrective actions include installation of a new drainage system on the western slope of the cover system, treating of active ant mounds on the cover system and repair of thin vegetation spots on the cover system.

There were no opportunities for system optimization determined during this review.

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

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

As the remedial work has been completed, most action-specific ARARS cited in the ROD have been met. Well Construction Standards (SC R.61-71) will remain applicable if monitoring wells are installed, modified, or abandoned. If future activities are deemed necessary in the Outfall Delta/Inner Swamp, the location-specific ARARS will remain applicable as they focus on protection of floodplains and wetlands. The chemical specific ARARs must still be met and have been evaluated.

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

Fact sheets provided on the USEPA webpage (https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern) regarding emerging contaminants were reviewed for applicability to this site. This webpage provides a link to specific fact sheets for each of the following contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs) and tungsten. None of the listed emerging contaminants, except for 1,4-dixoane, were identified as applicable to this OU.

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

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

VIII. Issues

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

IX. Recommendation and Follow-up Action

There are no recommendations or follow-up actions for the TAOU.

X. Protectiveness Statement(s)

The remedy at TAOU 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 media. All threats to contaminated soil at the TAOU have been addressed through excavation, removal, and the backfilling of excavated areas along with the installation of a final geosynthetic cover in the industrial section, addition of soil amendments to the Outfall Delta/Inner Swamp, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the TAOU 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 Geosynthetic or Stabilization/Solidification Cover Systems is scheduled for January 2028.

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, 2018. *2017 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U)*, SRNS-RP-2018-00573, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2019. *2018 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U)*, SRNS-RP-2019-00391, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2020. *2019 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U)*, SRNS-RP-2020-00328, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2021. *2020 Annual Comprehensive TNX Area Groundwater Monitoring and Remedial Action Effectiveness Interim Report (U)*, SRNS-RP-2021-03858, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

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

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

WSRC, 2005a. *X-001 for Outfall Drainage Ditch OU, NBN (U) Removal Action Reports*, Revision 0, WSRC-RP-2005-4010, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005b. *Record of Decision Remedial Alternative Selection for the T-Area Operable Unit,* WSRC-RP-2004-4070, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005c. *Corrective Measure Implementation/Remedial Action Implementation Plan (CMI/RAIP) for the T-Area Operable Unit (U)*, WSRC-RP-2005-4003, Revision1, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2006. *Land Use Control Implementation Plan (LUCIP) for T Area Operable Unit (U)*, WSRC-RP-2005-4029, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC.

WSRC, 2007. *Post-Construction Report for T-Area Operable Unit* (U), Revision 1, WSRC-RP-2006-4005, Washington Savannah River Company, Savannah River Site, Aiken, SC (includes the *Removal Action Report for TNX Outfall Delta, Lower Discharge Gully and Swamp OU* and *Removal Action Report for T-Area Tile Field #2, NBN*)

Various - *Inspection Data Sheets – Field Inspection Checklist, T-Area Operable Unit (TAOU) (U)*, ER-IDS-019-032, Inspection period: 2017 through 2021 (annually)

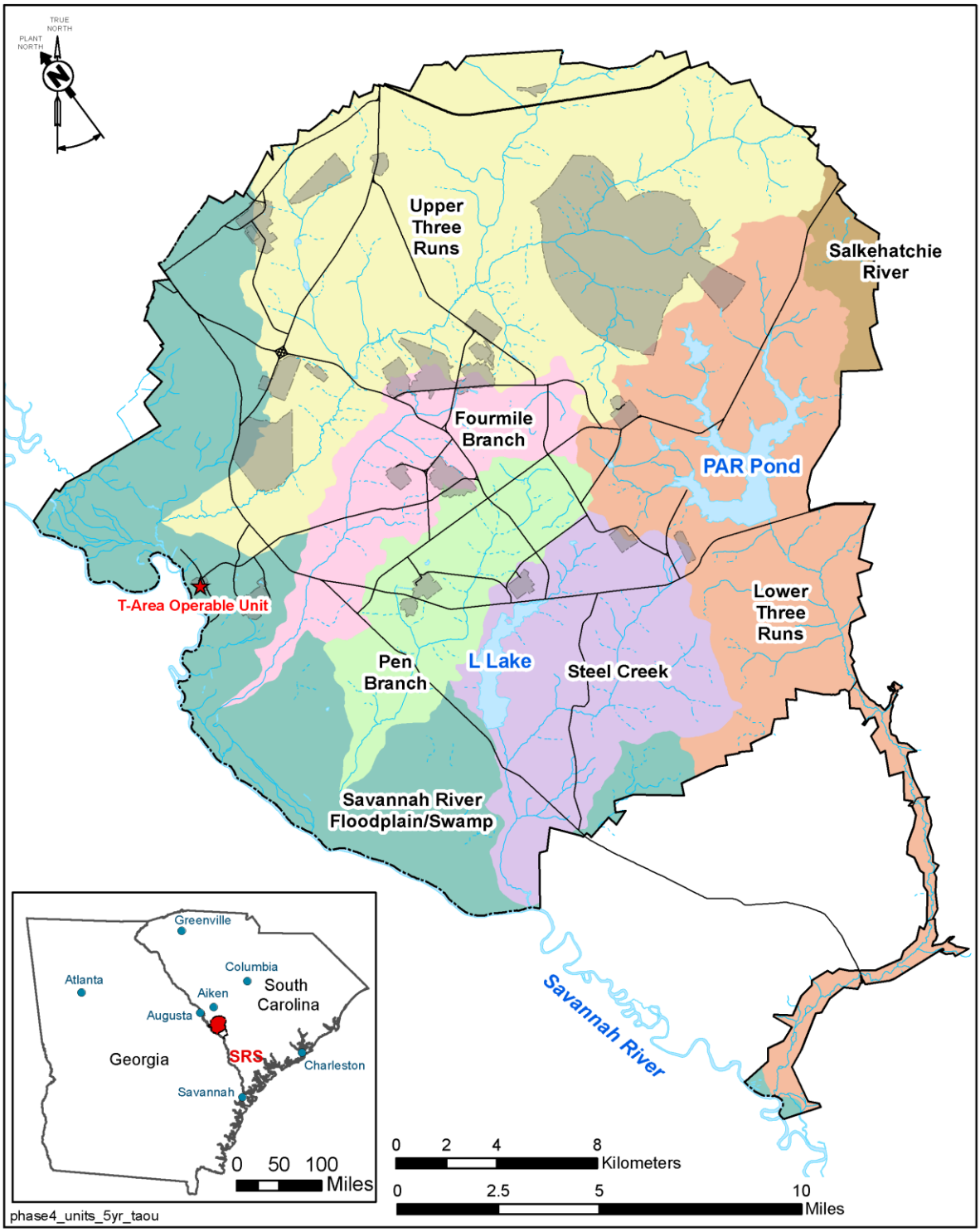

Figure R-1. Location of T Area OU at SRS

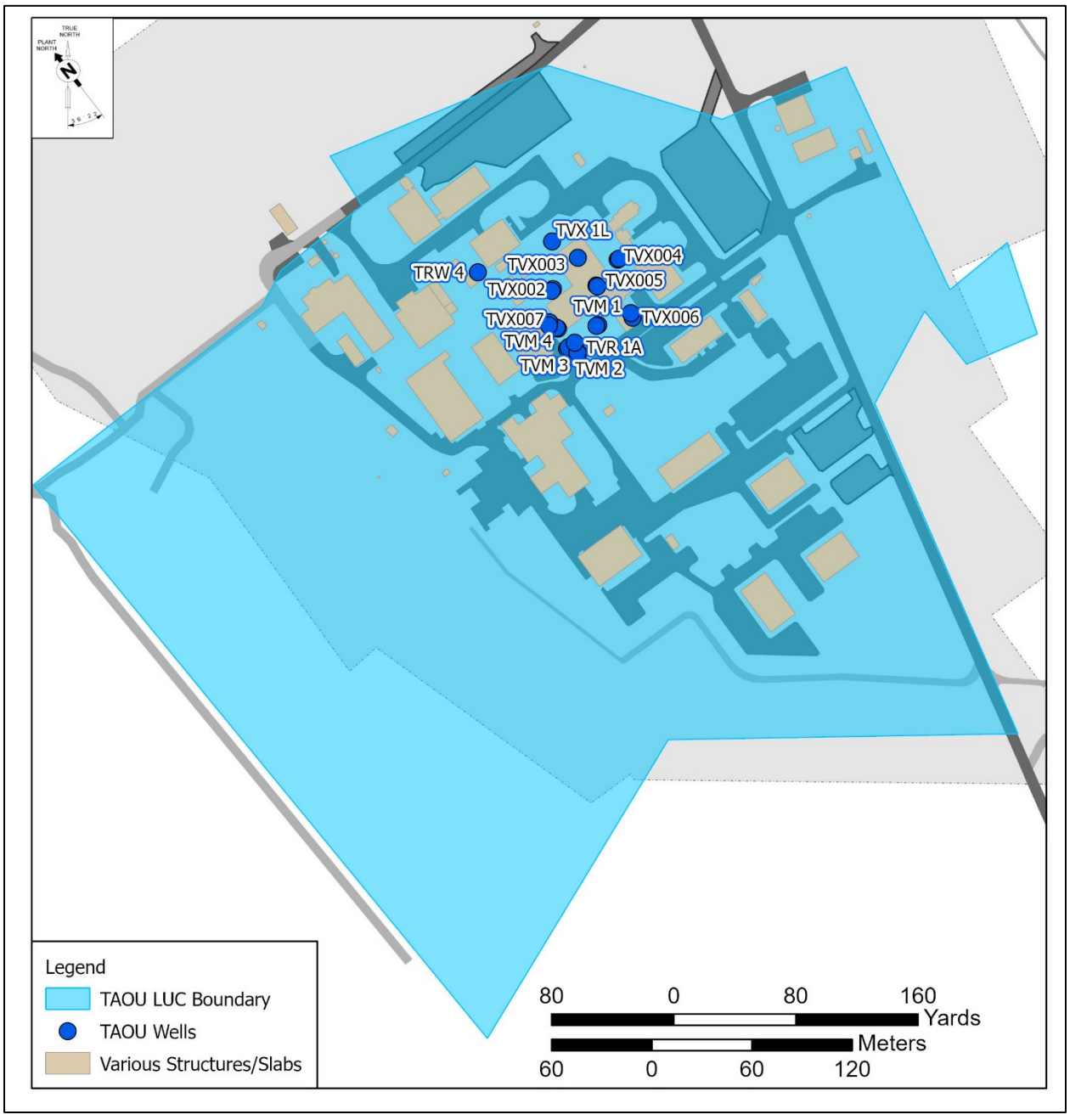

Figure R-2. T-Area Operable Unit ~~Pre-Remedial Action Site Plan~~

Attachment R-1. Five-Year Review Site Inspection Checklist – T-Area 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: Groundwater monitoring to confirm the soil cover effectiveness for the TAOU is addressed as part of the TNX OU. Review of groundwater monitoring records under the TNX OU are reported in the Five-Year Remedy Review Report for SRS OUs with Operating Equipment.

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

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: ______

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

A. Fencing

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

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

B. Signs

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

Remarks: Signs are in good condition.

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

VII. LANDFILL COVER/CONTAINMENT *(Continued)*

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

1. Gas Vents: ☐ Active ☐ Passive

- ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
- ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks:_____

2. Gas Monitoring Probes:

- ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
- ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks:_____

3. Monitoring Wells:

- ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
- ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: All monitoring wells penetrating the TAOU cover are associated with the TNX OU. Review of groundwater monitoring records under the TNX OU are reported in the Five-Year Remedy Review Report for SRS OUs with Operating Equipment.

4. Leachate Extraction Wells:

- ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
- ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks:_____

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☒ N/A

Remarks:_____

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

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
~~**Cover Penetrations**~~ ☒ ~~Applicable~~ ☐ ~~N/A~~
~~**6. Gas Vents:**~~ ☐ ~~Active~~ ☐ ~~Passive~~ ~~☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition~~ ~~☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A~~ ~~Remarks:~~
~~**7. Gas Monitoring Probes:**~~ ~~☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition~~ ~~☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A~~ ~~Remarks:~~
~~**8. Monitoring Wells:**~~ ~~☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition~~ ~~☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A~~ ~~Remarks:~~
~~**9. Leachate Extraction Wells:**~~ ~~☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition~~ ~~☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A~~ ~~Remarks:~~
~~**10. Settlement Monuments:**~~ ☐ ~~Located~~ ☐ ~~Routinely Surveyed~~ ☒ ~~N/A~~ ~~Remarks:~~
E. Gas Collection and Treatment ☐ Applicable ☒ N/A
F. Cover Drainage Layer ☐ Applicable ☒ N/A