United States Department of Energy

Savannah River Site

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SITE ASSESSMENT, REMEDIATION & REVITALIZATION

Fourth Five-Year Remedy Review Report for the Savannah River Site Aiken, South Carolina

SRNS-RP-2012-00011

Revision 1.1

Volume I

November 2013

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EXECUTIVE SUMMARY

This document presents the results of a technical evaluation of fifty-two (52) environmental remedies implemented at Savannah River Site (SRS). The remedies are evaluated to determine whether they are functioning as designed and whether they are protective of human health and the environment. This evaluation is required under Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). CERCLA requires that remedial actions which result in any hazardous substances, pollutants, or contaminant remaining at the site be subject to a remedy review every five years.

According to the data reviewed and the site inspections, the remedies implemented at SRS are functioning as intended. The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection are still valid for all of the remedial actions evaluated. No new information has come to light that calls into question the protectiveness of any of the remedies.

The remedies at SRS are protective of human health and the environment. For 50 of the 52 remedies evaluated in this Five Year Remedy Review, the remedies have been determined to be protective of human health and the environment. For two remedies, A/M Area Groundwater Operable Unit (OU) and the C-, K-, and L-Reactor Complexes, the remedies have been determined to be protective in the short-term. Remedies for A/M Area Groundwater OU are being implemented in compliance with the SRS Resource Conservation and Recovery Act (RCRA) permit. This report includes a recommendation to continue optimize remedial actions at the A/M Area Groundwater OU under the RCRA permit. The selected early action remedy chosen for the final end-state decision for the C-, K-, and L-Reactor Complexes is In Situ Decommissioning with land use controls. This remedy was determined to be protective in the short-term because the selected remedy component currently being implemented is land use controls, but the remainder of the remedy to implement In Situ Decommissioning will be completed upon closure of the C-, K-, and L-Reactor Complexes.

This report presents issues and recommendations that have resulted from the remedy review. Recommendations include:

- SRS recommends that future Five Year Remedy Review documents be developed separately for each individual operable unit or grouped in logical sets (e.g., by area, by media, remedy similarity, etc.) and submitted separately for regulatory review on a mutually agreeable schedule. A schedule that spreads the document submittal milestones over multiple years would allow for better use of available resources.
- SRS recommends that the cover inspection frequency for ten OUs be reduced to annual. This reduction would provide adequate monitoring and consistency, since the majority of OU covers are currently inspected annually. SRS intends to propose these changes in a letter from USDOE to USEPA and SCDHEC.
- SRS recommends optimization of groundwater monitoring and reporting at some OUs. These recommendations are consistent with the results of the SRS Groundwater Monitoring Optimization Report (SRNS 2012b). These recommendations will be proposed in operable unit specific regulatory documents.
- SRS recommends monitoring for 1,4-dioxane at six OUs where 1,4-dioxane is a potential contaminant based on its associated with other solvents present. SRS will report the results in the appropriate OU-specific groundwater monitoring reports. Based on the results, the USEPA, SCDHEC, and USDOE will determine whether or not 1,4-dioxane should be permanently added to the list of monitored constituents for the six OUs.
- SRS recommends reevaluation of the installation and maintenance activities for stormwater runoff covers for the E-Area LLWF. Further discussion with USEPA and SCDHEC of how these issues impact future covers is needed.
- The L-Area Hot Shop OU has reached the remedial goals for unrestricted land use, and SRS recommends that LUCs are no longer necessary and the site can be categorized as a No Action site.
- Enhanced bioremediation has been demonstrated to be successful in a Treatability Study. SRS recommends incorporating bioremediation (i.e., edible oil injection) into the remedy for the TNX Area OU.

- SRS recommends that groundwater remediation activities at the A/M Area Groundwater OU be evaluated and a strategy for optimization of plume capture and/or treatment be developed. SRS intends to propose future changes in revisions to the RCRA Post Closure Permit Application.

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Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Savannah River Site		
EPA ID: SC1890008989		
Region: 4	**State:** SC	**City/County:** Aiken/Aiken
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** US Department of Energy		
Author name (Federal or State Project Manager): N/A		
Author affiliation: Savannah River Nuclear Solutions, LLC		
Review period: April 17, 2012 – January 21, 2014		
Date of site inspection: July 2012 to September 2012		
Type of review: Statutory		
Review number: 4		
Triggering action date: January 21, 2009		
Due date *(five years after triggering action date)*: January 21, 2014		

Five-Year Review Summary Form (continued)

<table>
<tr><th colspan="5">Issues/Recommendations</th></tr>
<tr><td colspan="5">OU(s) without Issues/Recommendations Identified in the Five-Year Review:</td></tr>
<tr><td colspan="5">CERCLIS # 1, 2, 6, 7, 15, 19, 22, 27, 28, 30, 31, 33, 35, 38, 47, 50, 53, 55, 56, 58, 60, 63, 65, 67, 78, 79, 82, 90, 91, 92, 94, 96</td></tr>
<tr><td colspan="5">Issues and Recommendations Identified in the Five-Year Review:</td></tr>
<tr><td rowspan="3">OU(s): General</td><td colspan="4">Issue Category: No Issue/General Recommendation</td></tr>
<tr><td colspan="4">Issue: Implementation of a Five Year Remedy Review that includes a technical evaluation of 52 separate OUs in a single effort places a strain on resources and produces an unwieldy document.</td></tr>
<tr><td colspan="4">Recommendation: Prepare and submit Five Year Remedy Review documents for individual OUs separately on a staggered schedule.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Affect Current Protectiveness</td></tr>
<tr><td>No</td><td>No</td><td>Federal Facility</td><td>EPA/SCDHEC</td><td>No</td></tr>
<tr><td rowspan="3">OU(s): CERCLIS # 13,14, 16, 17, 20, 23, 26, 32, 39, 66</td><td colspan="4">Issue Category: Operations and Maintenance</td></tr>
<tr><td colspan="4">Issue: OU inspections are implemented more frequently than is warranted to ensure protectiveness.</td></tr>
<tr><td colspan="4">Recommendation: SRS recommends that the cover inspection frequency for ten OUs be decreased to once per year.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>No</td><td>Federal Facility</td><td>EPA/SCDHEC</td><td>2015</td></tr>
<tr><td rowspan="3">OU(s): CERCLIS # 8, 9, 25, 43, 77</td><td colspan="4">Issue Category: Monitoring</td></tr>
<tr><td colspan="4">Issue: Groundwater monitoring at some OUs is being implemented more frequently or with greater thoroughness than is warranted to collect adequate data to assess protectiveness.</td></tr>
<tr><td colspan="4">Recommendation: SRS recommends optimization of groundwater monitoring and reporting at selected OUs.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>No</td><td>Federal Facility</td><td>EPA/SCDHEC</td><td>2018</td></tr>
</table>

Five-Year Review Summary Form (continued)

Issues/Recommendations				
Issues and Recommendations Identified in the Five-Year Review *(Continued)*:				
OU(s): CERCLIS # 21,24, 29, 40, 59, 95	**Issue Category:** Monitoring			
	Issue: 1,4-Dioxane has been identified as a potential contaminant based on its association with other solvents that are present at six OUs. However, there is a lack of groundwater data to dismiss 1,4-dioxane as being present at levels which would be harmful to human health or the environment.			
	Recommendation: 1,4-Dioxane will be monitored and reported as detailed in the six OU remedy review reports. Based on the monitoring results, the USEPA, SCDHEC, and USDOE will determine whether or not 1,4-dioxane should be permanently added to the list of monitored constituents.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
FFA	No	Federal Facility	EPA/SCDHEC	2014
OU(s): CERCLIS # 86	**Issue Category:** Operations and Maintenance			
	Issue: Interim storm water runoff covers at the E-Area LLWF slit trench disposal units are showing signs of wear that are likely to result in higher than anticipated maintenance costs and installation modifications for new covers in the future.			
	Recommendation: Reevaluate the installation and maintenance activities for stormwater runoff covers. Further discussion of how these issues impact future covers is needed with USEPA/ SCDHEC.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	EPA/SCDHEC	2013
OU(s): CERCLIS # 76	**Issue Category:** No Issue			
	Issue: Land Use Controls are no longer needed as remedial goals for unrestricted land use have been achieved.			
	Recommendation: Remove land use control requirements at the LAHS OU after approval from USEPA and SCDHEC and identify as a No Action site. Eliminate future Five Year Remedy Reviews for this OU.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	EPA/SCDHEC	2014

Five-Year Review Summary Form (continued)

Issues/Recommendations				
Issues and Recommendations Identified in the Five-Year Review *(Continued)*:				
OU(s): CERCLIS # 21,29	**Issue Category:** No Issue			
	Issue: Enhanced bioremediation (i.e., edible oil injection) have demonstrated in a treatability study to successfully reduce the concentration and extent of volatile organic compounds in TNX Area OU groundwater.			
	Recommendation: Modify the selected remedy in the Record of Decision to incorporate enhanced bioremediation into the remedy via an Explanation of Significant Differences.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	EPA/SCDHEC	2013
OU(s): CERCLIS # 36	**Issue Category:** O&M			
	Issue: After successfully reducing VOC concentrations in the main source area of the plume, the highest dissolved concentrations of VOCs currently are located outside of the zone of capture of the recovery system.			
	Recommendation: Optimize the M-1 Air Stripper recovery system and/or consider other remediation technologies to treat this high concentration area.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/SCDHEC	2017

Five-Year Review Summary Form (continued)

Protectiveness Statement(s)		
Operable Unit: A-AREA BURNING/RUBBLE PITS (731-A/1A) AND RUBBLE PIT (731-2A), MISCELLANEOUS CHEMICAL BASIN (731-4A) AND METALS BURNING PIT (731-5A), CERCLIS #28	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the ABRP/MCB/MBP OU is protective of human health and the environment.		
Operable Unit: A-AREA MISCELLANEOUS RUBBLE PILE (731-6A), CERCLIS #30	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the ARP OU is protective of human health and the environment		
Operable Unit: A/M AREA GROUNDWATER, CERCLIS #36	*Protectiveness Determination:* Short-Term Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the A/M Area Groundwater OU currently protects human health and the environment because groundwater removal and treatment, in situ treatment, and contaminant source treatment have been successful in removing VOC contamination in groundwater, and by implementing Land Use Controls to prevent exposure. However, in order for the remedy to be protective in the long term, optimization of the M-1 Air Stripper recovery system and/or other remediation technologies must be implemented to treat the high concentration part of the plume located outside of the recovery well zone of capture.		
Operable Unit: C-AREA BURNING/RUBBLE PIT (131-C), CERCLIS #31	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the CBRP OU is protective of human health and the environment		
Operable Unit: C-AREA GROUNDWATER OU, CERCLIS #82	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the CAGW OU is protective of human health and the environment		
Operable Unit: C-AREA REACTOR SEEPAGE BASINS (904-66G, -68G), CERCLIS #60	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A

Five-Year Review Summary Form (continued)

Protectiveness Statement(s) *(continued)*		
Protectiveness Statement: The remedy at the CRSB OU is protective of human health and the environment		
Operable Unit: C-, K-, L-, AND R-REACTOR COMPLEXES, CERCLIS # 79,90, 91,95	*Protectiveness Determination:* Short-Term Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the C-, K-, and L-Reactor Complexes is protective of human health and the environment by implementing Land Use Controls to prevent exposure. However, in order for the remedy to be protective in the long-term, the remainder of the remedy in the EAROD to implement In Situ Decommissioning for the Reactor Building Complexes must be completed.		
Operable Unit: CENTRAL SHOPS BURNING RUBBLE PITS (631-1G AND 631-3G), CERCLIS #50	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the CSBRP OU is protective of human health and the environment		
Operable Unit: CHEMICALS, METALS, AND PESTICIDES PIT (080-170G, -171G, -180G, -181G, -182G, -183G, -190G), CERCLIS # 24	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the CMP Pits OU is protective of human health and the environment		
Operable Unit: D-AREA BURNING/RUBBLE PITS (431-D, -1D), CERCLIS #15	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the DBRP OU is protective of human health and the environment		
Operable Unit: D-AREA EXPANDED OPERABLE UNIT CONSISTING OF D-AREA ASH BASIN (488-D) AND D-AREA RUBBLE PIT (431-2D), CERCLIS #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: D-AREA OIL SEEPAGE BASIN (631-G), CERCLIS #27	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the DOSB OU is protective of human health and the environment		

Five-Year Review Summary Form (continued)

Protectiveness Statement(s) *(continued)*		
Operable Unit: D-AREA OPERABLE UNIT, CERCLIS #63	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the DAOU OU is protective of human health and the environment		
Operable Unit: E-AREA LOW-LEVEL WASTE FACILITY (643-26E), #86	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the E-Area LLWF (643-26E) is protective of human health and the environment		
Operable Unit: EARLY CONSTRUCTION AND OPERATIONAL DISPOSAL SITE (ECODS) L-1, N-2, P-2, and R-1A, -1B, -1C, CERCLIS #22	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the ECODs L-1, N-2, P-2, and R-1A, -2A, -1C OU is protective of human health and the environment		
Operable Unit: F-AREA BURNING/RUBBLE PITS (231-F, 231-1F, AND 231-2F), CERCLIS #14	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the FBRP OU is protective of human health and the environment		
Operable Unit: F-AREA GROUNDWATER OPERABLE UNIT (904-41G, -42G, -43G), CERCLIS #8	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the FAGW OU is protective of human health and the environment		
Operable Unit: F-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-41G, -42G, -43G), CERCLIS #6	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the FHWMF OU is protective of human health and the environment		
Operable Unit: F-AREA RETENTION BASIN (281-3F), CERCLIS #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		

Five-Year Review Summary Form (continued)

Protectiveness Statement(s) *(continued)*		
Operable Unit: FORD BUILDING SEEPAGE BASIN (904-91G), CERCLIS #58	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the FBSB OU is protective of human health and the environment		
Operable Unit: GENERAL SEPARATIONS AREA CONSOLIDATION UNIT INCLUDING OLD RADIOACTIVE WASTE BURIAL GROUND (643-E) AND OLD SOLVENT TANKS (650-1E THROUGH 650-22E), CERCLIS #32	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the GSACU OU is protective of human health and the environment		
Operable Unit: GUNSITE 012 (INCLUDING ECODS G-3), CERCLIS #78	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the Gunsite 012 OU is protective of human health and the environment		
Operable Unit: H-AREA GROUNDWATER OU (904-44G, -45G, -45G, -56G), CERCLIS #9	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement:		
Operable Unit: H-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-44G, -45G, -46G, -56G), CERCLIS #7	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the HHWMF OU is protective of human health and the environment		
Operable Unit: HEAVY EQUIPMENT WASH BASIN (NBN) AND CENTRAL SHOPS BURNING/RUBBLE PIT (631-5G), CERCLIS #53	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the HEWB/CSBRP OU is protective of human health and the environment.		
Operable Unit: K-AREA BINGHAM PUMP OUTAGE PIT (643-1G), #20	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the KBPOP OU is protective of human health and the environment		

Five-Year Review Summary Form (continued)

Protectiveness Statement(s) *(continued)*		
Operable Unit: K-AREA BURNING/RUBBLE PIT (131-K AND 631-20G), CERCLIS #40	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the KBRP OU is protective of human health and the environment		
Operable Unit: K-AREA REACTOR SEEPAGE BASIN (904-65G), CERCLIS #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 & P BINGHAM PUMP OUTAGE PITS (643-2G, 643-3G, 643-4G), CERCLIS #26, 39	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the L&P BPOP OU is protective of human health and the environment		
Operable Unit: L-AREA BURNING/RUBBLE PIT (131-L) & RUBBLE PILE (131-3L) & GAS CYLINDER DISPOSAL FACILITY (131-2L), CERCLIS #56	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at LBRP/LRP/GCDF OU is protective of human health and the environment		
Operable Unit: L-AREA HOT SHOP (707-G, 712-G, 717-G), CERCLIS #76	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the LAHS OU is protective of human health and the environment		
Operable Unit: L-AREA OIL AND CHEMICAL BASIN (904-83G, -79G), CERCLIS #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 (904-64G, -67G), CERCLIS #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		

Five-Year Review Summary Form (continued)

Protectiveness Statement(s) *(continued)*		
Operable Unit: L-AREA SOUTHERN GROUNDWATER, CERCLIS #77	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the LASGW OU is protective of human health and the environment		
Operable Unit: M-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-51G, -112G), CERCLIS #1	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the MHWMF OU is protective of human health and the environment		
Operable Unit: M-AREA INACTIVE PROCESS SEWER LINE (081-M), CERCLIS #19	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the MIPSL OU is protective of human health and the environment		
Operable Unit: M-AREA OPERABLE UNIT, CERCLIS #92	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the MAOU is protective of human health and the environment		
Operable Unit: METALLURGICAL LABORATORY HAZARDOUS WASTE MANAGEMENT FACILITY (904-110G), CERCLIS #2	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the MHWMF OU is protective of human health and the environment		
Operable Unit: MIXED WASTE MANAGEMENT FACILITY (643-28E), CERCLIS #33	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the MWMF OU is protective of human health and the environment		
Operable Unit: OLD F-AREA SEEPAGE BASIN (904-49G), CERCLIS #16	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the OFSB OU is protective of human health and the environment		

Five-Year Review Summary Form (continued)

Protectiveness Statement(s) *(continued)*		
Operable Unit: PAR POND (685-G), CERCLIS #35	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at PAR Pond is protective of human health and the environment.		
Operable Unit: P-AREA BURNING/RUBBLE PIT (131-P), CERCLIS #59	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the PBRP OU is protective of human health and the environment		
Operable Unit: P-AREA OPERABLE UNIT, CERCLIS #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 BASIN (904-61G, 904-62G, 904-63G), CERCLIS #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 BINGHAM PUMP OUTAGE PITS (643-8G, 643-9G AND 643-10G) AND R-AREA UNKNOWN PITS #1, #2, AND #3, CERCLIs #38	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the RBPOP/RUNK OU is protective of human health and the environment		
Operable Unit: R-AREA BURNING/RUBBLE PITS (131-R, 131-1R) AND RUBBLE PILE (631-25G), CERCLIS #43	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the RBRP/RP OU is protective of human health and the environment		
Operable Unit: R-AREA OPERABLE UNIT, CERCLIS #95	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the RAOU is protective of human health and the environment		

Five-Year Review Summary Form (continued)

Protectiveness Statement(s) *(continued)*		
Operable Unit: R-AREA REACTOR SEEPAGE BASINS (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) AND 108-4R OVERFLOW BASIN, CERCLIS #25	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the RRSB OU is protective of human health and the environment		
Operable Unit: SILVERTON ROAD WASTE UNIT (731-3A), CERCLIS #13	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the Silverton Road OU is protective of human health and the environment		
Operable Unit: SRL SEEPAGE BASINS (904-53G1, -53G2, -54G, AND -55G), CERCLIS #47	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the SRL Seepage Basins OU is protective of human health and the environment		
Operable Unit: T-AREA OPERABLE UNIT, CERCLIS #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		
Operable Unit: TNX AREA OPERABLE UNIT, CERCLIS #21,29	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The remedy at the TNX Area OU is protective of human health and the environment		

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****-first time remedy review.***

LIST OF ACRONYMS AND ABBREVIATIONS

ABRP	A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A)
ARAR	applicable or relevant and appropriate requirement
ARP	A-Area Miscellaneous Rubble Pile
AS	air sparging
BaP	benzo(a)pyrene
b/g	beta/gamma
bgs	below ground surface
BRA	Baseline Risk Assessment
CBRP	C-Area Burning/Rubble Pit
CCAP	Conceptual Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
cfs	cubic feet per second
Ci	Curie
cm/sec and cm/s	centimeter per second
CMCOC	contaminant migration constituent of concern
CMI/RAIP	Corrective Measures Implementation/Remediation Action Implementation Plan
CMI/RAR	Corrective Measures Implementation/Remedial Action Report
CMI/RD/RDR/RAWP	Corrective Measures Implementation/Remedial Design/Remedial Design Report/Remedial Action Work Plan
CMP	Chemicals, Metals, and Pesticides
CMS/FS	Corrective Measures Study/Feasibility Study
COC	Constituent of concern
CPRB	Coal Pile Runoff Basin
CPT	cone penetrometer technology
CRSB	C-Area Reactor Seepage Basins (904-66G, -67G, -68G)
DAOU	D area Operable Unit
DBRP	D-Area Burning/Rubble Pits (431-D/1D)
DCE	Dichloroethylene
DCM	Dichloromethane
DDD	dichlorodiphenyl dichloroethane
DDE	dichlorodiphenyl dichloroethylene
DDT	dichlorodiphenyl trichloroethane
DNAPL	dense non-aqueous phase liquid
DOSB	D-Area Oil Seepage Basin (631-G)
dpm/ml	Disintegrations per minute per milliliter
DUS	Dynamic Underground Stripping
DWPF	Defense Waste Processing Facility
ECODS	Early Construction and Operational Disposal Site
ESD	Explanation of Significant Difference

FBRP	F-Area Burning/Rubble Pits
FFA	Federal Facility Agreement
FIP	FFA Implementation Plan
FIPSL	F-Area Inactive Process Sewer Line
FPIT	FFA Process Improvement Team
FRB	F-Area Retention Basin (281-3F)
FRR	Final Remedial Report
ft	Feet
ft^2	square feet
ft^3	cubic feet
gpm	gallons per minute
GPRA	Government Performance and Result Act
GWMZ	groundwater mixing zone
HGCA	hybrid groundwater corrective action
HI	hazard index
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendment
HWMF	Hazardous Waste Management Facility
IAPP	Interim Action Proposed Plan
IAROD	Interim Action Record of Decision
ICMI/RAIP	Interim Corrective Measures Implementation/Remedial Action Implementation Plan
IRA	interim remedial action
IRAO	interim remedial action objective
IRG	interim remedial goal
ISD	In Situ Decommissioning
KBPOP	K-Area Bingham Pump Outage Pit (643-1G)
KBRP	K-Area Burning/Rubble Pit (131-K)
km	Kilometer
KRP	K-Area Rubble Pile (631-20G)
LAACB	L-Area Acid/Caustic Basin (904-79G)
L&P BPOP	L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)
LAOCB	L-Area Oil and Chemical Basin (904-83G)
LLWDF	Low-Level Waste Disposal Facility
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan
m	Meter
m^3	cubic meter
MAOU	M Area Operable Unit
MCB/MBP	Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/5A)
MCL	maximum contaminant level
µg/kg	microgram per kilogram
µg/L	micrograms per liter
mg/L	milligrams per liter

mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
mR/hr	milliRoentgen-equivalent-man (REM) per hour
MWMF	Mixed Waste Management Facility (643-28E)
msl	mean sea level
MZCL	mixing zone concentration limit
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NTSB	New TNX Seepage Basin
O&M	operation & maintenance
OCDD	octachlorodibenzo-p-dioxin
OFASB	Old F-Area Seepage Basin
ORWBG	Old Radioactive Waste Burial Ground (643-E)
OST	Old Solvent Tank
OTSB	Old TNX Seepage Basin
OU	operable unit
PAH	Polycyclic aromatic hydrocarbon
PAOU	P Area Operable Unit
PAR	P and R
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene, perchloroethylene, tetrachloroethene
ρCi/g	pico curies per gram
ρCi/L	pico curies per liter
PCR	Post-Construction Report
ppb	parts per billion
ppm	parts per million
ppmv	parts per million vapor
PSVE	passive soil vapor extraction
PTSM	principal threat source material
RAO	remedial action objective
RAOU	R Area Operable Unit
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RDR/RAWP	Remedial Design Report/Remedial Action Work Plan
RFI	RCRA Facility Investigation
RG	remedial goal
RI	Remedial Investigation
RME	Reasonable maximum exposure
ROD	Record of Decision
RQ	result qualifier
RSER/WCP	Removal Site Evaluation Report/Wastewater Closure Plan
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control

SDWA	Safe Drinking Water Act
SRLSB	SRL Seepage Basins (904-53-G1, -53G2, -54G, and –55G)
SRS	Savannah River Site
SRNS	Savannah River Nuclear Solutions, LLC
SRWU	Silverton Road Waste Unit (731-3A)
S/S	stabilization/solidification
SVE	soil vapor extraction
TBC	to-be-considered
TBG	TNX Burying Ground
TCE	Trichloroethylene, trichloroethene
TNXGW	TNX Groundwater
TNXOD	TNX Outfall Delta
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
UTR	Upper Three Runs
VC	vinyl chloride
VOC	volatile organic compound
WSRC	Washington Savannah River Company, Limited Liability Company
WSRC	Westinghouse Savannah River Company
yd^3	cubic yards

SAVANNAH RIVER SITE SUMMARY

I. INTRODUCTION

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

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

(WSRC 1997). The Second Five-Year Remedy Review was issued in February 2004 (WSRC 2003), and the Third Five-Year Remedy Review was issued in February 2009 (WSRC 2008). The five-year trigger date for submittal of the next five-year remedy review report is the USEPA signature date of the previous report. The USEPA signed the Third Five-Year Remedy Review Report on January 21, 2009. Therefore, the Fourth Five-Year Remedy Review Report is due no later than January 21, 2014.

This report documents 52 remedy reviews for 56 USEPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) units at the SRS. The data evaluation and visual inspections were conducted from April 2012 through October 2012. This report documents the results of the remedy reviews and is the fourth Five-Year Remedy Review for the SRS. Table 1 identifies the OU name, CERCLIS number, remedial action, and Record of Decision (ROD) issuance date for each of the OUs reviewed in this document. The issuance date represents the date the public was notified that the signed decision document was available. Figure 1 identifies the location of each of those OUs.

This Fourth Five-Year Remedy Review Report addresses each OU that had an approved remedy decision as of July 1, 2012. This report was prepared using the *2001 Comprehensive Five-Year Review Guidance* (USEPA 2001) and is supplemented by the *Recommended Evaluation of Institutional Controls* (USEPA 2011) and *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA 2012). This report summarizes common elements for the entire SRS. The 52 OU-specific reviews are included as Appendix C through Appendix BBB.

II. SITE CHRONOLOGY

On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 United States Code Section 9620, the United States Department of Energy (USDOE) has

negotiated a Federal Facility Agreement (FFA) (FFA 1993) with the USEPA and the South Carolina Department of Health and Environmental Control (SCDHEC) to coordinate remedial activities at SRS into one comprehensive program which fulfills these dual regulatory requirements. USDOE functions as the lead agency for remedial activities at SRS, with concurrence by the USEPA - Region 4 and the SCDHEC.

A chronology of site events is included as Table 2. The effective dates for the Consent Decree, the FFA and the NPL Listing are provided in Appendix A. Chronologies of significant activities and regulatory milestones for individual OUs are included in the site specific remedy review reports (Appendix C through Appendix BBB).

III. BACKGROUND

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

Hazardous waste materials handled at SRS are managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities require SCDHEC operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from the SCDHEC, which was most recently renewed on September 30, 2003. Module VIII of the Hazardous and Solid Waste Amendments (HSWA) portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

Physical Characteristics

SRS occupies approximately 310 mi^2 of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 40 km (25 mi) southeast of Augusta, Georgia, and 32 km (20 mi) south of

Aiken, South Carolina. Approximately 90 percent of SRS land consists of natural and managed forests. The locations at SRS where nuclear materials were produced, stored, and disposed are clustered into distinct industrial areas that are separated by large areas of forest. OUs are generally contained within or adjacent to these industrial areas.

SRS is located on the Atlantic Coastal Plain. Subsurface and groundwater contamination associated with OUs is located in unconsolidated sands and clays. The depth to the water table at SRS varies from just below the surface in wetlands and near streams to approximately 39 m (130 ft) below ground surface (bgs). Recharge to the aquifers underlying the SRS is primarily through rainfall. Groundwater flows toward and discharges into site streams and the floodplain of the Savannah River.

Land and Resource Use

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

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

SRS manages its own drinking and process water supply from groundwater located beneath the SRS. SRS domestic and process water systems are supplied from a network of approximately 40 wells in widely scattered locations across the site, of which 8 wells supply the primary drinking water system. Virtually all site process and drinking water is pumped from the deeper Crouch Branch and McQueen Branch aquifers. The SRS domestic water systems meet state and federal drinking water standards. There is no current or projected future use of surface water or shallow aquifer groundwater as a drinking water source at the SRS.

History of Contamination

During the early 1950s, SRS began to produce materials used in nuclear weapons, primarily tritium, plutonium-239, and other special nuclear materials for national defense

and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases disposed of at SRS. Hazardous substances, as defined by the CERCLA (CERCLA 2012), are currently present in the environment at SRS, with past disposal practices resulting in soil and groundwater contamination.

Initial Response

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

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

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

During the period from April 2009 – September 2012 funds for accelerated environmental clean-up became available as part of the national economic stimulus package authorized by the American Reinvestment and Recovery Act (ARRA). To take advantage of this additional funding, environmental clean-up under CERCLA was expedited by performing removal actions at a number of OUs using the administrative

vehicle of Removal Site Evaluation Report/Engineering Evaluations/Cost Analysis (RSER/EE/CAs). Early action remedial decisions were also implemented under ARRA.

Table 1 provides a summary of the remedial actions implemented to date at SRS OUs. Remedial actions include final actions, removal actions, and remedial actions conducted prior to a final Record of Decision (ROD). The remedial actions at individual OUs have been evaluated independently and site-specific details are included in Appendix C through Appendix BBB.

Basis for Taking Action

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

Groundwater contaminant plumes associated with OUs cover approximately 5000 acres of the SRS. The lateral extent of these plumes is indicated on Figure 2. The primary contaminants in groundwater are volatile organic compounds (VOCs) and tritium. Strontium-90, iodine-129, and metals are present in groundwater above drinking water standards to a lesser extent. VOCs are present in the vadose zone between the source unit and the groundwater and act as a secondary source of contamination to the groundwater at a number of units.

Surface water has been impacted by the discharge of contaminated groundwater to site streams. Tritium concentrations exceed primary drinking water standards in site streams, but concentrations are below standards at the Savannah River downstream of SRS.

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. Fifty-two (52) remedial decisions have been implemented at these OUs to address soil and groundwater contamination. Each OU is unique with respect to size, location, environmental factors, and contaminant type. The specific contaminants and

remedial actions for each OU are described in greater detail in the OU-specific appendices.

IV. REMEDIAL ACTIONS

A summary of remedial actions taken at the SRS is provided in Table 1. Remedial actions may target source areas, soil, vadose zone, and/or groundwater. Site specific details are provided in Appendix C through Appendix BBB. Remedial goals are defined for individual OUs, but in general remedial action objectives at SRS are:

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

Source Units

Protective cover systems are in place at many OUs at SRS. Cover systems vary in design and are often coupled with another remedy. In general, cover systems protect against human or ecosystem exposure to waste or contaminated material left in place. In addition, many of the cover systems are designed to protect groundwater by minimizing the infiltration of rainwater through the contaminated material left in place. In some cases, radioactively contaminated soils have been stabilized with in-situ grouting and then covered with low permeability covers to deter migration of contaminants to the groundwater. Cover systems are often paired with Soil Vapor Extraction (SVE) units that remove VOCs from the subsurface soil beneath the OU before they can migrate into the groundwater.

Other source area remedies have been implemented at SRS. Contaminated soils and rubble have been excavated at some OUs. Much of the excavated material has been consolidated at OUs on SRS or disposed of at the SRS Burial Ground Complex. Some excavated soils and debris have been shipped offsite for treatment and/or disposal at approved facilities. In-situ treatment by thermal or bioremediation technologies has also been applied to contaminated surface soils and rubble. In many cases, these source remedies have been used in conjunction with protective cover systems.

Groundwater

SRS uses a graded approach to groundwater remediation. The selection of groundwater remediation technologies for a specific contamination area is based on the size, contaminant type, contaminant concentration, and configuration of the plume. These attributes are the result of the nature and mass of the source of contamination and the subsurface characteristics in the area of the plume. A schematic diagram of a generic plume is shown in Figure 3. Many large plumes consist of several zones that are most efficiently addressed with separate complementary corrective action/remedial technologies. The highest concentrations of contaminants are found in the source zone. The most robust, high-mass-removal technologies are best suited for remediation of the source zone. In the primary plume zone, active remedies such as pump-and-treat may be necessary to remove contaminants and exert hydraulic control of the plume. In the dilute fringe zone, contaminants are generally low in concentration and can often be treated with passive techniques.

Aggressive active groundwater remediation technologies remove or immobilize sources and lower contaminant concentrations in plumes. As remediation projects mature and the bulk of contaminants are removed, it is most efficient to transition from robust active systems to passive, low-energy-consumption, low-carbon-emission technologies. The active systems are terminated and replaced with passive and enhanced-passive technologies. Ultimately, when final remedial goals have been met, the groundwater remediation systems can be permanently terminated. SRS has groundwater remediation projects in all phases of remediation.

Active Remediation Systems

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

Enhanced-Passive Systems

Enhanced-passive remedial systems are used extensively at SRS. These are low-energy-consumption, low-carbon-emission systems that are not completely passive. These "green" technologies leverage natural systems to protect and remediate groundwater.

Many existing SVE systems have been converted from active vacuum extraction powered by fossil fuel to enhanced-passive systems powered by natural non-fossil-fuel energy sources. BaroBall™ and MicroBlower™ systems are two types of enhanced-passive SVE currently in operation at SRS. BaroBalls™ rely on natural fluctuations in barometric pressure to pump VOCs from the subsurface to the atmosphere at individual SVE wells. SVE wells with MicroBlowers™ are designed to use solar power to generate a vacuum that exhausts VOC vapors from individual wells. Both MicroBlowers™ and Baroballs™ are low-energy-consumption, low-carbon-emission devices that remove VOC contaminants from the subsurface.

Barrier walls are used to provide a passive measure of hydraulic control over plumes without pumping. The groundwater barrier wall channels groundwater flow towards base injection zones in a funnel-and-gate configuration implementing *in situ* remediation.

Phytoremediation is in use as an enhanced-passive system. Tritium-contaminated groundwater is collected and controlled as it discharges to a dam/pond system. Water

from the pond is used to irrigate naturally-occurring pine forest. The trees take up the tritium-contaminated water through their roots and release tritium vapor into the atmosphere where it is safely diluted to miniscule concentrations in air. This semi-passive system makes use of natural processes of hydrology and evapotranspiration to reduce the amount of tritium-contaminated groundwater entering site streams and the Savannah River.

Subsurface injection systems are considered enhanced-passive systems when single or infrequent campaigns of injection are planned to modify geochemical conditions to enhance natural processes that result in remediation. Edible oil has also been injected into the subsurface to encourage microbiological activity that consumes VOCs; and silver chloride is being injected into an aquifer to stimulate geochemical reactions that will bind and immobilize iodine-129.

Passive Systems

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

Land Use Controls

Land use controls (LUCs) are maintained for all OUs where hazardous substances, pollutants, or contaminants remain on-site or have been left in place above levels that are

acceptable for unlimited use and unrestricted exposure. LUCs are institutional controls (i.e., administrative controls) and engineering controls and can include monitoring, maintenance, reporting, access restrictions, signage, fencing, and land use restrictions. In older SRS remedy documents, the term "institutional controls" was often used to refer to LUCs.

In the long term, if any SRS property containing LUCs is ever transferred from USDOE, the U.S. Government and/or USDOE will take those actions necessary pursuant to Section 120(h)(1) of CERCLA to include any contract, deed, or other transfer document, notice of the type and quantity of any hazardous substances that were known to have been stored (for more than one year), released, or disposed of on the property. The notice will also include the time at which the storage, release, or disposal took place to the extent such information is available. In addition, if the property, or any portion thereof, is ever transferred by deed, the U.S. Government will also satisfy the requirements of CERCLA 120(h)(3) to include a description of the remedial action taken, a covenant, and an access clause.

Systems Operation and Maintenance

A site-wide maintenance program is in place to care for closure caps, signs, monitoring wells, and other infrastructure associated with environmental remediation. Operation and maintenance (O&M) of cover systems consist of growing grass, mowing, managing surface storm water drainage, inspections, and repair of erosion or subsidence as necessary. Depending on site specific requirements, groundwater monitoring and fence maintenance may be performed. Groundwater monitoring networks require maintenance. Identifying signs must remain legible, and locks and well covers must be operational. Access to the wells must be maintained. Pumps and fittings periodically require repair or replacement, and sometimes wells are refurbished, redeveloped or abandoned.

Operating facilities (i.e., air strippers, recovery well systems, soil vapor extraction units, water treatment facilities) and passive remedial systems have varying site-specific requirements for O&M. An operations organization with trained and qualified personnel

manages the day-to-day activities at operating facilities. Environmental sampling, equipment operation, maintenance, and monitoring are among their responsibilities.

Groundwater monitoring is an important component of O&M at SRS. Groundwater monitoring includes installing monitoring wells, collecting water samples, analysis of samples at laboratories, data management, data interpretation, and document production. Groundwater monitoring reports are produced and submitted to USEPA and SCDHEC for individual OUs where monitoring and reporting are required.

The costs of the O&M activities for individual OUs have been compiled as part of this Five Year Remedy Review. As part of the process of selecting the most appropriate action for each unit, the cost of implementing each of the remedies was estimated and reported in the ROD. The actual costs incurred at each unit over the time period from FY07 to FY11 are compared to the estimated costs from the RODs in Table 3. Site-specific details concerning costs incurred are included for each unit in Appendix C through Appendix BBB.

In general, the actual costs of O&M activities for closure caps are less than originally estimated, and the costs associated with groundwater monitoring are higher than originally estimated. Improved designs and cap technologies have resulted in better than expected cost performance on closure cap O&M. Instituting a site-wide maintenance program for caps has also contributed to lower actual O&M costs. Groundwater monitoring activities, however, warrant closer scrutiny to manage costs in the future.

V. PROGRESS SINCE LAST REVIEW

The previous protectiveness statement from the Third Five-Year Remedy Review (WSRC 2008) concluded that the 45 remedial decisions were found to be either protective or expected to be protective. Seven OUs had interim actions. Three OUs were under construction at the time of the review and a definitive protectiveness statement could not be made. However, exposure pathways that could lead to unacceptable risk were controlled though interim actions and LUCs.

Recommendations from the Third Five-Year Remedy Review were incorporated into the fourth five-year remedy review as follows:

- Photographs of the OUs before the remedial action start (if available) and the current condition were included in each OU-specific review;
- Brief summary of issues and recommendations from periodic regulatory monitoring reports were documented for applicable OUs;
- Comparison of remedial goals to the current regulatory goals was conducted; and
- Maps and figures where remediation is ongoing, including the most recent plume maps, were presented as appropriate.

Since the Third Five-Year Remedy Review (WSRC 2008), nine new remedial action decision documents in the form of RODs or early action RODs (EARODs) have been issued for the following:

- C-, K-, L-, And R-Reactor Complexes;
- D-Area Operable Unit (DAOU);
- E-Area Low-Level Waste Facility (LLWF);
- Early Construction And Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, R -1B, R -1C Operable Unit;
- Gunsite 012 Operable Unit (Including ECODS G-3);
- M-Area Operable Unit (MAOU);
- PAR Pond Operable Unit- Lower Three Runs Integrator Operable Unit (Middle and Lower Tail Portions)
- P-Area Operable Unit (PAOU); and
- R-Area Operable Unit (RAOU).

In addition, it was determined that a remedy review was no longer needed for the C-, F-, K-, and P-Area Coal Pile Runoff Basins (CPRB) OU (CERCLIS # 41,42,52, 54). The

selected remedy for this OU was No Further Action with a five-year period of confirmatory groundwater monitoring at the K-Area CPRB. In the 2005-2006 time periods, USEPA and SCDHEC agreed to discontinue groundwater monitoring at the K-Area CPRB. The three agencies concurred in September 2012 that a remedy review was no longer needed for this OU and it was moved to the list of No Action OUs (Table A4).

VI. FIVE-YEAR REMEDY REVIEW PROCESS

USDOE has implemented the Fourth Five-Year Remedy Review. The review specifically evaluated remedies by comparing them to the OU-specific decision documents. The following actions were taken to perform the Fourth Five-Year Remedy Review:

- Conducted a scoping meeting on April 17, 2012 with USDOE, USEPA, and SCDHEC to discuss the scope of the report and to establish the review and approval schedule for the report;
- Reviewed appropriate data and documentation (i.e., including RODs, IRODs, EARODs, ESDs, ROD Amendments, etc.), annual groundwater monitoring reports, Land Use Control Implementation Plan (LUCIP) required field inspection checklists, etc. The specific data and document references used to review each remedy decision are listed in the OU-specific reports located in Appendix C through Appendix BBB;
- Confirmed protectiveness of the remedial actions through inspections and interviews. Cognizant personnel were interviewed as to the status and success of the current remedial systems. The results of the inspections and interviews are documented in the Site Inspection Checklist included with the OU-specific reports located in Appendix C through Appendix BBB. Inspections were not performed for No Action OUs;
- Reviewed changes in standards and to-be-considered guidance that would call into question whether the prescribed remedy was meeting the newer standards or guidance. Any problems or discrepancies are reported in the Section VII (Technical

Assessment), and Section VIII (Issues), and Section IX (Recommendations and Follow-up Actions) of the OU-specific appendices;

- Submitted a Fact Sheet with Revision 0 of the Fourth Five-Year Remedy Review Report.

USEPA is scheduled to perform site inspections of all waste units with issued RODs/IRODs during the week of January 28, 2013. The Revision 0 report will be submitted on or before November 20, 2012. USDOE will address any comments received from USEPA and SCDHEC and provide a Revision 1 for USEPA and SCDHEC approval. A notice of the availability of this report will be available in newspapers in Aiken, Columbia, Barnwell, and Allendale, South Carolina, and in Augusta, Georgia. Additionally, the availability of the report will be announced in the *SRS Environmental Bulletin*, which will be sent to the SRS mailing list. The report will be made available to the public at four information repositories. A briefing to the Citizen's Advisory Board will be conducted prior to finalizing the report.

VII. TECHNICAL ASSESSMENT

Technical assessment of the environmental cleanup program at SRS in general and each of the site specific remedies implemented at SRS (Appendix C through Appendix BBB) are described by answers to the following three questions posed by the USEPA.

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

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

SRS environmental remedies are functioning as intended as demonstrated below.

- Air stripping and soil vapor extraction units associated with the M Area Groundwater plume continue to operate reliably and remove VOCs from the groundwater and vadose zone.
- Passive and Low Energy SVE Systems, solar powered MicroBlowers™ and barometric pressure operated BaroBalls™ continue to remove contaminants from subsurface soils contaminated by low concentrations of VOCs.
- Thermal technologies using steam (DUS and ERH) have been successful in removing VOCs from subsurface zones characterized by very high concentrations and DNAPL.
- Thermal treatment of tritium contaminated soil and debris has been successfully implemented in D-Area.
- Barrier wall funnel and gate systems at the F/H-Area Seepage Basins and phytoremediation at the Mixed Waste Management Facility (MWMF) Southwest plume continue to mitigate tritium-contaminated groundwater in the General Separations Area discharging directly into site streams and have decreased tritium concentrations in Four Mile Branch significantly.
- Edible oil injection to induce bio-remediation has successfully decreased the size and concentration of the VOC plume in T Area.
- In-situ deactivation and decommissioning (D&D) of the P- and R-Reactor buildings has successfully broken the pathways for industrial worker exposure to radioactively contaminated material and contaminant migration to groundwater.
- Groundwater data at Monitored Natural Attenuation (MNA) remedy plumes indicates that groundwater concentrations are generally decreasing and plumes are not expanding.
- Contaminated material has been excavated and consolidated or left in place under protective cover systems breaking the pathway for worker exposure and for the migration of contaminants to groundwater.

- The cover system maintenance program and LUCs have been effective in maintaining the integrity of the cover systems at SRS OUs. The annual inspection reports indicate no significant deficiencies.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) still valid?

Answer: Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid for all of the OUs included in this report. An evaluation of changes in chemical and radiological standards that were in place for the 2007 five-year remedy review report to the current 2012 standards was conducted to determine if there were any changes that would affect the protectiveness of the selected remedies. Groundwater MCLs have not varied with the exception of arsenic that changed from 50 µg/L to 10 µg/L and total trihalomethanes that changed from 100 µg/L to 80 µg/L. Both MCL revisions occurred in the early 2000s and were in place during the previous five-year remedy review. The more conservative MCLs did not affect any remedy. There were no changes in chemical and radiological specific standards that would affect the protectiveness of the remedy. There were no changes in action-specific or location-specific requirements that would impact any remedy. This evaluation is included in Appendix B and described in the OU-specific appendices.

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

Answer: No other information that could call into question the protectiveness of the selected remedies and no outstanding issues have been identified in this Fourth Five-Year Remedy Review with the exception of the A/M Area Groundwater OU. Recent groundwater data collected for the A/M Area Groundwater OU indicate that the interim remedy is not meeting all for the interim remedial action objectives. The remedy is currently protective; however, in order for the remedy to be protective in the long term for this unit, optimization of the groundwater recovery system and/or other remediation technologies must be implemented. The remedy and recommendations for A/M Area Groundwater OU are discussed in more detail in Appendix E. The selected early action

remedy chosen for the final end-state decision for the C-, K-, and L-Reactor Complexes is In Situ Decommissioning (ISD) with LUCs. This remedy was determined to be protective in the short-term because the selected remedy component currently being implemented is LUCs, but the remainder of the remedy to implement ISD will be completed upon closure of the C-, K-, and L-Reactor Complexes.

For all OUs, land use at SRS remains consistent with assumptions in the respective decision documents.

Technical Evaluation Summary

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

VIII. ISSUES

Remedial actions evaluated in this Five-Year Remedy Review for SRS remain protective of human health and the environment and are functioning as intended; however, O&M costs associated with operating facilities and groundwater monitoring are often greater than originally estimated. All of the identified issues are associated with the efficiency and cost effectiveness of O&M and documentation.

- Implementation of a Five Year Remedy Review that includes a technical evaluation of 52 separate OUs in a single effort places on strain on resources and produces an unwieldy document.
- Waste site inspections at some OUs are being implemented more frequently than is warranted to ensure protectiveness.

- Groundwater monitoring at some OUs is being implemented more frequently or with greater thoroughness than is warranted to collect adequate data to assess protectiveness.
- 1,4-Dioxane was identified as a potential contaminant at six OUs based on its association with other solvents present. However, there is a lack of groundwater data to dismiss 1,4-dioxane as being present at levels which would be harmful to human health or the environment. Interim storm water runoff covers at the E-Area LLWF slit trenches are showing signs of wear that are likely to result in higher than anticipated maintenance costs in the future.
- The groundwater pump and treat system in the A/M Area OU has been successful in treating VOC contamination in the portions of the plume that originally contained the highest concentrations. Currently, the highest dissolved concentrations of VOCs are located outside of the recovery well network capture zone.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Optimization of remedial system operation and groundwater monitoring should continue to be evaluated and implemented. Remedies at SRS are protective of human health and the environment and are functioning as intended; however, O&M costs associated with operating facilities and groundwater monitoring are often greater than originally estimated. Recommendations for optimization of remedial systems and groundwater monitoring should be based on thorough analysis of the data and sound technical basis. Optimization of remedial systems can be based on improving the efficiency of current remedial technologies, selecting different technologies, transitioning from active to passive technologies, or by modifying operational strategies. Groundwater monitoring optimization can be based on strategies for collecting the most relevant information most efficiently. Recommendations are discussed in the OU-specific appendices, as appropriate, in the Five-Year Review Summary Form (Executive Summary), and summarized below:

- SRS recommends that future Five Year Remedy Review documents be developed separately for each individual operable unit or grouped in logical sets (e.g., by area, by media, remedy similarity, etc.) and submitted separately for regulatory review on a mutually agreeable schedule. A schedule that spreads the document submittal milestones over multiple years would allow for better use of available resources.
- SRS recommends that the cover inspection frequency for ten OUs be reduced to annual. This reduction would provide adequate monitoring and consistency, since the majority of OU covers are currently inspected annually. SRS intends to propose these changes in a letter from USDOE to USEPA and SCDHEC.
- SRS recommends optimization of groundwater monitoring and reporting at some OUs. These recommendations are consistent with the results of the SRS Groundwater Monitoring Optimization Report (SRNS 2012b). These recommendations will be proposed in operable unit specific regulatory documents.
- SRS recommends monitoring of 1,4-dioxane for six OUs and reporting the results in the OU-specific groundwater reports. Based on the monitoring results, the USEPA, SCDHEC, and USDOE will determine whether or not 1,4-dioxane should be permanently added to the list of monitored constituents.
- SRS recommends reevaluation of the future installation and maintenance activities for stormwater runoff covers for the E-Area LLWF. Further discussion with USEPA/SCDHEC of how these issues impact future covers is needed..
- The L-Area Hot Shop OU has reached the remedial goals for unrestricted land use, and SRS recommends that LUCs are no longer necessary and the site can be categorized as a No Action site.
- Enhanced bioremediation has been demonstrated to be successful in a Treatability Study. SRS recommends incorporating bioremediation (i.e., edible oil injection) into the remedy for the TNX OU.
- SRS recommends that groundwater remediation activities at the A/M Area Groundwater OU be evaluated and a strategy for optimization of plume capture

and/or treatment be developed. SRS intends to propose future changes in revisions to the RCRA Post Closure Permit Application.

X. PROTECTIVENESS STATEMENT(S)

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

For 50 of the 52 remedies evaluated in this Five Year Remedy Review, the remedies have been determined to be protective of human health and the environment. For two remedies, A/M Area Groundwater OU and the C-, K-, and L-Reactor Complexes, the remedies have been determined to be protective in the short-term. A final remedy that will be protective in the long term has yet to be selected and implemented for A/M Area Groundwater OU as part of the RCRA post closure permitting process at this unit. In the interim, exposure pathways that could result in unacceptable risk are being controlled and LUCs are in place. ISD with LUCs has been chosen as the final remedies for the C-, K-, and L-Reactor Complexes. In the interim, exposure pathways that could result in unacceptable risk are being controlled and LUCs are in place. LUCs are maintained for all OUs where hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unlimited use and unrestricted exposure have been left in place.

Soil contamination, contaminated rubble, and buried wastes associated with spills, pits, piles, and seepage basins have been controlled either by excavation and removal, closure cap systems, or treatment. Pathways for contaminants to reach human and ecological receptors and for migration to groundwater have been successfully broken.

Groundwater contamination is being remedied through a variety of technologies that are tailored to plume specific characteristics. In some cases, multiple remedial technologies are employed either in conjunction or sequentially. Technologies successfully implemented include thermal treatment, air stripping, in-situ injection of nutrients to

enhance bioremediation of VOCs, funnel and gate with in-situ injection of base solution to change the pH of groundwater and immobilize contaminants, and MNA. In each groundwater remedy evaluated, data indicates that progress is being made toward meeting remedial goals and that the remedies are protective.

A protectiveness statement for each OU at which a remedial action has begun is included in the OU-specific remedy review located in Appendix C through Appendix BBB. The protective statements are also provided in the Five-Year Review Summary Form located in the Executive Summary.

XI. NEXT REVIEW

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

XII. OU-SPECIFIC FIVE-YEAR REMEDY REVIEW REPORTS

The OU-specific Five-Year Remedy Reviews for the 52 OUs that have been evaluated in this document are included in Appendix C through Appendix BBB.

XIII. REFERENCES

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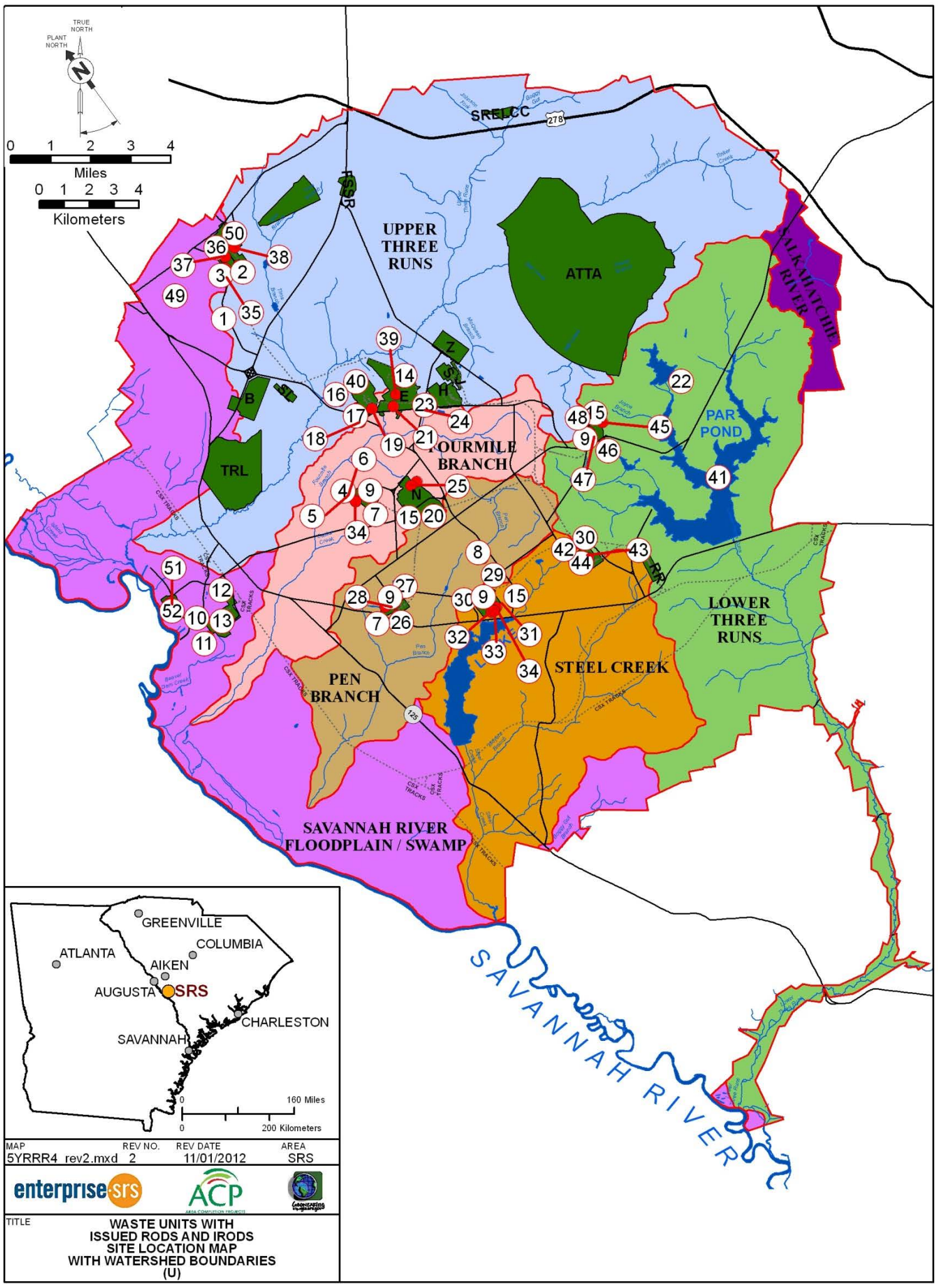
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WSRC, 1997. *Five-Year Review of Records of Decision Report (U),* WSRC-RP-97-403, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

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WSRC 2006. *Background Soils Statistical Summary Report for Savannah River Site*, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC.

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



1 *A-AREA BURNING/RUBBLE PITS (731-A/1A) AND RUBBLE PIT (731-2A), MISCELLANEOUS CHEMICAL BASIN (731-4A) AND METALS BURNING PIT (731-5A)*
2 *A-AREA MISCELLANEOUS RUBBLE PILE (731-6A)*
3 *A/M AREA GROUNDWATER*
4 *C-AREA BURNING/RUBBLE PIT (131-C)*
5 *C-AREA GROUNDWATER*
6 *C-AREA REACTOR SEEPAGE BASINS (904-66G, -68G)*
7 *CENTRAL SHOPS BURNING RUBBLE PITS (631-1G AND 631-3G)*
8 *CHEMICALS, METALS, AND PESTICIDES PIT (080-170G, -171G, -180G, -181G, -182G, -183G, -190G)*
9 *C-, K-, L-, AND R-REACTOR COMPLEXES*
10 *D-AREA BURNING/RUBBLE PITS (431-D/1D)*
11 *D-AREA EXPANDED OPERABLE UNIT CONSISTING OF D-AREA ASH BASIN (488-D) AND D-AREA RUBBLE PIT (431-2D)*
12 *D-AREA OIL SEEPAGE BASIN (631-G)*
13 *D-AREA OPERABLE UNIT*
14 *E-AREA LOW-LEVEL WASTE FACILITY (643-26E)*
15 *EARLY CONSTRUCTION AND OPERATIONAL DISPOSAL SITE (ECODS) L-1, N-2, P-2, and R-1A, -1B, -1C*
16 *F-AREA BURNING/RUBBLE PITS (231-F, 231-1F, AND 231-2F)*
17 *F-AREA GROUNDWATER OPERABLE UNIT (904-41G, -42G, -43G)*
18 *F-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-41G, -42G, -43G)*
19 *F-AREA RETENTION BASIN (281-3F)*
20 *FORD BUILDING SEEPAGE BASIN (904-91G)*
21 *GENERAL SEPARATIONS AREA CONSOLIDATION UNIT including OLD RADIOACTIVE WASTE BURIAL GROUND (643-E) and OLD SOLVENT TANKS (650-1E through 650-22E) OPERABLE UNIT1*
22 *GUNSITE 012 (including ECODS G-3)*
23 *H-AREA GROUNDWATER OU (904-44G, -45G, -45G, -56G)*
24 *H-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-44G, -45G, -46G, -56G)*
25 *HEAVY EQUIPMENT WASH BASIN AND CENTRAL SHOPS BURNING/RUBBLE PIT (631-5G)*
26 *K-AREA BINGHAM PUMP OUTAGE PIT (643-1G)*
27 *K-AREA BURNING/RUBBLE PIT AND K-AREA RUBBLE PILE (131-K and 631-20G)*
28 *K-AREA REACTOR SEEPAGE BASIN (904-65G)*
29 *L & P BINGHAM PUMP OUTAGE PITS (643-2G, 643-3G, 643-4G)*
30 *L-AREA BURNING/RUBBLE PIT (131-L) & RUBBLE PILE (131-3L) & GAS CYLINDER DISPOSAL FACILITY (131-2L)*
31 *L-AREA HOT SHOP (707-G, 712-G, 717-G)*
32 *L-AREA OIL AND CHEMICAL BASIN (904-83G, -79G)*
33 *L-AREA AND C-AREA REACTOR SEEPAGE BASINS (904-64G, -67G)*
34 *L-AREA SOUTHERN GROUNDWATER*
35 *M-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-51G, -112G)*
36 *M-AREA SETTLING BASIN INACTIVE PROCESS SEWERS TO MANHOLE 1(081-M)*
37 *M-AREA OPERABLE UNIT*
38 *METALULURGICAL LABORATORY HAZARDOUS WASTE MANAGEMENT FACILITY (904-110G)*
39 *MIXED WASTE MANAGEMENT FACILITY (643-28E)*
40 *OLD F-AREA SEEPAGE BASIN (904-49G)*
41 *PAR POND (685-G)*
42 *P-AREA BURNING/RUBBLE PIT (131-P)*
43 *P-AREA OPERABLE UNIT*
44 *P-AREA REACTOR SEEPAGE BASIN (904-61G, 904-62G, 904-63G)*
45 *R-AREA BINGHAM PUMP OUTAGE PITS (643-8G, 643-9G AND 643-10G) AND R-AREA UNKNOWN PITS #1, #2, AND #3*
46 *R-AREA BURNING/RUBBLE PITS (131-R, 131-1R) AND RUBBLE PILE (631-25G)*
47 *R-AREA OPERABLE UNIT*
48 *R-AREA REACTOR SEEPAGE BASINS (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G AND 108-4R OVERFLOW BASIN)*
49 *SILVERTON ROAD WASTE UNIT (731-3A)*
50 *SRL SEEPAGE BASINS (904-53G1, -53G2, -54G, and –55G)*
51 *T-AREA OPERABLE UNIT*
52 *TNX AREA GROUNDWATER OPERABLE UNIT*

Figure 1. Location Map for SRS OUs Included in the Fourth Five-Year Review

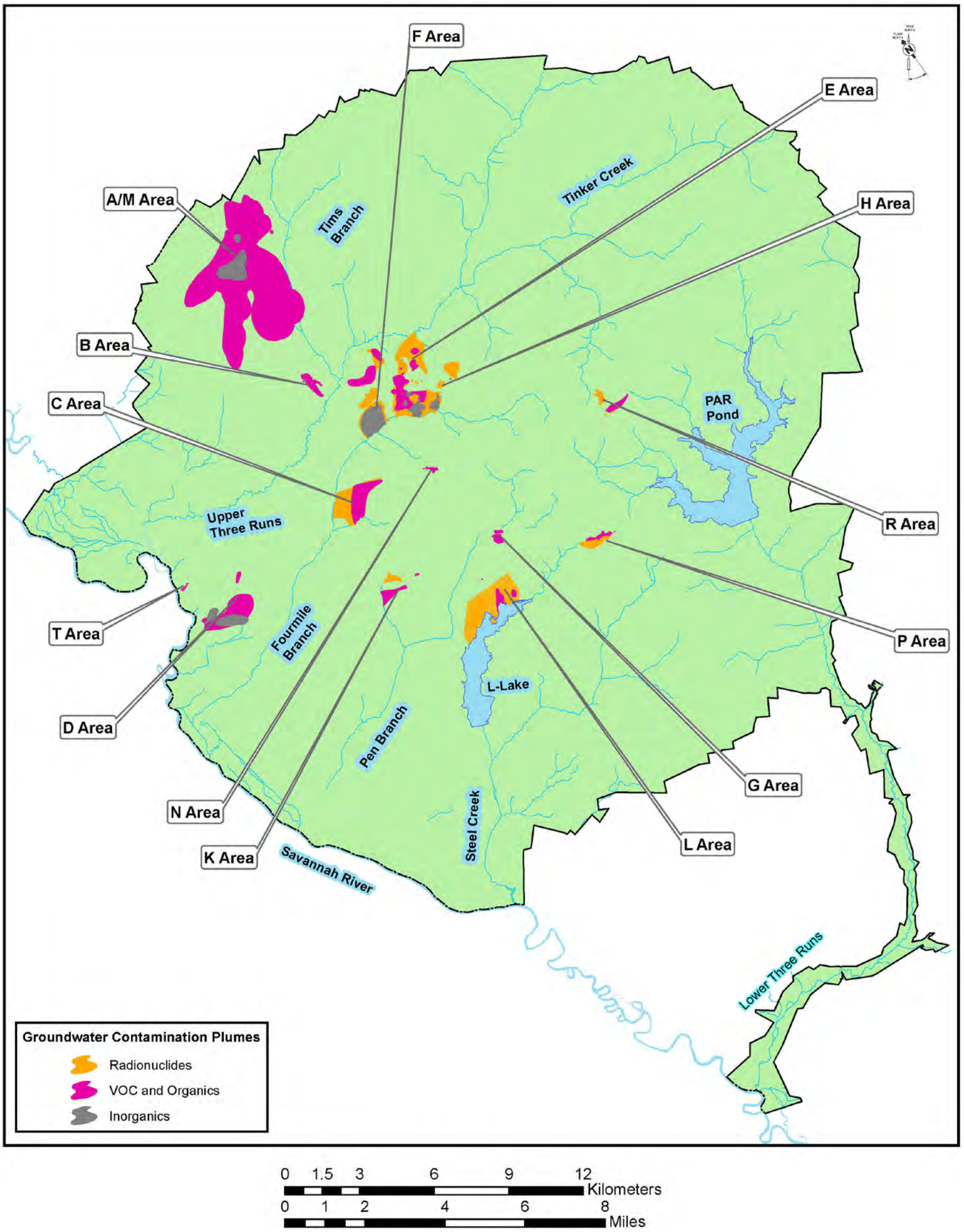


Figure 2. Groundwater Contamination at the Savannah River Site

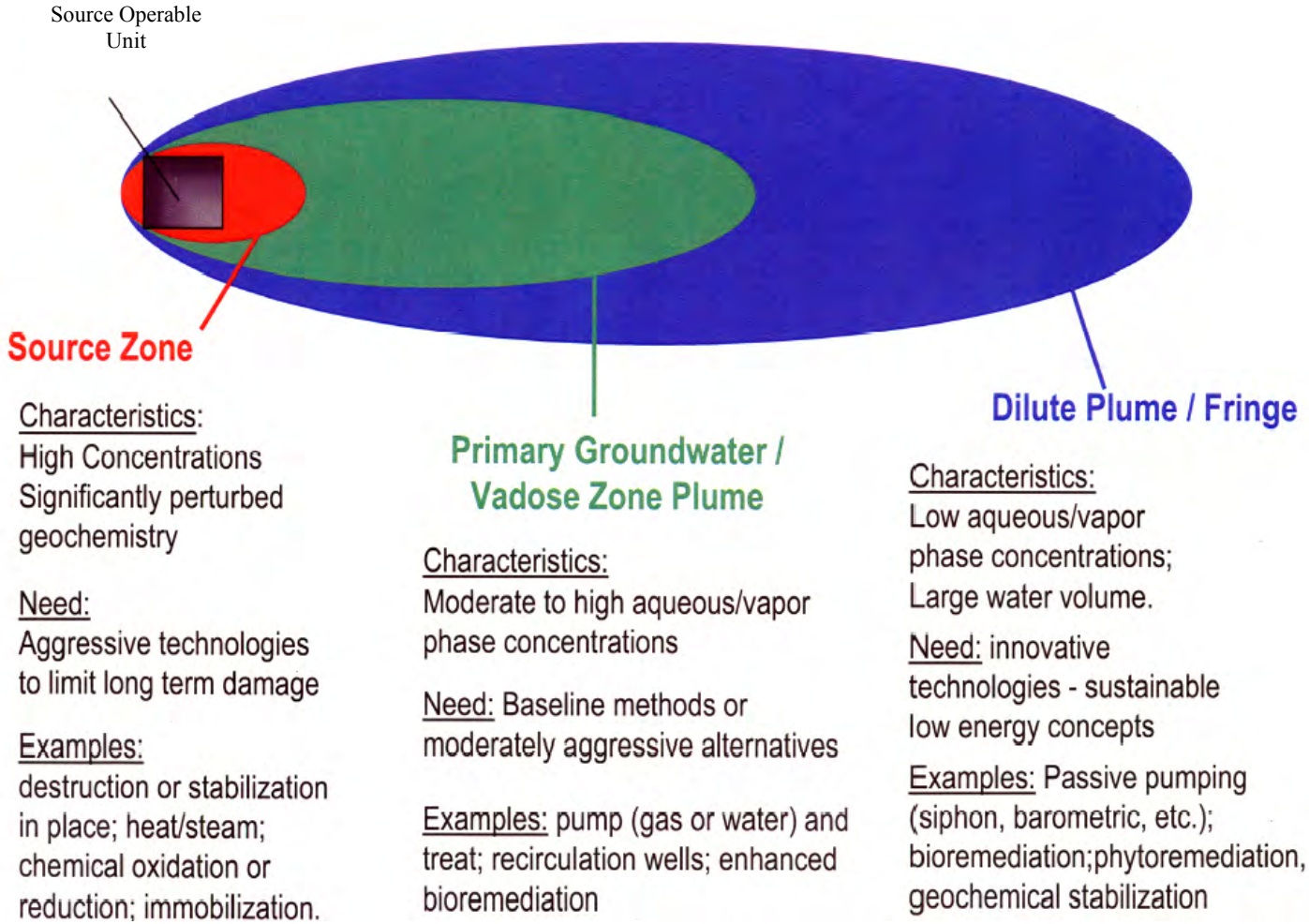


Figure 3. SRS Graded Approach to Groundwater Remediation

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Table 1. Fourth Five-Year Review Operable Units and Associated Remedial Actions

#	Appendix	Operable Unit	CERCLIS No.	ROD/IROD Year	Remedial Action
1	C	A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A)	28	2007	SVE, Passive SVE, Air Sparging, Soil Cover, LUCs
2	D	A-Area Miscellaneous Rubble Pile (731-6A)	30	2003	Excavation, SVE, soil cover, LUCs
3	*E*	*A/M Area Groundwater*	*36*	*1992*	*Pump-and-Treat with Air Stripping, Dynamic Underground Stripping (RCRA Permit)*
4	F	C-Area Burning/Rubble Pit (131-C)	31	2008	SVE, Air Sparging, Soil Cover, Monitored Natural Attenuation (MNA)
5	G	C-Area Groundwater	82	2004	Electrical Resistance Heating (ERH) with SVE
6	H	C-Area Reactor Seepage Basins (904-66G, -68G)	60	2000	In Situ Stabilization/Solidification (S/S), Soil Cover, LUCs
7	I	Central Shops Burning Rubble Pits (631-1G / 631-3G)	50	1997	Stormwater Management, LUCs
8	J	Chemicals, Metals and Pesticides Pits (080-170G, -171G, -180G, -181G, -182G, -183G, -190G)	24	2005	Enhanced Bioremediation, ERH, SVE, Passive SVE, Soil Cover, MNA, LUCs
9	**K**	**C-, K-, L-, and R-Reactor Complexes**	**79, 90, 91, 95**	**2009**	**In situ Decommissioning (ISD), LUCs**
10	L	D-Area Burning/Rubble Pits (431-D/1D)	15	1997	LUCs
11	M	D-Area Expanded Operable Unit consisting of: D-Area Ash Basin (488-D) and D-Area Rubble Pit (431-2D)	67	2004	Excavation, Soil Cover, Groundwater Monitoring, LUCs
12	N	D-Area Oil Seepage Basin (631-G)	27	1999	Removal Action (Excavation), Groundwater Mixing Zone (GWMZ), LUCs
13	**O**	**D-Area Operable Unit**	**63**	**2011**	**Removal Action (Excavation, SVE), LUCs**
14	**P**	**E-Area Low-Level Waste Facility(643-26E)**	**86**	**2010**	**Interim Stormwater Runoff Covers, LUCs**
15	**Q**	**Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, -1B, -1C**	**22**	**2009**	**LUCs**
16	R	F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	14	1997	LUCs
17	*S*	*F-Area Groundwater Operable Unit (904-41G, 904-42G, 904-43G)*	*8*	*1995*	*Barrier Wall Funnel and Gate System with Base Injection (Pump-and-Treat Groundwater previously implemented), LUCs (RCRA Permit)*

Table 1. Fourth Five-Year Review Operable Units and Associated Remedial Actions *(continued)*

#	Appendix	OPERABLE UNIT	CERCLIS No.	ROD/IROD Year	Remedial Action
18	*T*	*F-Area Hazardous Waste Management Facility (904-41G, -42G, -43G)*	*6*	*1993*	*In Situ S/S, RCRA Soil Cover, LUCs*
19	U	F-Area Retention Basin (281-3F)	23	1998	In Situ S/S, Soil Cover, Groundwater Monitoring, LUCs
20	V	Ford Building Seepage Basin (904-91G)	58	2002	Excavation, LUCs
21	W	General Separations Area Consolidation Unit including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E)	32	2002	Excavation, Consolidation, Low Permeability Cover, LUCs
22	**X**	**Gunsite 012 (including ECODS G-3)**	**78**	**2011**	**Removal Action (Asbestos Removal), LUCs**
23	*Y*	*H-Area Groundwater OU (904-44G, 904-45G, 904-45G, 904-56G)*	*9*	*1995*	*Barrier Wall Funnel and Gate System with Base Injection (Pump-and-Treat Groundwater previously implemented), LUCs (RCRA Permit)*
24	*Z*	*H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G)*	*7*	*1993*	*In Situ S/S, RCRA Soil Cover, LUCs*
25	AA	Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G)	53	2005	LUCs
26	BB	K-Area Bingham Pump Outage Pit (643-1G)	20	1998	LUCs
27	CC	K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G)	40	2001	Soil Cover, GWMZ, LUCs
28	DD	K-Area Reactor Seepage Basin (904-65G)	55	2002	In Situ S/S, Soil Cover, LUCs
29	EE	L-Area and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, 643-4G)	26, 39	2000	LUCs
30	FF	L-Area Burning/Rubble Pit (131-L), Rubble Pile (131-3L) and Gas Cylinder Disposal Facility (131-2L)	56	2003	Removal Action (Excavation), GWMZ, LUCs
31	GG	L-Area Hot Shop (717-G)	76	2003	Excavation, LUCs
32	HH	L-Area Oil and Chemical Basin (904-83G) and L-Area Acid/Caustic Basin, 904-79G)	17	1998	In Situ S/S, Soil Cover, LUCs
33	II	L-Area and C-Area Reactor Seepage Basins (904-64G, 904-67G)	65, 60	2003	Soil Cover, LUCs
34	JJ	L-Area Southern Groundwater	77	2007	MNA, LUCs
35	KK	M-Area Hazardous Waste Management Facility (904-51G, 904-112G)	1	1992	In Situ S/S, RCRA Soil Cover, LUCs
36	LL	M-Area Settling Basin Inactive Process Sewers to Manhole 1 (081-M)	19	2007	SVE, Soil Fracturing, LUCs
37	**MM**	**M-Area Operable Unit**	**92**	**2009**	**SVE, Passive SVE, LUCs**

Table 1. Fourth Five-Year Review Operable Units and Associated Remedial Actions *(continued)*

#	Appendix	OPERABLE UNIT	CERCLIS No.	ROD/IROD Year	Remedial Action
38	*NN*	*Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)*	*2*	*1992*	*In situ S/S, RCRA Soil Cover, LUCs*
39	*OO*	*Mixed Waste Management Facility (643-28E)*	*33*	*1994*	*RCRA Soil Cover, LUCs*
40	PP	Old F-Area Seepage Basin (904-49G)	16	1997	In Situ S/S, GWMZ, LUCs
41	QQ	PAR Pond (685-G)	35	1995/2012	Repair Dam and Maintain the Level at 58.5 m (195 ft) Elevation Minimum, Excavation, LUCs
42	RR	P-Area Burning/Rubble Pit (131-P)	59	2003	Soil Cover, Passive SVE, Groundwater Monitoring
43	**SS**	**P-Area Operable Unit**	**94**	**2010**	**Removal Actions (ISD of P-Reactor Building [105-P], Excavation, Cover), Soil Fracturing with Chemical Oxidation, SVE, LUCs**
44	TT	P-Area Reactor Seepage Basins (904-61G, 904-62G, 904-63G)	66	2003	In Situ S/S , Consolidation, Soil Cover, LUCs
45	UU	R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3	38	2003	LUCs
46	VV	R-Area Burning/Rubble Pits (131-R, 131-1R) and Rubble Pile (63125G)	43	2004	Excavation, Soil Cover, LUCs
47	**WW**	**R-Area Operable Unit**	**95**	**2010**	**Removal Actions (ISD of R-Reactor Building [105-R], Excavation, Cover) , MNA, LUCs**
48	XX	R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin	25	2004	Concrete Intruder Barrier, Excavation, On-Site Disposal, GWMZ, LUCs
49	YY	Silverton Road Waste Unit (731-3A)	13	1997	LUCs
50	ZZ	SRL Seepage Basins (904-53G1, -53G2, -54G, and –55G)	47	2000	Excavation, Offsite Disposal, LUCs
51	AAA	T-Area Operable Unit	96	2005	Cover, Excavation, Soil Amendments, LUCs
52	BBB	TNX Area Operable Unit	21, 29	1994	Excavation, In Situ S/S, SVE (Pump-and-Treat with Air Stripping, Recirculation Wells, Air Sparging previously implemented), Treatability Study (Enhance Bioremediation with Edible Oil), Cover, Groundwater Monitoring, LUCs

Notes:
Bold Shaded Text indicates new OUs not previously included in the Third Five-Year Review.
Italic Text indicates a RCRA unit with approved remedy decision document.

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Table 2. Chronology of SRS Events

Event	Date
Consent Decree Signed	May 26, 1988
NPL Listing Effective Date	December 21, 1989
Federal Facility Agreement Declared Effective	August 16, 1993
First Five-Year Remedy Review	June 30, 1997
Second Five-Year Remedy Review	February 12, 2004
Third Five-Year Remedy Review	January 21, 2009

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Table 3. Fourth Five-Year Summary of Operation and Maintenance Project Costs

Operable Unit	Main Remedy	ROD Issue Date	FY07-FY11 O&M Estimate	FY07-FY11 O&M Actual	% of Estimate	Comments
F-Area Burning/Rubble Pits	Cap	1997	$2,500	$24,836	993%	Inspections/maintenance is not in estimate.
D-Area Burning/Rubble Pits / D-Area Rubble Pile	Cap	1997	$3,700	$28,694	3200%	Inspections/maintenance is not in estimate.
F-Area Retention Basin	Cap	1998	$12,500	$31,332	250%	Inspections/maintenance is not in estimate.
Central Shops Burning/Rubble Pits	Cap	1997	$40,000	$40,101	100%	GW level measurements.
SRL Seepage Basin	Cap	2000	$30,000	$26,589	89%	
M-Area Operable Unit	Cap	2009	$85,000	$75,078	88%	
D-Area Expanded Operable Unit	Cap	2004	$59,000	$49,740	84%	
T Area	Cap	2005	$324,808	$271,761	84%	
L-Area Hot Shop	Cap	2003	$35,000	$28,694	82%	Longer inspection/ maintenance life.
Old F-Area Seepage Basin	Cap	1997	$35,000	$27,291	78%	
R-Area Bingham Pump Outage Pits	Cap	2003	$32,500	$24,134	74%	
L-Area Bingham Pump Outage Pits / P-Area Bingham Pump Outage Pits	Cap	2000	$49,500	$29,395	60%	
C-Area Reactor Seepage Basin	Cap	2000	$47,505	$25,888	54%	
Ford Building Seepage Basin	Cap	2002	$50,000	$23,783	48%	
General Separations Area Consolidation Unit	Cap	2002	$195,600	$89,025	46%	
L-Area Oil and Chemical Basin / L-Area Acid/Caustic Basin	Cap	1998	$86,667	$26,589	31%	
K-Area Reactor Seepage Basin	Cap	2002	$91,469	$25,186	28%	
P-Area Reactor Seepage Basin	Cap	2003	$117,250	$29,045	25%	
L-Area Reactor Seepage Basin	Cap	2003	$117,250	$27,291	23%	
K-Area Bingham Pump Outage Pits	Cap	1998	$113,000	$24,485	33%	
Early Construction and Operational Disposal Site	Cap	2009	$40,000	$3,482	9%	

Table 3. Fourth Five-Year Summary of Operation and Maintenance Project Costs *(continued)*

Operable Unit	Main Remedy	ROD Issue Date	FY07-FY11 O&M Estimate	FY07-FY11 O&M Actual	% of Estimate	Comments
E-Area Low-Level Waste Facility (Slit Trench Disposal Units 1 & 2)	Tarp	2010	$11,000	$500	5%	
Silverton Road Waste Site	Cap	1997	$5,500	$33,605	611%	Mowing costs underestimated.
Heavy Equipment Wash Basin	Cap	2005	$25,000	$24,836	99%	
K-Area Burning/Rubble Pits / K-Area Rubble Pile	Groundwater Monitoring/ Cap	2001	$27,812	$220,476	793%	Higher GW monitoring/reporting costs.
D-Area Oil Seepage Basin	Groundwater Monitoring	1999	$59,000	$327,149	554%	Higher Mixing Zone Report costs
L-Area Burning/Rubble Pits / L-Area Rubble Pile / Gas Cylinder Disposal Facility	Groundwater Monitoring	2003	$30,000	$160,744	536%	Higher Mixing Zone Report costs
R-Area Burning/Rubble Pits / R-Area Rubble Pile	Groundwater Monitoring/ Cap	2004	$30,000	$41,074	137%	Higher GW monitoring/reporting costs.
C-Area Burning Rubble Pit	SVE / MicroBlowers™	2008	$186,000	$247,107	133%	Higher GW monitoring/reporting costs.
R-Area Reactor Seepage Basin / Overflow Basin	Groundwater Monitoring/ Cap	2004	$1,293,408	$1,285,750	99%	
P-Area Burning/Rubble Pits	Groundwater Monitoring / Passive SVE	2003	$128,346	$108,927	85%	
L-Area Southern Groundwater	Groundwater Monitoring	2007	$252,520	$189,129	75%	
A-Area Miscellaneous Rubble Pile	SVE	2003	$262,500	$628,400	239%	Longer operational life, higher treatment costs.
CMP Pits	Electrical Resistance Heating / SVE	2005	$956,524	$1,582,972	165%	Larger vadose zone treatment volume.
A-Area Burning Rubble Pits	SVE	2007	$816,308	$753,063	92%	Longer operational life.
TNX Area	SVE	1994	$1,504,457	$1,296,454	86%	

Table 3. Fourth Five-Year Summary of Operation and Maintenance Project Costs *(continued)*

Operable Unit	Main Remedy	ROD Issue Date	FY07-FY11 O&M Estimate	FY07-FY11 O&M Actual	% of Estimate	Comments
P-Area Operable Unit	SVE, In Situ Decommissioning	2010	$605,900	$351,492	58%	
M-Area Settling Basin Inactive Process Sewer Lines	SVE	2007	$1,387,900	$738,608	53%	
C-Area Groundwater	Electrical Resistance Heating / SVE	2004	$414,000	$151,121	37%	

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DECISION DOCUMENTS ISSUED FOR SRS

The following tables and figures are included for information only.

- Figure A-1 provides an SRS map indicating the location of OU subunits with remedial actions and correlates with Table A-5.
- Table A-1 chronologically lists all Savannah River Site (SRS) issued decision documents (i.e., Record of Decisions [RODs], Interim RODs, Early Action RODs, ROD Amendments, and Explanation of Significant Difference [ESDs]) including No Action sites. Document numbers are provided for reference;
- Table A-2 provides a summary of remedial actions taken without the use of operating equipment at SRS;
- Table A-3 provides a summary of remedial actions taken using operating equipment at SRS;
- Table A-4 provides a summary of the no remedial actions selected in the decision documents; and
- Table A-5 provides the OU subunits with issued RODs, IRODs, and EARODs and their associated CERCLIS number.

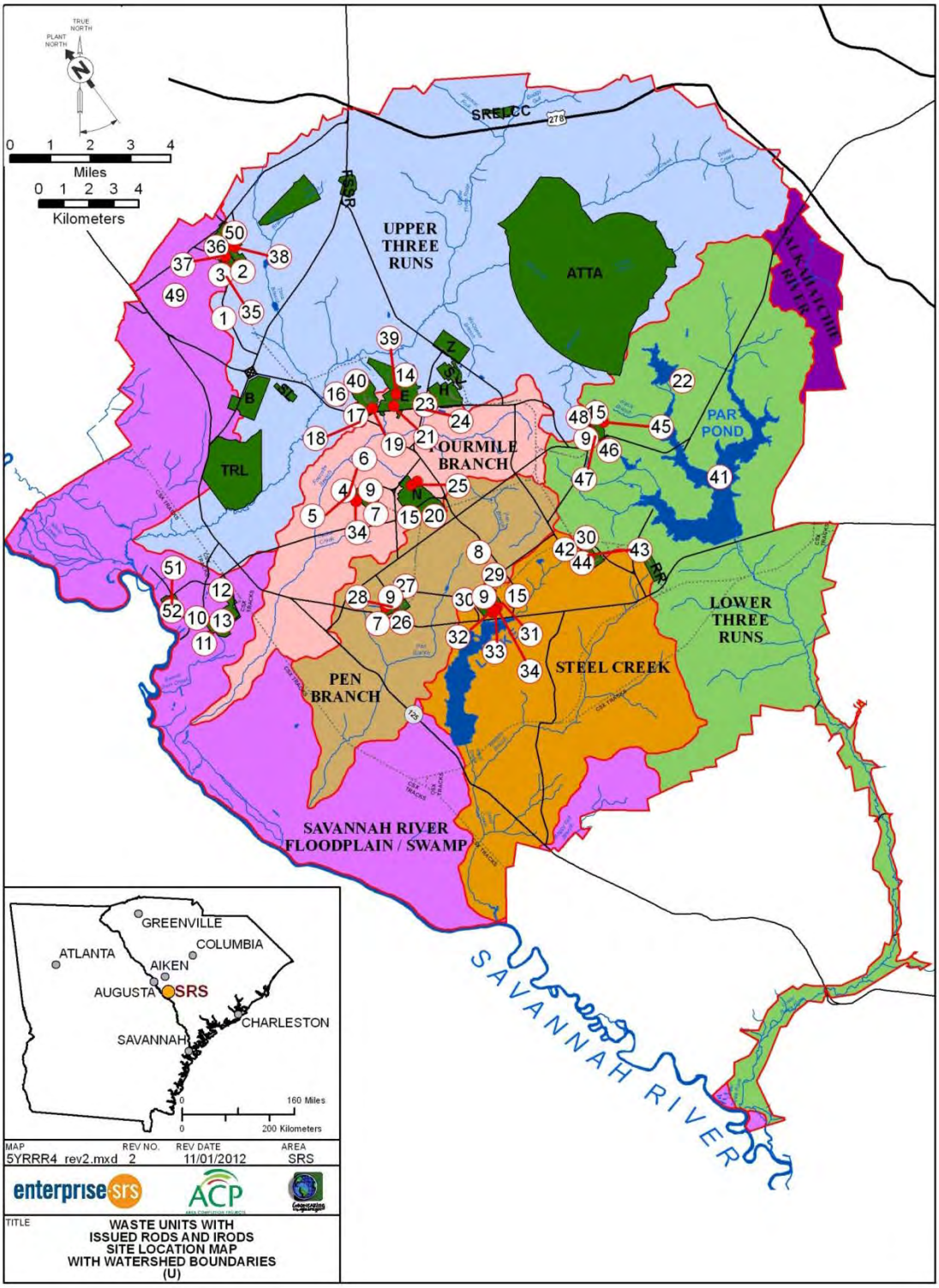


Figure A-1. Location Map of SRS OU Subunits with Issued RODs, IRODs, and EARODs.

For SRS Location Number key – see Table A-5.

Table A-1 Chronological Listing of SRS Issued Decision Documents

Document Title	Document Number	Revision	Issuance Date
NPL Listing Effective Date			December 21, 1989
Federal Facility Agreement Declared Effective			August 16, 1993
A/M Area Groundwater, Interim ROD (RCRA)	WSRC-RP-92-744	0	June 29, 1992
M-Area Hazardous Waste Management Facility (904-51G, -112G), Interim ROD (RCRA)	WSRC-RP-92-743	0	June 29, 1992
Metallurgical Laboratory Hazardous Waste Management Facility (904-110G), Interim ROD (RCRA)	WSRC-RP-92-745	0	June 29, 1992
F-Area Hazardous Waste Management Facility (904-41G, -42G, -43G), ROD (RCRA)	WSRC-RP-93-1042	1	September 10, 1993
H-Area Hazardous Waste Management Facility (904-44G, -45G, -46G, -56G), ROD (RCRA)	WSRC-RP-93-1043	1	September 10, 1993
Mixed Waste Management Facility (643-28E), ROD (RCRA)	WSRC-RP-93-1511	1	September 23, 1994
Tank 105-C Hazardous Waste Management Facility, ROD (RCRA)	WSRC-RP-94-106	1	September 23, 1994
TNX Groundwater Operable Unit, Interim ROD	WSRC-TR-94-0375	1	November 16, 1994
TNX Groundwater Operable Unit, ESD	WSRC-RP-2001-00764	0	November 16, 1994
PAR Pond (685-G), Interim ROD	WSRC-RP-93-1549	0	February 16, 1995
F-Area Groundwater Operable Unit (904-41G, -42G, -43G), Interim ROD (RCRA)	WSRC-RP-94-1162	1	April 13, 1995
H-Area Groundwater Operable Unit (904-44G, -45G, -45G, -56G), Interim ROD (RCRA)	WSRC-RP-94-1163	1	April 13, 1995
M-Area West Unit (631-21G), ROD	WSRC-RP-95-626	0	September 29, 1995
Old Radioactive Waste Burial Ground (643-E), Interim ROD	WRSC-RP-96-102	0	June 18, 1996
Burma Road Rubble Pit (231-4F), ROD	WSRC-RP-96-101	1	July 8, 1996
D-Area Burning/Rubble Pits (431-D, 431-1D), ROD	WSRC-RP-96-867	1	April 22, 1997
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F), ROD	WSRC-RP-96-868	1	April 22, 1997
Grace Road Site (631-22G), ROD	WSRC-RP-96-160	1	April 22, 1997

Table A-1. Chronology of All RODs, IRODs, EARODs, ROD Amendments, and ESDs Issued at SRS *(continued)*

Document Title	Document Number	Rev	Issuance Date
Gunsite 113 Access Road Unit (631-24G), ROD	WSRC-RP-96-833	1	April 22, 1997
Gunsite 720 Rubble Pit Unit (631-16G), ROD	WSRC-RP-96-832	1	April 22, 1997
Silverton Road Waste Unit (713-3A), ROD	WSRC-RP-96-171	1	April 22, 1997
Central Shops Burning/Rubble Pit (631-6G), ROD	WSRC-RP-96-873	1	June 19, 1997
Old F-Area Seepage Basin (904-49G), ROD	WRSC-RP-96-872	1.1	June 19, 1997
First Five-Year Remedy Review	***WSRC-RP-97-403***	***0***	***June 30, 1997***
TNX Groundwater Operable Unit, ESD	WSRC-RP-97-169	1	September 22, 1997
L-Area Oil and Chemical Basin and L-Area Acid/Caustic Basin (904-83G, -79G), ROD	WSRC-RP-97-143	1	January 5, 1998
K-Area Bingham Pump Outage Pit (643-1G), ROD	WSRC-RP-97-178	1	April 14, 1998
Old F-Area Seepage Basin (904-49G), ESD	WSRC-RP-98-4123	1	September 3, 1998
716-A Motor Shops Seepage Basin (904-101G), ROD	WSRC-RP-97-840	0	September 17, 1998
Fire Department Hose Training Facility (904-113G), ROD	WSRC-RP-97-171	1	September 17, 1998
F-Area Retention Basin (281-3F), ROD	WSRC-RP-97-145	1.1	October 19, 1998
C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, 189-P), ROD	WSRC-RP-97-850	1	November 10, 1998
D-Area Oil Seepage Basin (631-G), ROD	WSRC-RP-97-402	1	March 4, 1999
C-Area Burning/Rubble Pit (131-C), Interim ROD	WSRC-RP-98-4039	0	March 4, 1999
Ford Building Waste Site (643-11G), ROD	WSRC-RP-98-4066	1	June 7, 1999
Chemicals, Metals, and Pesticides Pits (080-170G, -171G, -180G, -181G, -182G, -183G, -190G), Interim ROD	WSRC-RP-98-4192	1.1	November 29, 1999
SRL Seepage Basins (904-51G1, -52G2, -52G, -55G), ROD	WSRC-RP-97-848	1.1	March 15, 2000
C Reactor Seepage Basins (904-66G, -67G, -68G), Plug-In ROD, ESD	WSRC-RP-2000-4032	0	August 3, 2000
L & P Bingham Pump Outage Pits (643-2G, -3G, -4G), ROD	WSRC-RP-98-4015	1	August 31, 2000
A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A), Interim ROD	WSRC-RP-2000-4001	1	November 17, 2000
West of SRL "Georgia Fields" Site (631-19G), ROD	WSRC-RP-99-4164	0	November 17, 2000
Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/5A), Interim ROD	WSRC-RP-98-4031	1.1	December 7, 2000
Burma Road Rubble Pit, 231-4F, ESD	WSRC-RP-98-4170	1	February 6, 2001
F-Area Retention Basin (281-3F), ESD	WSRC-RP-2000-4079	1	June 7, 2001
K-Area Burning/Rubble Pit (131-K & 631-20G), ROD	WSRC-RP-97-862	1	August 8, 2001

Table A-1. Chronology of All RODs, IRODs, EARODs, ROD Amendments, and ESDs Issued at SRS *(continued)*

Document Title	Document Number	Rev	Issuance Date
ORWBG Old Solvent Tanks (650-01E - 22E), Interim ROD	WSRC-RP-2000-4193	1	September 14, 2001
Ford Building Seepage Basin ROD	WSRC-RP-2000-4156	1	February 14, 2002
CMP Pits Interim Action ROD Amendment	WSRC-RP-2000-4158	1.2	March 8, 2002
K-Area Reactor Seepage Basin ESD	WSRC-RP-99-4200	1.1	September 16, 2002
General Separations Area Consolidation Unit ROD	WSRC-RP-2002-4002	0	September 26, 2002
C-Area & L-Area Reactor Seepage Basin ROD Amendment	WSRC-RP-2002-4063	1	October 23, 2002
L-Area Burning/Rubble Pit (131-L) & Rubble Pile (131-3l) & Gas Cylinder Disposal Facility (131-2l), ROD	WSRC-RP-98-4195	1.1	January 10, 2003
A-Area Burning/Rubble Pits (731-A/1a) And Rubble Pit (731-2a), ESD	WSRC-RP-2001-4281	1	January 27, 2003
R-Area Bingham Pump Outage Pits (643-8G, 643-9G And 643-10G) And R-Area Unknown Pits #1, #2, And #3, ROD	WSRC-RP-2001-4129	1.1	April 23, 2003
TNX Area Groundwater Operable Unit ESD	WSRC-RP-2001-00764	0	May 19, 2003
P-Area Burning/Rubble Pit (131-P) ROD	WSRC-RP-2000-4197	1	July 21, 2003
A-Area Miscellaneous Rubble Pile (731-6A) ROD	WSRC-RP-2001-4197	1.3	July 21, 2003
P-Area Reactor Seepage Basin (904-61G, 904-62G, 904-63G) ESD	WSRC-RP-2002-4105	1.1	September 24, 2003
CMP Pits Second Interim Action ROD Amendment	WSRC-RP-2001-4232	1.1	October 7, 2003
L-Area Hot Shop (717-G) ROD	WSRC-RP-2002-4025	1.1	October 21, 2003
Road A Chemical Basin (904-111G), ROD	WSRC-RP-2002-4153	0	October 21, 2003
Second Five-Year Remedy Review	***WSRC-RP-2001-4163***	***1.1***	***February 12, 2004***
R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G And 108-4R Overflow Basin) ROD	WSRC-RP-2003-4093	1	March 10, 2004
TNX Burying Ground (643-G), New TNX Seepage Basin, Old TNX Seepage Basin and TNX Groundwater (082-G) ROD	WSRC-RP-2003-4017	1	March 25, 2004
SRL Oil Test Site (808-16G)	WSRC-RP-2003-4164	1	August 5, 2004
C-Area Reactor Groundwater IROD	WSRC-RP-2004-4022	1	September 13, 2004
R-Area Burning/Rubble Pits (131-R, 131-1R) and Rubble Pile (631-25G) ROD	WSRC-RP-2004-4004	1	September 13, 2004
D-Area Expanded Operable Unit (Consisting of D-Area Ash Basin, 488-D and D-Area Rubble Pit, 431-2D) ROD	WSRC-RP-2004-4007	1	November 15, 2004

Table A-1. Chronology of All RODs, IRODs, EARODs, ROD Amendments, and ESDs Issued at SRS *(continued)*

Document Title	Document Number	Rev	Issuance Date
Old F-Area Seepage Basin (904-49G) ROD Amendment	WSRC-RP-2003-4136	1	November 15, 2004
Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) ROD	WSRC-RP-2003-4185	1.1	January 7, 2005
Chemical, Metals, Pesticides Pits ROD	WSRC-RP-2004-4090	1	February 7, 2005
Silverton Road Waste Site ESD	WSRC-RP-2004-4092	1.1	March 7, 2005
TNX Area OU ESD	WSRC-RP-2005-4030	1	September 2, 2005
Hydrofluoric Acid Spill (631-4G), ROD	WSRC-RP-2005-4000	0	December 12, 2005
T-Area OU ROD	WSRC-RP-2004-4070	1	December 21, 2005
K-Area Sludge Land Application Site (761-4G) and PAR Pond Sludge Land Application Site (761-5G), ROD	WSRC-RP-2005-4064	1	June 6, 2006
211-FB Pu-239 Release (081-F), ROD	WSRC-RP-2005-4090	1	September 5, 2006
M-Area Inactive Process Sewer Line ROD	WSRC-RP-2006-4001	1	April 20, 2007
L-Area Southern Groundwater ROD	WSRC-RP-2006-4052	1.1	April 26, 2007
A-Burning/Rubble Pits and Rubble Pit (731-A, 731-1A, 731-2A) ROD	WSRC-RP-2005-4095	1.1	May 9, 2007
C-Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) ROD	WSRC-RP-2007-4082	1	June 25, 2008
M-Area Operable Unit ROD	WSRC-RP-2008-4030	1	January 1, 2009
P-Area Operable Unit Early Action ROD	WSRC-RP-2008-4037	1.1	January 1, 2009
Third Five-Year Remedy Review	***WSRC-RP-2007-4063***	***1.1***	***January 21, 2009***
M-Area Operable Unit ESD	SRNS-RP-2009-00406	1	July 9, 2009
P-Area Operable Unit Early Action ESD	SRNS-RP-2009-00704	1	October 27, 2009
Early Construction and Operational Disposal Site L-1, N-2, P-2, R-1A, R-1B, R-1C ROD	SRNS-RP-2009-00072	1	December 1, 2009
C-, K-, L- and R-Reactor Complexes	SRNS-RP-2009-00707	1	December 8, 2009
E-Area Low Level Waster Facility (Slit Trench Disposal Units 1 and 2) IROD	SRNS-RP-2009-00538	1	January 22, 2010
P-Area Operable Unit ROD	SRNS-RP-2009-01368	1	April 1, 2010
E-Area Low Level Waste Facility (Slit Trench Disposal Units 1 and 2) ESD	SRNS-RP-2009-01128	1	April 22, 2010
Gunsite 218 ROD	SRNS-RP-2010-00051	1	October 5, 2010

Table A-1. Chronology of All RODs, IRODs, EARODs, ROD Amendments, and ESDs Issued at SRS *(continued)*

Document Title	Document Number	Rev	Issuance Date
R-Area Operable Unit ROD	SRNS-RP-2010-01062	1	December 1, 2010
Gunsite 012 (including ECODS G-3) ROD	SRNS-RP-2010-01232	1	March 1, 2011
L-Area Northern Groundwater ROD	SRNS-RP-2011-00134	1	May 1, 2011
D-Area Operable Unit Early Action ROD	SRNS-RP-2010-00162	1.2	July 1, 2011

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Table A-2. Summary of Remedial Actions without Operating Equipment at SRS – Waste Isolation

OU Name	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
Geosynthetic Clay (hydraulic conductivity $1/10^{-7}$, $1x10^{-8}$ cm/sec)						
General Separations Area Consolidation Unit	77.3	0	0	50,950	0	86
Sanitary Landfill	54.8	0	0	0	0	0
D-Area Expanded Operable Unit	25	0	0	60,110	2,000	43
E-Area Low-Level Waste Facility	13.6	0	0	0	0	0
Low-Level Radioactive Waste Disposal Facility	13	0	0	0	0	0
T-Area Operable Unit	9.4	0	0	0	0	48
P-Area Reactor Seepage Basin	2.3	14,408	7,400	1,928	0	3.1
R-Area Burning/Rubble Pits and Rubble Pile	0.32	0	0	0	0	1.1
Compacted Clay (hydraulic conductivity $1x10^{-7}$ cm/sec)						
Mixed Waste Management Facility	58	0	0	0	0	85
H-Area Hazardous Waste Management Facility	22	0	0	0	0	25
F-Area Hazardous Waste Management Facility	7	0	0	0	0	10
L-Area And C-Area Reactor Seepage Basins	1.73	0	0	0	0	1.7
M-Area Hazardous Waste Management Facility	2	0	0	0	0	4.5
P-Area Burning/Rubble Pit	1	0	0	0	0	0.9
Metallurgical Laboratory Hazardous Waste Management Facility	0	0	0	0	0	3.5
Compacted Clay w/ Waste Solidification (hydraulic conductivity $1x10^{-5}$ cm/sec)						
C-Area Reactor Seepage Basins	3.5	0	1,700	0	0	3.1
Old F-Area Seepage Basin	1.8	0	10,150	0	0	1.8
F-Area Retention Basin	0.5	0	11,500	42	0	0.6
L-Area Oil And Chemical Basin	0.45	0	2,170	200	0	1.3
K-Area Reactor Seepage Basin	0.2	0	583	2	0	0.7
Asphalt/Concrete						
R-Area Reactor Seepage Basins and 108-4R Overflow Basin	18.1	0	0	0	0	38
Compacted Common Fill (no hydraulic conductivity requirement)						
R-Area Operable Unit	15	0	0	0	0	450
P-Area Operable Unit	13.7	0	0	0	0	118
D-Area Operable Unit	5.5	0	0	5,720	0	165
SRL Seepage Basins	2.1	0	0	0	0	2.6
A-Area Miscellaneous Rubble Pile	1.2	0	0	0	24	3.1
K-Area Burning/Rubble Pit	0.8	0	0	10,000	0	1.2

Table A-2. Summary of Remedial Actions without Operating Equipment at SRS – Waste Isolation *(continued)*

OU Name	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
C-Area Burning/Rubble Pit	0.6	0	0	0	0	141
Ford Building Seepage Basin	0.35	0	0	1,925	3	0.3
Chemicals, Metals, And Pesticides Pits	0.3	0	0	0	0	7.1
Compacted Native Soil						
Silverton Road Waste Unit	10.3	0	0	0	0	5.5
Central Shops Burning Rubble Pits	2.81	0	0	0	0	2.8
R-Area Bingham Pump Outage Pits and R-Area Unknown Pits #1, #2, #3	1.75	0	0	0	0	3.1
A-Area Burning/Rubble Pits and Rubble Pit, Miscellaneous Chemical Basin, Metals Burning Pit	9.8	0	0	0	10,167	10
Early Construction and Operational Disposal Site L-1, N-2, P-2, And R-1A, -1B, -1C	1.22	0	0	0	0	6.4
F-Area Burning/Rubble Pits	1.18	0	0	0	0	3.8
K-Area Bingham Pump Outage Pit	0.59	0	0	0	0	0.6
D-Area Burning/Rubble Pits	0.54	0	0	0	0	0.7
L-Bingham Pump Outage Pits	0.59	0	0	0	0	0.7
P-Bingham Pump Outage Pits	0.59	0	0	0	0	0.
Water Cover						
PAR Pond	1340	0	0	0	0	0

Table A-3. Summary of Remedial Actions with Operating Equipment at SRS – Waste Treatment

Operating Equipment (Ranked by Active to Passive Technologies)

OU Name	Start	Finish	Zone of Influence Area (acres)	Volume Treated	Volume Removed (lbs)	Description (as of 12/1/09)
Pump-and-Treat				***(gal)***		
Water Treatment Units						
F-Area Groundwater OU	1997	2003	500	42,500,000		
H-Area Groundwater OU	1997	2003				
Air Stripper						
A-Area Groundwater OU	1992	Ongoing	1,600	1,914,506,457	17,306	PCE, TCE
M-Area Groundwater OU	1983	Ongoing		5,267,510,897	471,042	PCE, TCE
TNX-Area OU	1996	2007	80	3,500,000		
Airlift Recirculation Pumps						
A/M-Area Groundwater OU	1997	Ongoing	0.08	1,900,000,000		
Thermal Treatments				***(yd^3)***		
Dynamic Underground Stripping						
A/M-Area Groundwater OU	2000	2001	1.10	1,350,000		
A/M-Area Groundwater OU	2005	2010		12,000,000		
Electrical Resistance Heating with Soil Vapor Extraction						
C-Area Groundwater	2006	2006	0.02	1,800		
Chemicals, Metals, and Pesticides Pits	2008	2008	0.05	5,300		
Detritiation						
DAOU	2009	2011		1,650	472 Ci	Tritium
Soil Vapor Extraction				***(yd^3)***		
Mechanical						
A-Area Burning/Rubble Pits and Rubble Pit, Miscellaneous Chemical Basin, Metals Burning Pit	2001	Ongoing	0.34	55,000		
A-Area Miscellaneous Rubble Pile	2004	Ongoing		6,000		
A/M-Area Groundwater OU	1995	Ongoing				
C-Area Burning/Rubble Pit	2000	2004	0.28	4,500		
M-Area Inactive Process Sewer Line	2008	Ongoing	0.05	1,200		
CMP Pits Field A	2002	2005	0.56	9,000		
CMP Pits Field B	2001	2002	0.21	3,400		

Table A-3. Summary of Remedial Actions with Operating Equipment at SRS *(continued)*

Operating Equipment (Ranked by Active to Passive Technologies)

OU Name	Start	Finish	Zone of Influence Area (acres)	Volume Treated	Volume Removed (lbs)	Description (as of 12/1/09)
Soil Vapor Extraction				***(yd3)***		
			MicroBlowers™			
A-Area Burning/Rubble Pits and Rubble Pit	2003	Ongoing	0.07	1,200		
Miscellaneous Chemical Basin, Metals Burning Pit	2001	Ongoing	0.04	580		
A/M-Area Groundwater OU	2006	Ongoing				
C-Area Burning/Rubble Pit	2004	Ongoing	0.03	465	140	2 yrs TCE
DAOU	2010	Ongoing		4,000		
M-Area Inactive Process Sewer Line	2008	Ongoing				
PAOU	2010	Ongoing		94,622		
TNX-Area OU	2007	Ongoing		1,500		
			BaroBalls™			
A-Area Burning/Rubble Pits and Rubble Pit	2003	Ongoing	0.22	3,500		
Miscellaneous Chemical Basin, Metals Burning Pit	2001	Ongoing	0.19	3,200		
A/M-Area Groundwater OU	1998	Ongoing				
Chemicals, Metals, and Pesticides Pits	2002	Ongoing				
MAOU	2010	Ongoing	0.59	4,350		
P-Area Burning/Rubble Pit	2004	Ongoing	0.03	1,400		
Injection						
			Base Injection with Vertical Barrier Walls			
F-Area Groundwater OU	2205	Ongoing				
H-Area Groundwater OU	2010	Ongoing				
			Edible Oil			
TNX-Area OU	2008	2010				

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

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	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)
Grace Road Site (631-22G)	No Action
Gunsite 113 Access Road Unit (631-24G)	No Action
Gunsite 218 (621-23G)	No Action
Gunsite 720 Rubble Pit Unit (631-16G)	No Action
Hydrofluoric Acid Spill	No Action
K-Area and PAR Pond Sludge Land Application Site	No Action
L-Area Northern Groundwater	No Action
M-Area West Unit (631-21G)	No Action
R-Area Acid/Caustic Basin	No Action
Road A Chemical Basin	No Action
SRL Oil Test Site (080-16G)	No Action
West of SRL "Georgia Fields" Site (631-19G)	No Action
No Action/No Further Action Waste Units Associated with OUs Requiring Remedial Action	
108-4R Overflow Basin (108-4R)	No Further Action
Central Shops Burning/Rubble Pit (631-5G)	No Action
Gas Cylinder Disposal Facility (131-2L)	No Action
L-Area Rubble Pile (131-3L)	No Action
L-Area Acid/Caustic Basin (904-79G)	No Action
Rubble Pile Across From Gunsite 012 (NBN)	No Action
ECODS G-3 (Adjacent to Gunsite 012) (NBN)	No Action
RCRA No Further Action	
H-Area Hazardous Waste Management Facility (904-44G, -45G, -46G, -56G)	No Further Action (Low Permeability Cap)
Tank 105-C Hazardous Waste Management Facility	No Further Action
F-Area Hazardous Waste Management Facility (904-41G, -42G, -43G)	No Further Action (Low Permeability Cap, In Situ S/S)
Mixed Waste Management Facility (643-28E)	No Further Action (Low Permeability Cap)

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

#[a]	OU Subunits[b]	CERCLIS #
1	A-Area Burning/Rubble Pit, 731-1A	28
1	A-Area Burning/Rubble Pit, 731-A	28
1	A-Area Rubble Pit, 731-2A	28
1	Miscellaneous Chemical Basin, 731-4A	28
1	Metals Burning Pit, 731-5A	28
2	A-Area Miscellaneous Rubble Pile, 731-6A	30
3	A/M Area Groundwater	36
4	C-Area Burning/Rubble Pit, 131-C	31
4	Old C-Area Burning/Rubble Pit, NBN	31
5	C-Area Groundwater	82
6	C-Area Reactor Seepage Basin, 904-66G	60
6	C-Area Reactor Seepage Basin, 904-67G	60
6	C-Area Reactor Seepage Basin, 904-68G	60
7	Central Shops Burning/Rubble Pit, 631-1G	50
7	Central Shops Burning/Rubble Pit, 631-3G	50
8	CMP Pit, 080-170G	24
8	CMP Pit, 080-171G	24
8	CMP Pit, 080-180G	24
8	CMP Pit, 080-181G	24
8	CMP Pit, 080-182G	24
8	CMP Pit, 080-183G	24
8	CMP Pit, 080-190G	24
9	C-, K-, L- and R-Reactor Complexes (*P-Reactor also shown as #43; R-Reactor also shown as #47)	79, 90,91,95
10	D-Area Burning/Rubble Pit, 431-D	15
10	D-Area Burning/Rubble Pit, 431-1D	15
11	D-Area Ash Basin, 488-D	67
11	D-Area Rubble Pit, 431-2D	67
12	D-Area Oil Seepage Basin, 631-G	27
13	D-Area Coal Pile Runoff Basin, 489-D	63
13	D-Area Waste Oil Facility, 484-10D	63
13	D-Area Asbestos Pit, 080-20G	63
13	Combined Spills from 483-D and Associated Areas, NBN	63
13	D-Area Process Sewer Lines as Abandoned, NBN	63
14	E-Area Low Level Waste Facility, 643-26E	86
15	ECODS L-1, NBN	22
15	ECODS P-2, NBN	22
15	ECODS R-1A, -1B, -1C, NBN	22
15	ECODS N-2, NBN	22
16	F-Area Burning/Rubble Pit, 231-1F	14
16	F-Area Burning/Rubble Pit, 231-2F	14
16	F-Area Burning/Rubble Pit, 231-F	14
17	F-Area Groundwater Operable Unit (904-41G, 904-42G, 904-43G)	8
18	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-41G)	6
18	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-42G)	6
18	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-43G)	6
19	F-Area Retention Basin, 281-3F	23

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

#[a]	OU Subunits[b]	CERCLIS #
20	Ford Building Seepage Basin, 904-91G	58
21	General Separations Area Consolidation Unit including Old Radioactive Waste Burial Ground(643-E) and Old Solvent Tanks (650-01E through 650-22E)	32
21	Warner's Pond, 685-23G and Spill of 3/08/1978 of Unknown Seepage Basin Pipe Leak in H-Area Seepage Basin and Spill on 02/08/1978 of Unknown H-Area Process Sewer Line Cave-In, NBN	32
21	H-Area Retention Basin, 281-3H and Spill of 5/01/1956 of Unknown Retention Basin Pipe Leak, NBN	21
21	HP-52 Ponds, NBN	21
22	Gunsite 012 Rubble Pile, NBN	22
22	Rubble Pile across from Gunsite 012, NBN	22
22	ECODS G-3 (Adjacent to Gunsite 012), NBN	22
23	H-Area Groundwater OU	23
24	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-44G)	24
24	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-46G)	24
24	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-45G)	24
24	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-56G)	24
25	Heavy Equipment Wash Basin, NBN	25
26	K-Area Bingham Pump Outage Pit, 430-1G	26
27	K-Area Burning/Rubble Pit, 131-K	27
27	K-Area Rubble Pile, 631-20G	27
28	K-Area Reactor Seepage Basin, 904-65G	28
29	L-Area Bingham Pump Outage Pit, 643-2G	29
29	L-Area Bingham Pump Outage Pit, 643-3G	29
29	P-Area Bingham Pump Outage Pit, 643-4G	29
30	L-Area Burning/Rubble Pit, 131-L	30
31	L-Area Hot Shop, 717-G (including Sandblast Area CML-003, NBN)	31
32	L-Area Oil Chemical Basin, 904-83G	32
33	L-Area Reactor Seepage Basin, 904-64G	33
34	L-Area Southern Groundwater, NBN	34
35	M-Area Hazardous Waste Management Facility: Lost Lake, 904-51G)	35
35	M-Area Hazardous Waste Management Facility: M-Area Settling Basin, 904-51G	35
36	M-Area Settling Basin Inactive Process Sewers to Manhole 1, (081-M)	36
37	Inactive Clay Process Sewer Lines (Including Potential Release of TCT, TET, TCE, HNO3, U, Heavy Metals from 321-M Abandoned Sewer Line), NBN	37
37	Salvage Yard, 741-A	37
37	M-Area Underground Sump 321-M #001	37
37	M-Area Underground Sump 321-M #002	37
37	M-Area Test Pile Facility, 305-A	37
38	Metallurgical Laboratory Hazardous Waste Management Facility (904-110G)	2
39	Mixed Waste Management Facility, 643-28E	33
40	Old F-Area Seepage Basin, 904-49G	16
41	PAR Pond (including the Pre-Cooler Ponds and Canals), 685-G	35
42	P-Area Burning/Rubble Pit, 131-P	59
43	P-Area Ash Basin (including Outfall P-007), 188-P	94
43	Potential Release from P-Area Disassembly Basin, NBN	94
43	Potential Release from P-Area Reactor Cooling Water System, 186/190-P	94

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

#[a]	OU Subunits[b]	CERCLIS #
43	P-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN	94
43	P-Area Process Sewer Lines as Abandoned, NBN and Spill on 3/15/79 of 5500 Gallons of Contaminated Water, NBN	94
44	P-Area Reactor Seepage Basin, 904-61G	66
44	P-Area Reactor Seepage Basin, 904-62G	66
44	P-Area Reactor Seepage Basin, 904-63G	66
45	R-Area Bingham Pump Outage Pit, 643-10G	38
45	R-Area Bingham Pump Outage Pit, 643-8G	38
45	R-Area Bingham Pump Outage Pit, 643-9G	38
45	R-Area Unknown Pit #1 (Runk-1), NBN	38
45	R-Area Unknown Pit #2 (Runk-2), NBN	38
45	R-Area Unknown Pit #3 (Runk-3), NBN	38
46	R-Area Burning/Rubble Pit, 131-1R	43
46	R-Area Burning/Rubble Pit, 131-R	43
46	R-Area Rubble Pit, 631-25G	43
47	Area on the North Side of Building 105-R	95
47	Laydown Area North of 105-R	95
47	R-Area Cooling Water Effluent Sump, 107-R	95
47	Potential Release of NaOH/H2SO4 from 183-2R, NBN	95
47	R-Area Ash Basin, 188-R	95
47	Potential Release from R-Area Disassembly Basin, NBN	95
47	R-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN	95
47	Release from the Decontamination of R-Reactor Disassembly Basin, NBN	95
47	Combined Spills North of Building 105-R, NBN	95
47	R-Area Process Sewer Lines as Abandoned, NBN	95
47	R-Area Reactor Building, 105-R	95
48	R-Area Reactor Seepage Basin, 904-103G	25
48	R-Area Reactor Seepage Basin, 904-104G	25
48	R-Area Reactor Seepage Basin, 904-57G	25
48	R-Area Reactor Seepage Basin, 904-58G	25
48	R-Area Reactor Seepage Basin, 904-59G	25
48	R-Area Reactor Seepage Basin, 904-60G	25
49	Silverton Road Waste Site, 731-3A	13
50	SRL Seepage Basin, 904-53G1	47
50	SRL Seepage Basin, 904-53G2	47
50	SRL Seepage Basin, 904-54G	47
50	SRL Seepage Basin, 904-55G	47
51	Neutralization Sump, 678-T	96
51	X-001 Outfall Drainage Ditch, NBN	96
51	TNX Outfall Delta, Lower Discharge Gully and Swamp, NBN	96
51	TNX-Area Process Sewer Lines and Tile Fields as Abandoned, NBN	96
52	TNX Groundwater, 082G	21
52	New TNX Seepage Basin, 901-102G	29
52	Old TNX Seepage Basin, 904-76G	29
52	TNX Burying Ground, 643-5G (Including Spill on 1/12/53 of ½ Ton of Uranyl Nitrate, NBN)	29

a # Corresponds to Map numbers shown in Figure A-1.
b OU subunits include RCRA/CERCLA units and RCRA regulated units. D&D facilities are not represented.

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EVALUATION OF CHANGES IN STANDARDS AND TOXICITY

This appendix provides an evaluation of changes in standards and toxicity for chemical and radiological constituents since the last five-year remedy review was initiated in 2007. The purpose of the evaluation is to determine if there are any changes in standards or toxicity values that would call into question the protectiveness of the remedy for the 52 remedy reviews evaluated in this report. No protectiveness issues with respect to changes in standards and toxicity were identified in the previous five-year remedy review report.

The most current chemical and radiological risk based screening levels and/or standards were compared to the values available in 2007 when the last five-year remedy review was initiated. The following list contains the references for the current levels evaluated in this review.

- United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for Non Radiological Constituents (May 2012);
- USEPA Preliminary Remediation Goals (PRGs) for Radionuclides (August 2010); and
- USEPA Maximum Contaminant Levels (MCLs).

The evaluation was performed for analytes that were identified as constituents of concern (COCs) for each of the operable units (OUs) evaluated. Table B-1 shows the nonradiological (i.e., chemical) soil PRGs available in 2007 compared to the 2012 nonradiological soil RSLs[a] (i.e., formerly PRGs). Table B-2 shows the comparison of the radiological soil PRGs available in 2007 and the current PRG values. Soil media for most OUs is remediated to human health industrial cleanup standards as designated by the land use. However, the levels for both the industrial worker and hypothetical residential receptor are provided for comparative purposes. For groundwater media, Table B-3a provides the current USEPA MCLs for nonradiological constituents. In the absence of an MCL, a comparison of drinking water PRGs available in 2007 to the most current nonradiological drinking water RSLs is provided in Table B-3b. MCLs are available for all radiological analytes in groundwater media as shown in Table B-4.

[a] Radiological and nonradiological constituents were previously identified as PRGs. The term "RSLs" was introduced for nonradiological constituents in September 2008.

Rather than generate a comparison table for each of the 52 remedy reviews contained in this report, Tables B-1 through B-4 were developed to serve as a comprehensive reference for all OUs. In Tables B-1 through B-4, CERCLIS numbers are shown for each analyte to identify the OU(s) where the analyte was initially identified as a COC. In the event that a significant change is identified for a chemical and/or radiological analyte, the applicable OU(s) were reviewed to determine if there was any impact to the selected remedy.

In many cases, a change in a standard or value is irrelevant because the analyte(s) may no longer be present or is significantly reduced if the selected remedy included excavation and offsite disposal, treatment technologies, etc. In addition, exposure to contaminants may be controlled by cover systems or stabilization remedies. The comparison tables do not make any distinction between COCs that were the primary drivers for the selected remedial action and other analytes that were simply addressed through the same remedy. Most importantly, the values presented in Tables B-1 through B-4 are not cleanup levels and should not be considered remedial goals unless otherwise noted in the OU-specific remedy reviews. For these reasons, the information in Appendix B is not stand alone, but must be considered in context with the information and selected remedy presented in the OU-specific reviews located in Appendix C through Appendix BBB.

More conservative (i.e., lower) soil screening levels were identified in 2012 for some analytes as shown in Table B-1 and Table B-2. Changes to the soil screening level is unique to each analyte and is often related to revisions in reference doses, cancer potency factors, and exposure pathways used to calculate the screening value. For the reasons explained in the previous paragraph, the impact that more stringent RSLs or PRGs have on protectiveness must be considered with respect to the OU-specific remedy. For example, a significant change to the soil RSL for 1,1-dichloroethane (100 times more stringent in 2012) is shown in Table B-1. This constituent was identified as a COC for the Mixed Waste Management Facility (643-28E), CERCLIS #33. However, the remedy for this OU was a low permeability cover system designed to prevent contact with the contaminated soil and prevent contaminant mobility to groundwater. Land use controls are also in place to restrict access. The change to a more conservative RSL for 1,1-dichloroethane appears significant (100 times more stringent in 2012), when in reality, the remedy remains protective because the cover system eliminates the exposure pathway. Another

factor to consider is background concentrations at the OU. In some cases, the change to a RSL or PRG is still lower (more conservative) than what is found naturally occurring in background. In this situation, the remedial goal is established at a background concentration and the PRG or RSL value is inconsequential.

For groundwater, the MCL for two constituents changed in prior years. In 2001, the MCL for arsenic changed from 50 μg/L to 10 μg/L. The MCL value for total trihalomethanes was revised from 100 μg/L to 80 μg/L in 2003. Although both of these changes were relevant for the previous five-year remedy review report, the change is recognized again to demonstrate that the revised MCL for these two nonradiological constituents did not result in any changes for the physical remedies or call into question the protectiveness of the remedies. In the absence of nonradiological MCLs, a comparison of the PRG values available in 2007 to the 2012 RSL values for drinking water was also conducted and did not indicate any significant changes that would impact the protectiveness of the remedy.

The carcinogenic and noncarcinogenic soil toxicity values for PCE and TCE have changed since the 2007 five-year remedy review. As previously explained, MCLs are the primary standard for protection of groundwater and the MCLs for TCE and PCE have not changed. Therefore, changes in soil toxicity values for PCE and TCE do not impact the protectiveness of SRS groundwater remedies. Any future revision to the MCLs for TCE and PCE will be considered in subsequent five-year remedy reviews as appropriate.

The evaluation for each remedy to determine if exposure assumptions, toxicity data, cleanup levels, and remedial action objectives are still valid is discussed in each OU-specific review located in Appendix C through Appendix BBB. The evaluations shown in Tables B-1 through B-4 confirm that there have been no significant changes in standards or toxicity factors for the COCs identified for each OU that would affect the protectiveness of the 52 remedies evaluated in this report.

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

Analyte	2007 PRGs[a]		2012 RSLs[b]		CERCLIS Number
	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	
Aluminum	7.6E+04	1.0E+05	7.7E+04	9.9E+05	17, 33,76
Antimony and compounds	3.1E+01	4.1E+02	3.1E+01	4.1E+02	59,67
Arsenic	3.9E-01	1.6E+00	3.9E-01	1.6E+00	13,14,15,17,23, 28,30,32,40,58,63, 66,67, 78,94
Barium and compounds	5.4E+03	6.7E+04	1.5E+04	1.9E+05	6, 7, 33, 43, 67
Beryllium and compounds	1.5E+02	1.9E+03	1.6E+02	2.0E+03	33, 67
Cadmium	3.7E+01	4.5E+02	7.0E+01	8.0E+02	6,7,17, 32,33,43,56
Chlordane	1.6E+00	6.5E+00	1.6E+00	6.5E+00	53
Chloroform	2.2E-01	4.7E-01	2.9E-01	1.5E+00	33
Chromium (III)	1.0E+05	1.0E+05	1.2E+05	1.5E+06	59
Chromium (VI)	3.0E+01	6.4E+01	2.9E-01	5.6E+00	17, 47
Copper	3.1E+03	4.1E+04	3.1E+03	4.1E+04	7,43,56,59
DDD	2.4E+00	1.0E+01	2.0E+00	7.2E+00	24
DDE	1.7E+00	7.0E+00	1.4E+00	5.1E+00	24,53
DDT	1.7E+00	7.0E+00	1.7E+00	7.0E+00	24,53
Dibenzofuran	1.5E+02	1.6E+03	7.8E+01	1.0E+03	59
1,1-Dichloroethane	5.1E+02	1.7E+03	3.3E+00	1.7E+01	33
1,2-Dichloroethane	2.8E-01	6.0E-01	4.3E-01	2.2E+00	33
Dieldrin	3.0E-02	1.1E-01	3.0E-02	1.1E-01	24
Hexachlorodibenzo-p-dioxin, Mixture	NA	NA	9.4E-05	3.9E-04	31
Dioxin (2,3,7,8-TCDD)	3.9E-06	1.6E-05	4.5E-06	1.8E-05	14,15,53
Endrin	1.8E+01	1.8E+02	1.8E+01	1.8E+02	24
Furan	2.5E+00	8.5E+00	7.8E+01	1.0E+03	53
Heptachlor epoxide	5.3E-02	1.9E-01	5.3E-02	1.9E-01	24,53
Iron	2.3E+04	1.0E+05	5.5E+04	7.2E+05	33,67,76
Lead and Compounds	4.0E+02	8.0E+02	4.0E+02	8.0E+02	17, ,32,33,43,56
Manganese	1.8E+03	1.9E+04	1.8E+03	2.3E+04	15,33,43
Mercury and compounds	2.3E+01	3.1E+02	1.0E+01	4.3E+01	21,32,47,56,67,96
Methylene chloride	9.1E+00	2.1E+01	5.6E+01	9.6E+02	24
Nickel (soluble salts)	1.6E+03	2.0E+04	1.5E+03	2.0E+04	6,7,17,33,59
Phenol	1.8E+04	1.0E+05	1.8E+04	1.8E+05	33
Polychlorinated biphenyls (PCBs)					
~Aroclor 1242	2.2E-01	7.4E-01	2.2E-01	7.4E-01	59
~Aroclor 1254	2.2E-01	7.4E-01	2.2E-01	7.4E-01	14,26,30,39,56,58, 67,79,90,91,94,95
~Aroclor 1260	2.2E-01	7.4E-01	2.2E-01	7.4E-01	15,24,26, 39,67,96
Polynuclear Aromatic Hydrocarbons (PAHs)					
~Benzo[a]anthracene	6.2E-01	2.1E+00	1.5E-01	2.1E+00	30,40,50,59,78

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

Analyte	2007 PRGs[a]		2012 RSLs[b]		CERCLIS Number
	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	
~Benzo[j]fluoranthene	NA	NA	3.8E-01	1.3E+00	26,30,39,50
~Benzo[a]pyrene	6.2E-02	2.1E-01	1.5E-02	2.1E-01	13,14,15,26,30,38,39, 40,50,53,59,67,78
~Benzo[b]fluoranthene	6.2E-01	2.1E+00	1.5E-01	2.1E+00	59,78
~Benzo[k]fluoranthene	6.2E+00	2.1E+01	1.5E+00	2.1E+01	40,59,78
~Chrysene	6.2E+01	2.1E+02	1.5E+01	2.1E+02	59
~Dibenzo[a,h]anthracene	6.2E-02	2.1E-01	1.5E-02	2.1E-01	13,26,30,38,39,40, 50,59,78
~Fluoranthene	2.3E+03	2.2E+04	2.3E+03	2.2E+04	59
~Indeno[1,2,3-cd]pyrene	6.2E-01	2.1E+00	1.5E-01	2.1E+00	40,50,59,78
~Methylnaphthalene, 2-			2.3E+02	2.2E+03	63
~Pyrene	2.3E+03	2.9E+04	1.7E+03	1.7E+04	59
Selenium	3.9E+02	5.1E+03	3.9E+02	5.1E+03	28,67
Silver	3.9E+02	5.1E+03	3.9E+02	5.1E+03	21,47
Tetrachloroethylene (PCE)	4.8E-01	1.3E+00	2.2E+01	1.1E+02	6,7,19, 24,28, 30,33, 43,59,63,92,94
Thallium (Soluble Salts)	5.2E+00	6.7E+01	7.8E-01	1.0E+01	17,23,43,67
Trichloroethylene (TCE)	5.3E-02	1.1E-01	9.1E-01	6.4E+00	6,7,19,28,30,31,33, 59,92,94
Uranium (Soluble Salts)	1.6E+01	2.0E+02	2.3E+02	3.1E+03	79,90,91,94,95
Vanadium and Compounds	7.8E+01	1.0E+03	3.9E+02	5.2E+03	17,47,67,76
Vinyl Chloride	7.9E-02	7.5E-01	6.0E-02	1.7E+00	33
Zinc and Compounds	2.3E+04	1.0E+05	2.3E+04	3.1E+05	6,7,33,43,59,67

[a] USEPA Region 9 Nonradiological PRGs, October 2004.
[b] USEPA Nonradiological RSLs, May 2012.
NA Not available

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

Analyte	2007 PRGs[a]		2012 PRGs[b]		CERCLIS Number
	Residential Soil (pCi/g)	Industrial Worker Soil (pCi/g)	Resident Soil (pCi/g)	Industrial Worker Soil (pCi/g)	
Actinium-228	7.32E+02	1.18E+03	6.79E+02	9.88E+02	21,23,47,67,96
Americium-241	1.97E+00	5.71E+00	1.89E+00	4.82E+00	6,7,16,17,25,32,47,55, 79,90,91,94,95
Americium-243+D	1.67E-01	3.41E-01	1.57E-01	2.88E-01	79,90,91,94,95
Bismuth-133	1.75E-01	3.03E-01	1.73E-01	2.69E-01	79,90,91,94,95
Bismuth-212	2.27E+04	3.67E+04	2.06E+04	2.99E+04	76
Bismuth-214	8.19E+03	1.32E+04	7.95E+03	1.16E+04	76
Carbon-14	2.79E+02	1.23E+03	2.79E+02	1.11E+03	25,32,33,55,60,79,90, 91,94,95
Cerium-137	5.06E+04	8.18E+04	4.69E+04	6.83E+04	14,16,25,
Curium-243	3.51E-01	6.74E-01	3.33E-01	5.75E-01	6,7,23,47,79,90,91,94, 95
Curium -244	7.36E+00	3.98E+01	7.25E+00	3.41E+01	6,7,17,23,47, 79,90,91,94,95
Curium -245	4.16E-01	8.70E-01	3.95E-01	7.40E-01	79,90,91,94,95
Curium -246	3.74E+00	1.96E+01	3.69E+00	1.69E+01	6,7
Cobalt-60	3.62E-02	5.96E-02	3.90E-02	5.78E-02	6,7,16,17,25,32,38, 47, 55,58,60,65,66,76, 79,90,91,94,95
Cesium-137+D	6.05E-02	1.12E-01	6.23E-02	1.03E-01	6,7,13,16,17,20,21,23, 32,35,38,47,55,58, 60, 65,66,76,79,90,91,94, 95
Europium-152	4.16E-02	7.31E-02	4.06E-02	6.43E-02	17,79,90,91,94,95
Europium-154	4.99E-02	8.50E-02	4.80E-02	7.35E-02	16,17,23,58,76, 79,90,91,94,95
Tritium (H-3)	2.69E+00	4.23E+00	9.34E-01	1.27E+00	6,7,32,33,63,79,90,91,94, 95
Iodine-129	2.52E+00	1.08E+01	2.49E+00	9.49E+00	16,32
Potassium-40	1.38E-01	2.71E-01	1.50E-01	2.65E-01	14,16,17,23, 28,32,47,60, 67,76,79,90,91,94, 95
Molybdenum-93	1.16E+02	3.45E+02	1.14E+02	2.99E+02	79,90,91,94,95
Sodium-22	8.66E-02	1.40E-01	9.04E-02	1.32E-01	79,90,91,94,95
Niobium-94	1.53E-02	2.97E-02	1.60E-02	2.79E-02	79,90,91,94,95
Niobium-95	6.81E+00	1.10E+01	7.11E+00	1.03E+01	16
Nickel-59	1.08E+03	1.23E+04	1.08E+03	1.11E+04	79,90,91,94,95
Nickel-63	4.93E+02	5.55E+03	4.93E+02	4.99E+03	60, 79,90,91,94,95
Neptunium-237+D	1.36E-01	2.70E-01	1.26E-01	2.25E-01	32
Lead-212	3.70E+03	6.07E+03	3.60E+03	5.33E+03	21,23,47,67,96
Lead-214	4.63E+04	7.49E+04	4.48E+04	6.53E+04	76

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

Analyte	2007 PRGs[a]		2012 PRGs[b]		CERCLIS Number
	Residential Soil (pCi/g)	Industrial Worker Soil (pCi/g)	Resident Soil (pCi/g)	Industrial Worker Soil (pCi/g)	
Promethium-147	2.37E+04	3.84E+04	2.38E+04	3.46E+04	65
Plutonium-238	3.27E+00	1.66E+01	3.23E+00	1.44E+01	17,25,32,47, 79, 90,91,94, 95
Plutonium -239	2.86E+00	1.45E+01	2.82E+00	1.25E+01	17,23,25,32,47, 55,60, 65,66,79,90,91,94,95
Plutonium -240	2.86E+00	1.46E+01	2.83E+00	1.27E+01	23,25,55,79,90,91,94, 95
Radium-226+D	1.31E-02	2.55E-02	1.27E-02	2.23E-02	6,7,15, 23,28,32,67, 76,79,90,91,94,95
Radium-228+D	8.54E-02	1.49E-01	3.19E-02	4.84E-02	6,7,15,16,21,28,47, 60,67,76,79,90, 91,94, 95,96
Antimony-125	4.62E-01	7.50E-01	4.72E-01	6.88E-01	17,79, 90,91,94,95
Strontium-90+D	3.92E+00	1.07E+01	3.71E+00	8.91E+00	6,7,14,17,23,25,32, 47, 55,60,65,66,79, 90, 91, 94,95
Technetium-99	9.63E+01	8.94E+02	9.61E+01	7.96E+02	6,7,32
Thorium-228+D	1.54E-01	2.52E-01	1.54E-01	2.30E-01	21,28,32,47,67,76,79, 90,91,94,95,96
Thorium-234	1.37E+03	3.25E+03	2.80E+02	4.07E+02	21,67
Thallium-208	2.26E+04	3.65E+04	2.31E+04	3.36E+04	76
Uranium-233	4.75E+00	2.95E+01	4.70E+00	2.55E+01	6,7,21
Uranium-234	4.97E+00	3.34E+01	4.92E+00	2.91E+01	6,7,17,21,33,67
Uranium-235+D	1.97E-01	3.94E-01	1.94E-01	3.48E-01	17,21,32,33,47, 67,96
Uranium-238+D	7.77E-01	1.79E+00	7.25E-01	1.49E+00	6,7,17,21,28,32,33,47, 67,79,90,91,94,95,96

[a] USEPA Radiological PRGs, September 2002.
[b] USEPA Radiological PRGs, August 2010.

Table B-3a. Nonradiological Standards in Groundwater Media (MCLs)[a]

Analyte	MCL (µg/L)	CERCLIS Number
Antimony	6	6,7,8,9
Arsenic	10	6,7,8,9,13,67
Barium	2,000	6,7,8,9
Benzene	5	6,7,8,9,27
Beryllium	4	6,7,9
Bis(2-ethylhexl)phthalate	6	8,9,13,24
Cadmium	5	6,7,8,9
Carbon tetrachloride	5	13,24,29,36,56
Chromium	100	6, 8,9,15
Copper	1,300	9
Cyanide	200	6,7,8,9
1-1-Dichloroethene (DCE)	7	27,59
cis-1,2-Dichloroethene (DCE)	70	27,31
Dichloromethane (methylene chloride)	5	9,24,27,31,36
Lead	15	6,7,8,9,36
Lindane	0.2	24
Mercury	2	6,7,8,9,29
Nitrate	10,000	6,7,8,9
Selenium	50	6,7,8,9
Tetrachloroethylene (PCE)	5	2,6,7,8,9,24,27,29,31,36,40, 77
Thallium	2	6,7,8,9, 13,67
Trichloroethylene (TCE)	5	2,6,7,8,9,24,27,29,31,36,40, 59,77,82
Trihalomethanes (total)	80	6,7,24,56
Uranium	30	6,7,29
Vinyl chloride	2	27,31

[a] Current MCL table provided for reference only. Comparative analysis is not shown because MCLs have not changed since previous five-year remedy review.

Table B-3b. Comparison of Nonradiological Standards in Groundwater Media (2007 PRGs and 2012 RSLs)

Analyte	2007 PRG[a] (µg/L)	2012 RSL[b] (µg/L)	CERCLIS Number
Aldrin	3.95E-03	4.0E-03	13
alpha-Benzene hexachloride (BHC)	1.07E-02	6.2E-03	24
beta-Benzene hexachloride (BHC)	3.74E-02	2.2E-02	24
delta-Benzene hexachloride (BHC) (cyclohexane)	1.03E+04	1.3E+04	24
Cobalt	7.30E+02	4.7E+00	8,9
Dieldrin	4.20E-03	1.5E-03	13,24
Nickel	7.30E+02	3.0E+02	6,7,8
Phenol	1.09E+04	4.5E+03	6,7,8
Silver	1.82E+02	7.1E+01	6,7,8,9
Tin	2.19E+04	9.3E+03	9
Trichlorofluoromethane	1.29E+03	1.1E+03	6,7,8,9
Vanadium	3.65E+01	7.8E+01	6,7,8,9
Zinc	1.09E+04	4.7E+03	6,7,8,9

[a] USEPA Region 9 Nonradiological PRGs, October 2004.
[b] USEPA Nonradiological RSLs, May 2012.

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

Analyte	MCL (pCi/L)	CERCLIS Number
Amercium-241	15[b]	6,7,9,25
Carbon-14	2,000[b]	6,7,9
Cesium-137	200[c]	6,7,8
Cobalt-60	100[c]	6,7,9
Curium-242	15[b]	6,7,8,9
Curium-243/244	15[b]	6,7,8,9
Curium-246	15[b]	6,7,8
Iodine-129	1[b]	6,7,8,9
Nickel-63	50[c]	9
Plutonium-238	15[a]	6,7,8,9
Plutonium-239/240	15[a]	6,7,8,9
Radium-226	5[d]	6,7,8,9, 3,29
Radium-228	5[d]	6,7,8,29
Radium total	5 [d]	6,7,8,9,13
Strontium-90	8[c]	6,7,8,9,25
Technetium-99	900[b]	6,7,8,9
Thorium-228	15[b]	6,7,8,9
Thorium-230	15[b]	6,7,8,9
Tritium	20,000[c]	6,7,8,9,77
Uranium-233/234	10[e]	6,7,8,9
Uranium-234	10[e]	6,7,9
Uranium-235	0.5[e]	6,7,8,9
Uranium-238	10[e]	6,7,8,9

[a] Current MCL table provided for reference only. Comparative analysis is not shown because MCLs have not changed since previous five-year remedy review.
[b] Gross alpha particle activity = 15 pCi/L
[c] Man-made beta/gamma emitters = 4 mrem/year dose
[d] Combined radium-226 and radium-228 = 5 pCi/L
[e] Uranium values based on MCL of 30 µg/L; derived using naturally occurring isotopes of uranium in secular equilibrium.

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A-AREA BURNING/RUBBLE PITS (731-A, -1A) AND RUBBLE PIT (731-2A) MISCELLANEOUS CHEMICAL BASIN/METALS BURNING PIT (731-4A, -5A) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) (ABRP) and Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/731-5A) (MCB/MBP) Operable Unit (OU). The review was conducted from August 2012 through October 2012. Contaminants have been left in place at the OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table C-1 lists the chronology of events for the ABRP/MCB/MBP OU.

III. Background

ABRP and MCB/MBP are listed as separate Resource Conservation and Recovery Act (RCRA) / Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) units in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for the Savannah River Site (SRS). To achieve final closure, the individual units have been consolidated to form the ABRP/MCB/MBP OU. The media of concern is surface and vadose zone soils. The final action for the groundwater in the area is being addressed under the A/M Groundwater OU corrective action.

Physical Characteristics

The ABRP/MCB/MBP OU is located approximately 4.8 km (3 mi) east of the SRS boundary and 2.4 km (1.5 mi) south of M Area (Figure C-1). The OU is situated on the eastern edge of a north-south trending topographic ridge within the Upper Three Runs watershed. This ridge drains east to Tim's Branch and west to the Savannah River

floodplain. Its relief is characterized by flat areas and a few low rolling hills. Pine/hardwood forests are dominant, with some grassy areas.

The ABRP/MCB/MBP OU is comprised of the following subunits (Figure C-2):

ABRP Area Subunits

- A-Area Burning/Rubble Pit (731-A) - constructed in 1951 and is approximately 6.6 m (22 ft) wide, 2.7 to 3 m (9 to 10 ft) deep, and 75 m (250 ft) long:
- A-Area Burning/Rubble Pit (731-1A) - constructed in 1951 and is approximately 6.6 m (22 ft) wide, 2.7 to 3 m (9 to 10 ft) deep, and 75 m (250 ft) long:
- A-Area Rubble Pit (731-2A) - used from about 1951 until 1983 and is approximately 12 m (40 ft) wide, 195 m (650 ft) long, with a depth that could extend to 6 m (20 ft);
- Potential Pit - estimated dimensions of 60 x 78 m (200 x 260 ft);
- Depressional Area - estimated dimensions of 48 x 111 m (160 x 370 ft);
- Ash Scatter Area/Ditch - area is approximately 0.4 hectares (1.0 acre) and the ditch measures approximately 90 x 6 m (300 x 20 ft).
- A-Area Ash Pile (788-2A) - covered approximately 1.02 hectares (2.5 acres) and rose approximately 4.2 to 7.2 m (14 to 24 ft) above the surrounding topography. Based on an average ash thickness of 6 m (20 ft), the total volume of ash was approximated to be 60,435 m3 (79,000 yd3);
- Trench subunit - approximately 4.6 m (15 ft) wide by 91.4 m (300 ft) long, most of which is overlain by about 6.1 m (20 ft) of compacted ash, and is between 2.4 and 4.6 m (8 and 15 ft) deep, with approximately 5% to 10% of the Trench is exposed south of the Ash Pile; and
- Vadose zone in the vicinity of the ABRP is about 40 m (130 ft) thick with the upper 24 m (80 ft) comprised of sands and silt. This is underlain by a predominantly clay, 1.8 to 2.4 m (6 to 8 ft) layer that sits atop another sand/silt layer approximately 12.2 m (40 ft) thick. A perched water zone is present at times just above the clay-rich zone at a depth of 22.9 to 25.9 m (75 to 85 ft) below the surface.

MCB/MBP Subunits

- MCB Surface Soil Subunit –approximately 6 by 6 m (20 by 20 ft) and approximately 0.3 m (1 ft) deep (Figure C-3);
- MCB vadose zone is approximately 36.6 m (120 ft) thick and contains a fine-grained sediment zone up to 4.6 m (15 ft) below ground surface (bgs), underlain by 18.3 to 21.3 m (60 to 70 ft) of sands/silts, a 3.0 m (10 ft) thick clay lens at a depth of 22.9 to 25.9 m (75 to 85 ft), and sands and silts to the water table; and
- MBP Surface Soil Subunit - irregular in shape, approximately 120 by 120 m (400 by 400 ft). Waste materials were piled 0.9 to 1.8 m (3 to 6 ft) high within the MBP boundaries.

Land and Resource Use

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

History of Contamination

Starting in 1951, the three pits, 731-A, -1A and -2A, were used on a monthly basis to burn paper, plastics, wood, rubber, rags, cardboard, oil degreasers, and solvents. After burning was discontinued in October 1973, the burn area was covered with a layer of soil. The pits were subsequently filled with rubble consisting of paper, wood, concrete, empty galvanized steel barrels, and cans. The pits reached capacity in 1978, and were retired from service in 1983. Pits 731-A and 731-1A were covered with native soils to grade-level and vegetation was allowed to re-establish. Rubble Pit 731-2A was backfilled and seeded.

The Potential Pit and Depressional Area were areas of depression/subsidence that were investigated, but produced no evidence of waste disposal. The Ash Scatter Area/Ditch was located between the A-Area Ash Pile (788-2A) and the Depressional Area.

The A-Area Ash Pile (788-2A) subunit was used to dispose of ash from the A-Area Powerhouse prior to 1994, as permitted under Industrial Wastewater Permit No. 7289, issued on June 29, 1981.

The Trench subunit was filled with debris and covered with soil prior to construction of the A-Area Ash Pile (788-2A), and was mostly buried beneath the compacted ash along the eastern portion of the ash pile. No disposal records for the trench have been found.

The MCB was an old borrow pit, later used to receive liquid chemical wastes. No disposal records were kept, though the assumed use was disposal of waste solvents and used oil. It is likely that waste drums were emptied at this site, and the empty drums were discarded at the MBP. Existing records indicate that the basin was in use from about 1956 to 1974.

The MBP was a cleared area used for burning lithium-aluminum alloys, scrap, and cuttings from A/M-Area machining operations. Wastes were primarily contained in two discrete areas: one large pile and a series of small piles oriented in a semi-circular arc. The pit was reportedly placed in service in 1960 and taken out of service in 1974.

Initial Response

Following assessment of the ABRP/MCB/MBP OU, no remedial action was required for the Burning/Rubble Pits 731-A and 731-1A, Depressional Area, Potential Pit, and Ash Scatter Area/Ditch.

An interim Record of Decision (IROD) was approved in November 2000 for ABRP OU (WSRC 2000) to address benzo(a)pyrene contamination in soil at Rubble Pit 731-2A and reduce concentrations of volatile organic compounds (VOCs) in the M-Area aquifer zone. The approved final remedial action for soil was installation of a 1-ft thick earthen cap, coupled with implementation of land use controls (i.e., institutional controls). The approved interim action for groundwater involved the implementation of an active/passive soil vapor extraction (SVE) system (installed at Rubble Pit 731-2A) to reduce VOCs in the M-Area aquifer contaminated plume. A passive SVE system was installed to reduce VOCs in the vadose zone beneath the trench underlying the Ash Pile. An ABRP monitoring well system was installed to determine the effectiveness of the

SVE systems and began operation in September 2001. Based on the results of the first year of operation and subsequent testing of the air sparging system, it was determined that the system had not and likely would not meet the remedial action objectives for the subunit. An Explanation of Significant Differences (ESD) for the ABRP was issued in 2003 to remove the air sparging system and expand the SVE portion of the remedy presented in the ABRP IROD to operate four MicroBlower™-equipped SVE wells at the Trench subunit to remediate VOCs in the vadose zone.

An IROD was approved in December 1999 for MCB/MBP OU (WSRC 1999a) to address elevated levels of aluminum in MBP surface and subsurface soil, elevated levels of polychlorinated biphenyls (PCBs) (i.e., Aroclor 1254 and Aroclor 1260) in MCB surface and subsurface soil, elevated levels of VOCs in MCB vadose zone soils, and elevated levels of VOCs in groundwater. Interim actions at the MCB/MBP OU were taken beginning in 2000 to remove contaminated surface soils exceeding 1,000 µg/kg Aroclor 1254 and 215 µg/kg Aroclor 1260 at MCB, and exceeding 11,000 mg/kg aluminum at MBP (considered final actions), and to treat VOC-contaminated vadose zone soils with active and passive SVE. Contaminated surface soils at MCB/MBP were excavated and shipped to a sanitary landfill. Clean fill was backfilled into the excavated areas. At MCB, the area was cleared and remediation equipment (i.e., active SVE followed by passive SVE using BaroBall™ technology) was installed to treat the contaminated vadose zone soils by lowering VOC concentrations to below 50 ppmv. Three banks of airlift recirculation wells (i.e., in situ air stripping) were used to treat contaminated groundwater.

Basis for Taking Action

No human health, ecological, or contaminant migration (CM) constituents of concern (COCs) have been identified at the Burning/Rubble Pits (731-A, 731-1A), Potential Pit, Depressional Area, and Ash Scatter Area/Ditch subunits. Thus, there is no problem warranting action for these subunits.

Benzo[a]pyrene in surface soil at Rubble Pit 731-2A was identified as a COC for the future industrial worker at concentrations exceeding the remedial goal (RG) of 0.2 mg/kg.

Arsenic and coal-related radionuclides are present at the A-Area Ash Pile subunit (788-2A) at concentrations that exceed the $1x10^{-6}$ risk for the future industrial worker. Arsenic and selenium are present in concentrations that may be predictive of a potential ecological hazard (hazard quotients [HQs] > 1). These RGs are listed in Table C-2.

In 2001, before the start of the interim action, the maximum detection of trichloroethylene (TCE) at the Trench subunit was 487, 000 µg/kg. TCE concentrations in the vadose zone were present at levels expected to migrate to groundwater above the maximum contaminant level (MCL) of 5 µg/L in less than 10 years.

At the MCB subunit, PCBs exceeding both the human health RG (1 mg/kg) and the ecological RG (0.215 mg/kg) were present in surface soils. Octachlorodibenzo-p-dioxin (OCDD) was also present as a human health COC.

In the MCB vadose zone, tetrachloroethylene (PCE) and TCE contamination was found at levels that would migrate to groundwater at a concentration above the MCL of 5 µg/L in less than 10 years.

Aluminum concentrations at the MBP subunit exceeded the ecological RG of 11,000 mg/kg at two areas totaling approximately 1,765 m^2 (19,000 ft^2).

IV. Remedial Actions

Remedy Selection

As stated in the ABRP/MCB/MBP OU ROD (WSRC 2007c), the final RAOs are as follows:

A-Area Ash Pile (788-2A) Subunit

- Prevent human exposure to COCs that present a risk to future industrial workers.
- Prevent ecological exposure to COCs that present a hazard to ecological receptors.

A-Area Trench Subunit

- Prevent migration of TCE contamination in soil to groundwater resulting in concentrations above the TCE MCL of 5 µg/L.

As stated in the ABRP/MCB/MBP OU Interim ROD (WSRC 2000), the final RAOs that were addressed by the interim action are as follows:

A-Area Rubble Pit (731-2A) Surface Soils

- Prevent direct contact with and ingestion of benzo[a]pyrene contaminated surface soul which may present a significant risk ($>1x10^{-6}$ or hazard index=1) to current and future workers.

MCB/MBP Surface and Vadose Zone Soils

- Prevent direct contact with aluminum, OCDD, Aroclor-1254 and Aroclor-1260 contaminated surface/subsurface soils, such that the COCs are not a continued significant risk to human health or the ecological receptors.

As stated in the ABRP/MCB/MBP OU ROD (WSRC 2007c), the selected final remedial actions to meet the RAOs are as follows:

A-Area Ash Pile (788-2A) Subunit (refer to Figures 4 through 6)

- Installation of a soil cover; and
- Institutional controls.

A-Area Trench Subunit

- Expand the existing interim remedial action SVE system (Figure C-7); and
- Institutional controls

MCB Vadose Zone

- Continued passive operation of SVE BaroBall™ wells (Figure C-10); and
- Institutional controls

A-Area Rubble Pit (731-2A) Surface Soils

- Installation of a soil cover; and
- Institutional controls.

MCB Surface Soil (Figures C-8 through C-10)

- Excavation of soil containing levels of Aroclor 1260 above the ecological RG of 215 µg/kg, to consist of soil removal areas 3 and 4 to a maximum depth of 0.3 m (1 ft), and soil removal area 5 to maximum depth of 1.2 m (4 ft). Excavation of the 0.3-m (1-ft) interval will also remove all soil contaminated with Aroclor 1260 above the Applicable or Relevant and Appropriate Requirement (ARAR)-based limit of 1,000 µg/kg;
- Excavation of soil contaminated with Aroclor 1254 above the ARAR limit of 1000 µg/kg to a maximum depth of 0.3 m (1 ft) from soil removal areas 3 and 4 and 1.2 m (4 ft) from soil removal area 5;
- Disposal of excavated soil to a Subtitle D landfill, backfilled with clean fill, vegetation of surface soil; and
- Institutional Controls.

MCB Vadose Zone

- Active SVE wells, transitioned to passive SVE operation in 2004, located in the vicinity of historically high VOC concentrations (>50 ppmv, defined for this OU as a hot spot area). Active SVE wells were transitioned to passive SVE after concentrations decreased to less than 50 ppmv;
- Passive SVE wells located in lower concentration areas (<50 ppmv, considered now to be entire MCB area (Figure C-3); and
- SVE off-gas is monitored to ensure off-gas exhausted to the atmosphere does not exceed air permit limits (<8.67 pounds per hour total VOCs).

MBP Surface and Subsurface Soil

- Excavation of soil containing aluminum in excess of the site-specific maximum background of 11,000 mg/kg to a maximum depth of 1.2 m (4 ft), to consist of soil removal areas 1 and 2;

- Disposal of excavated soil at a Subtitle D landfill, backfilled with clean fill, vegetation of surface soil; and
- Institutional controls.

Remedy Implementation

The selected final action remedies were implemented to meet the RAOs and included the following activities. Remedial actions completed during the interim action phase are noted below.

A-Area Ash Pile (788-2A) Surface Soils

- In 2008, as the final remedial action, installed a 1.02-hectare (2.5-acre) soil cover with a minimum of 45 cm (18 in) of compacted common fill and 15 cm (6 in) of topsoil and sod.

A-Area Rubble Pit (731-2A) Surface Soils (completed during the interim action phase)

- In 2001, installed a 2.4-hectare (6-acre) soil cover with a minimum of 30 cm (12 in) of compacted common fill and 7.5 cm (3 in) of topsoil and sod. The soil cover also covered the Burning/Rubble Pits (731-A, 731-1A) for adequate drainage purposes. This was accepted as part of the final remedial action for the OU.

ABRP Vadose Zone

- In 2001, installed an air sparging system for removal of VOC from the vadose zone contaminated soils. However, air sparging operations were found to be ineffective due to the presence of impermeable soils just above the water table and, with concurrence of the U.S. Environmental Protection Agency (USEPA), South Carolina Department of Health and Environmental Control (SCDHEC) and USDOE, were discontinued in March of 2003. The wells of the sparging system were converted to passive SVE using BaroBalls™.
- In 2003, under the Interim Action, installed four (4) passive SVE wells (operating with either MicroBlowers™ or BaroBalls™) at the Trench Subunit to remove VOCs

from the ABRP vadose zone contaminated soils. The four passive SVE wells installed at this time were ABV-01, ASH-06, AHT-05, and AHT-06.

- In 2008, in support of the final remedial action, installed an active SVE system, consisting of a vacuum blower, condensate removal system, piping to the well bank, 17 extraction wells, and control instrumentation, to treat 42,000 m^3 (55,000 yd^3) of vadose zone soil. Additionally, when the SVEU is not operable, ASH-06, AHT-05, ABV-01 ARV-2D1, ARV-2D2, and ARV-2D3 will be operated as MicroBlower™ SVE wells.
- Near-term, future modification will place ASH-06 into the active SVE system. Further, transitioning of active SVE wells to passive operation will occur prior to the next review. SVE will continue until RAOs are met for the OU.

MCB/MBP Surface Soil (completed during the interim action phase)

- In 2002, removed 10,200 yd^3 (4,000 yd^3 at MCB; 6,200 yd^3 at MBP) of soil contaminated with Aroclor 1260 and Aroclor 1254 by excavating to a depth of 0.3 m (1 ft) in soil removal areas 3 and 4 and 1.2 m (4 ft) in soil removal areas 1, 2, and 5, packaging, and shipping to a Subtitle D landfill; then
- Backfilled 0.59 hectares (1.45 acres) of excavated areas to grade with clean native soil and vegetated surface soil after confirmatory sampling verified that RGs were met; and
- Established a maintenance program for 0.59 hectares (1.45-acre) native soil cover.

MCB Vadose Zone (completed during the interim action phase)

- Installed an active SVE system, consisting of a vacuum blower, condensate removal system, underground piping to the well bank, five extraction wells, and control instrumentation, to treat 459 m^3 (6,000 yd^3) of vadose zone soils. Active SVE was discontinued in 2004 and the system's SVE wells were transitioned to passive SVE operation; and
- Installed additional passive SVE wells to supplement the active SVE system. The current SVE system consists of 2 MicroBlowers™ SVE wells and 25 BaroBalls™

SVE wells. SVE operation will continue at the MCB vadose zone subunit until RAOs are met.

ABRP/MCB/MBP OU

- In 2008, established land use controls for 4.11 hectares (10.13 acres) including posting 11 warning signs.

System Operations/Operation and Maintenance

The ABRP/MCB SVE systems are operational and will continue operations until RGs are achieved for the ABRP/MCB/MBP OU.

The SVE systems, with implementation of the interim and final remedies, in ABRP and MCB started operation in 2001, with full implementation at ABRP in 2008. The active SVE system at ABRP removed approximately 133 lbs TCE. The active system at MCB removed approximately 170 lbs TCE. A quantitative removal estimate is not available for passive SVE but the system is monitored for qualitative results to ensure off-gas concentrations continue to decrease over time. For ABRP, active SVE operations are estimated to continue for another year or so, followed by an estimated 25 years of passive SVE operations. For MCB, passive SVE operations are estimated to continue for an estimate of 25 years. A Performance Evaluation Report (PER) is submitted annually to USEPA and SCDHEC and provides the results and analysis of the baseline sampling prior to active SVE and passive SVE operation and all process and performance monitoring during operation.

The following maintenance activities are ongoing:

- Visual inspections for evidence of damage to the cover systems due to erosion or intrusion by burrowing animals are being performed annually as a minimum. The inspections also address upkeep of the vegetative cover and access control barriers (e.g., the warning signs).

- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, active SVE system maintenance, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.
- Institutional controls are being enforced to preclude access through the SRS Site/Use Site Clearance program and SRS site security.
- The operation and maintenance (O&M) costs associated with the selected remedy for ABRP OU (include O&M costs of the SVE systems, soil covers and institutional controls) has a ROD estimated present worth of $2,182,257 discounted at 3.9% per year for 150 years of maintenance activities. The actual O&M cost since the interim remedial operations started in FY02 until FY11 is $3,379,802. The actual O&M costs (Table C-3) over the last five years are as expected. The O&M cost estimate was based on three years of active SVE operation starting in FY07. Actual active SVE operation started in late FY08 and will last longer than the estimated three years because RGs have not been fully achieved.

V. Progress since Last Review

The previous protectiveness statement concluded that the remedial actions at ABRP/MCB/MBP OU are expected to be protective and, in the interim, exposure pathways that could result in unacceptable risks are being controlled by the operation of active SVE / passive SVE and cover systems along with institutional controls that have been functioning properly.

Since the previous review, in support of final remediation activities as set forth in the Corrective Measures Implementation/Remedial Action Implementation Plan (WSRC 2007a), the following actions have been completed:

Installation of the vegetative soil cover over the A-Area Ash Pile Subunit for protective of human health and ecological receptors, and

Installation of the active SVE system (17 wells) at the ABRP Trench subunit occurred to bolster the previously installed passive SVE system, which addresses TCE contamination in the vadose zone soils.

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial actions;
- Reviewed all process and performance monitoring data provided by the annual PERs and provided a technical assessment of whether the active SVE / passive SVE are functioning as intended by the ROD and whether the shutdown criteria has been achieved;
- Inspected the OU, reviewed the annual site inspection reports, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment C-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance

Data Review

Five annual Performance Evaluation Reports have been submitted to date and were reviewed (WSRC 2008b, SRNS 2009, SRNS 2010, SRNS 2011, and SRNS 2012). Additionally, review of the annual inspection reports for the previous five-year period found that the grass on-unit needed mowing. There were no significant deficiencies noted.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M Staff member, on May 24, 2012 at the ABRP OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The ABRP OU was inspected by SRNS and USDOE personnel on September 17, 2012. No issues were identified for the ABRP OU during this inspection and interviews.

On January 29, 2013 a site inspection was conducted by US EPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspections.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The removal of contaminated soils at MCB/MBP (731-4A / 731-5A surface soil subunits) and the cover systems installed at ABRP (A-Area Rubble Pit [731-2A] and Ash Pile [788-2A] subunits) are effective in preventing residential receptor and ecological exposure to COCs. The MCB/MBP removal action has achieved industrial RGs. The ABRP cover system maintenance program is effective in maintaining the integrity of the cover systems. The annual inspection reports indicate no significant deficiencies.

The active SVE / passive SVE systems at the ABRP Trench and MCB subunits are effective in preventing the migration of VOC contamination in the vadose zone soils to the groundwater at concentrations above MCLs. Sampling and analysis of groundwater samples indicate that the underlying groundwater VOC concentrations have also been steadily decreasing with time.

As reported in the annual PERs, VOC concentrations in soil gas samples have been decreasing over time, which is expected to correlate to decreasing concentrations of VOC contamination in the vadose zone soils. Only 29 pounds total of both TCE and PCE were removed from the annual operation of the entire SVE system in 2012. Active SVE performance monitoring has determined that TCE and tetrachloroethylene (PCE) extraction have been successful at the ABRP Trench (Figures 11 and 12).

MCB and ABRP (Trench subunit) vadose zones are approaching their respective RGs, but the rate of approach is very slow. Final remedial action completion is not expected to be achieved for many years, continuing at ABRP well after transition of active SVE to passive SVE and with continued passive SVE operation at MCB.

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

Exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. MCLs for TCE and PCE have not changed since implementation of the remedy. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

With regard to the A-Area Ash Pile and A-Area Burning/Rubble Pits subunits, more stringent 2012 PRGs/RSLs do not impact the protectiveness of the remedy because soil covers installed at both subunits prevent exposure of human and ecological receptors to remaining soil contaminants left in place. Similarly, excavation and off0site disposal of soil contaminants at the MCB/MBP subunit followed by a soil cover eliminates the human health and ecological exposure pathway. There have been no changes in the MCLs for TCE and PCE that would impact SVE operations in the MCB and ABRP vadose zones. Finally, more stringent PRGs/RSLs would not impact the LUCs already in place at the ABRP/MCB/MBP OU.

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

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

VIII. Issues

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

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

The remedy at the ABRP/MCB/MBP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by the soil covers and LUCs, continued operation of the ASVE/PSVE systems, environmental monitoring, site inspections and maintenance activities. All threats at the ABRP/MCB/MBP OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the ABRP/MCB/MBP OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

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

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WSRC, 1999b. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2000. *Interim Record of Decision Remedial Alternative Selection for the A-Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) (U)*, WSRC-RP-2000-4001, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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WSRC, 2005b. *Performance Evaluation Report for the Combined A-Area Burning/Rubble Pits, Miscellaneous Chemical Basin, and Metals Burning Pit Operable Unit; October 2003 through December 2004 (U)*, WSRC-RP-2005-4016, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006. *Performance Evaluation Report for the Combined A-Area Burning/Rubble Pits, Miscellaneous Chemical Basin, and Metals Burning Pit Operable Unit; January 2005 through December 2005 (U)*, WSRC-RP-2006-4009, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007a. *Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP) for the A-Area Burning/Rubble Pits (731-A, -1A) and Rubble Pit (731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, -5A) Operable Unit (U)*, WSRC-RP-2006-4071, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007b. *Performance Evaluation Report for the Combined A-Area Burning/Rubble Pits, Miscellaneous Chemical Basin, and Metals Burning Pit Operable Unit, January through December 2006 (U)*, WSRC-RP-2007-4023, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

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SRNS, 2009. *Performance Evaluation Report for the A-Area Burning/Rubble Pits, Miscellaneous Chemical Basin/Metals Burning Pit Operable Unit, January through*

December 2008 (U), SRNS-RP-2009-00497, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Performance Evaluation Report for the Combined A-Area Burning/Rubble Pits, Miscellaneous Chemical Basin, and Metals Burning Pit Operable Unit, January through December 2009 (U)*, SRNS-RP-2010-00585, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Performance Evaluation Report for the A-Area Burning/Rubble Pits, Miscellaneous Chemical Basin/Metals Burning Pit Operable Unit, January through December 2010 (U)*, SRNS-RP-2011-00283, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Performance Evaluation Report for the A-Area Burning/Rubble Pits, Miscellaneous Chemical Basin/Metals Burning Pit Operable Unit, January through December 2011 (U)*, SRNS-RP-2012-00112, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist A-Area Burning/Rubble Pits (731-A/731-1A) and Rubble Pit (731-2A) and A-Area Ash Pile (788-2A) (U)*, ER-IDS-019-010, Inspection period 2007 through 2011 (annually)

Various - Inspection Data Sheets – *Field Inspection Checklist Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/731-5A) (U)*, ER-IDS-019-014, Inspection period 2007 through 2011 (annually)

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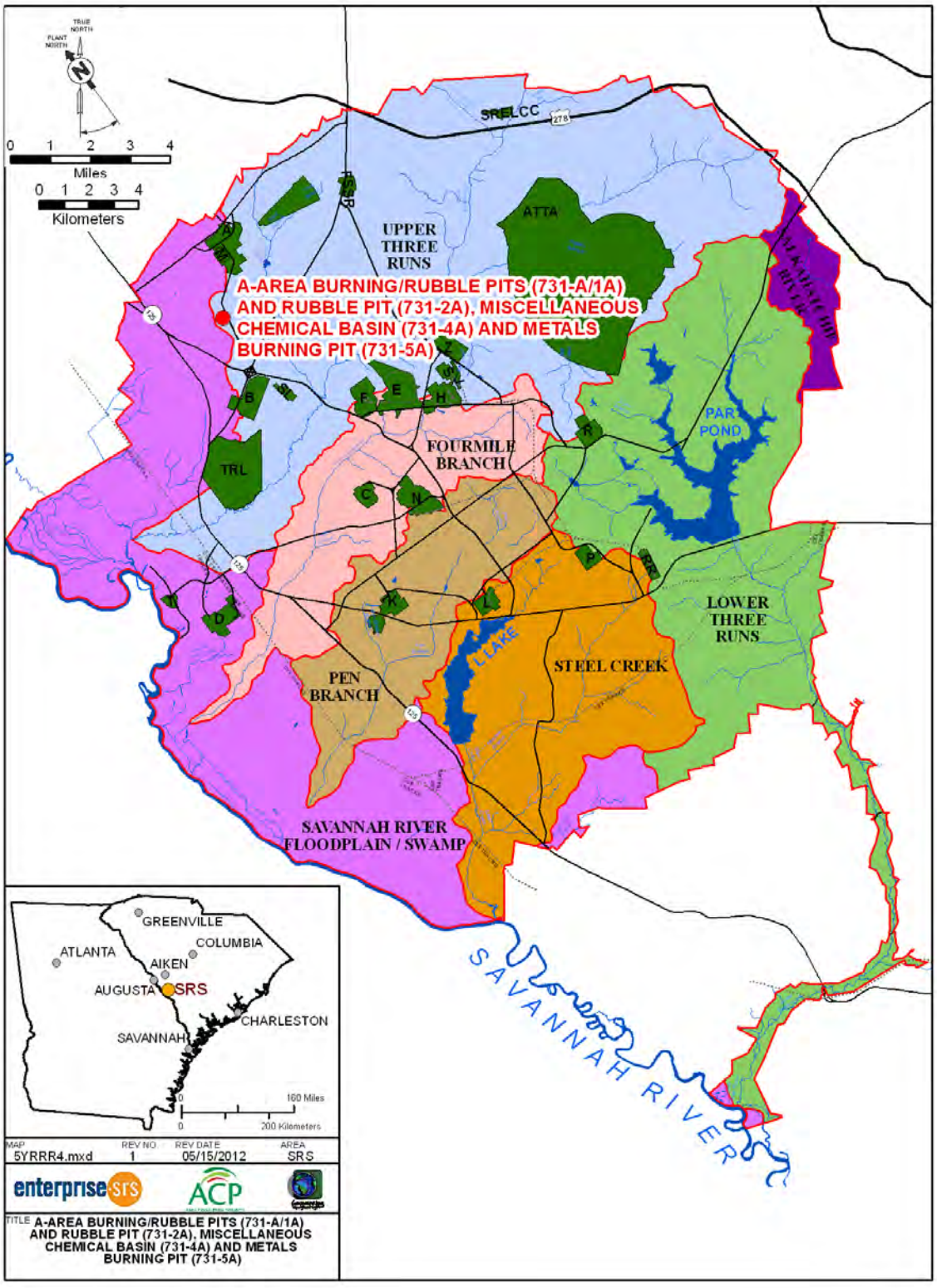


Figure C-1. Location of ABRP/MCB/MBP OU at SRS

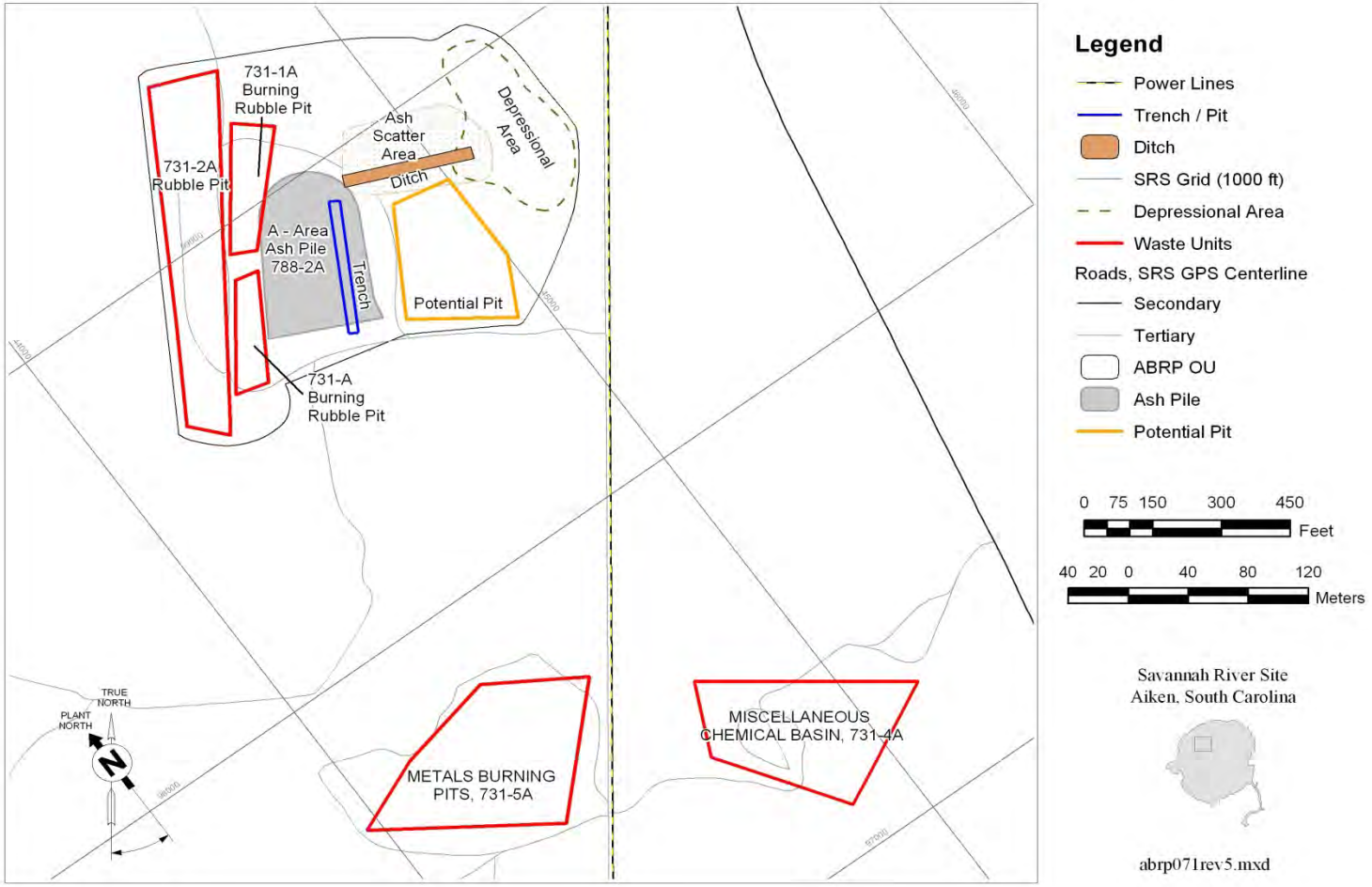


Figure C-2. ABRP/MCB/MBP OU Subunits Layout

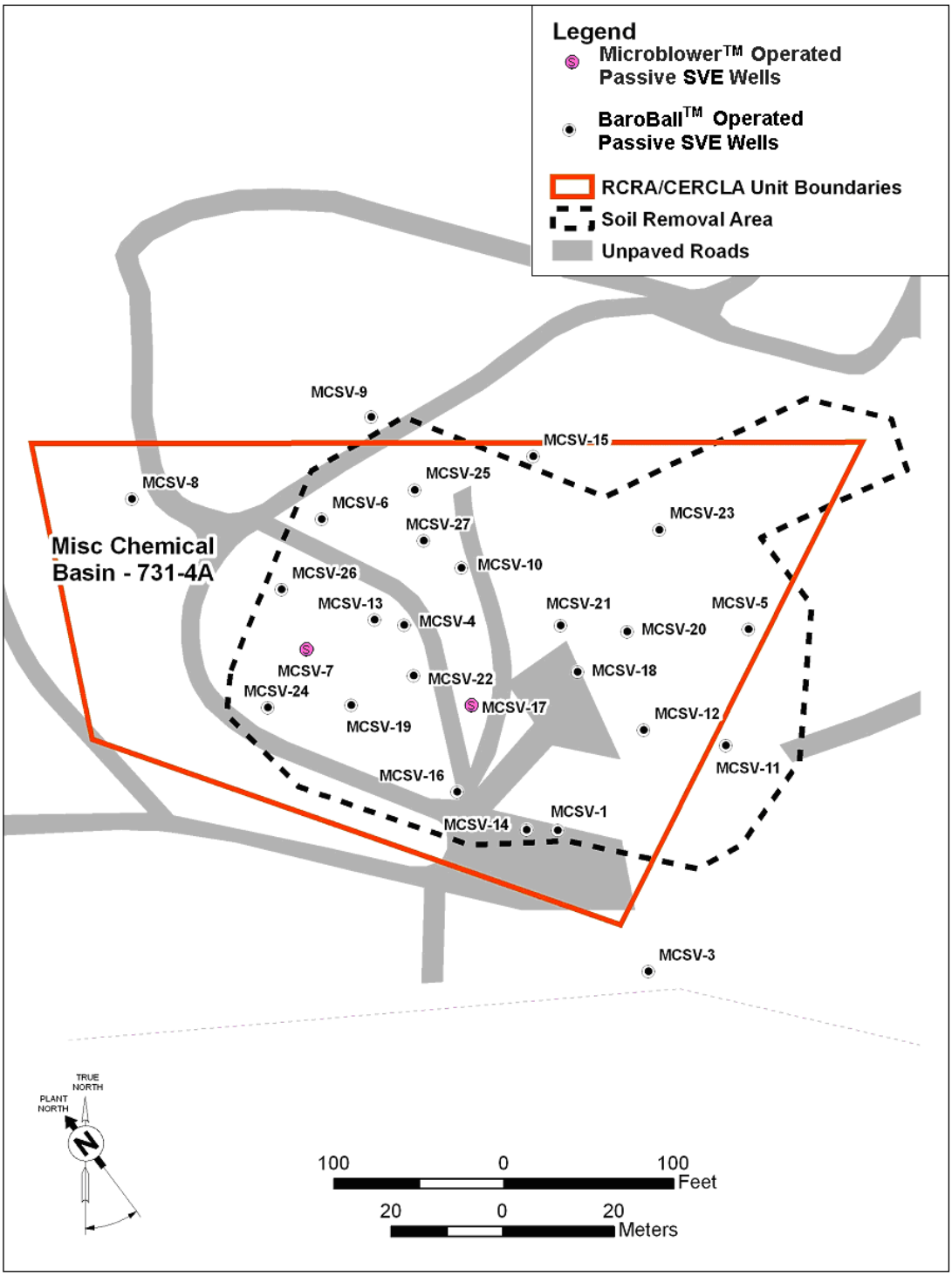


Figure C-3. MCB Subunit SVE System



Figure C-4. A-Area Ash Pile during Operations



Figure C-5. A-Area Ash Pile after Halting Operations, prior to Final Action



Figure C-6. ABRP and A-Area Ash Pile after Remedial Action, with Installation of Trench Subunit SVE System

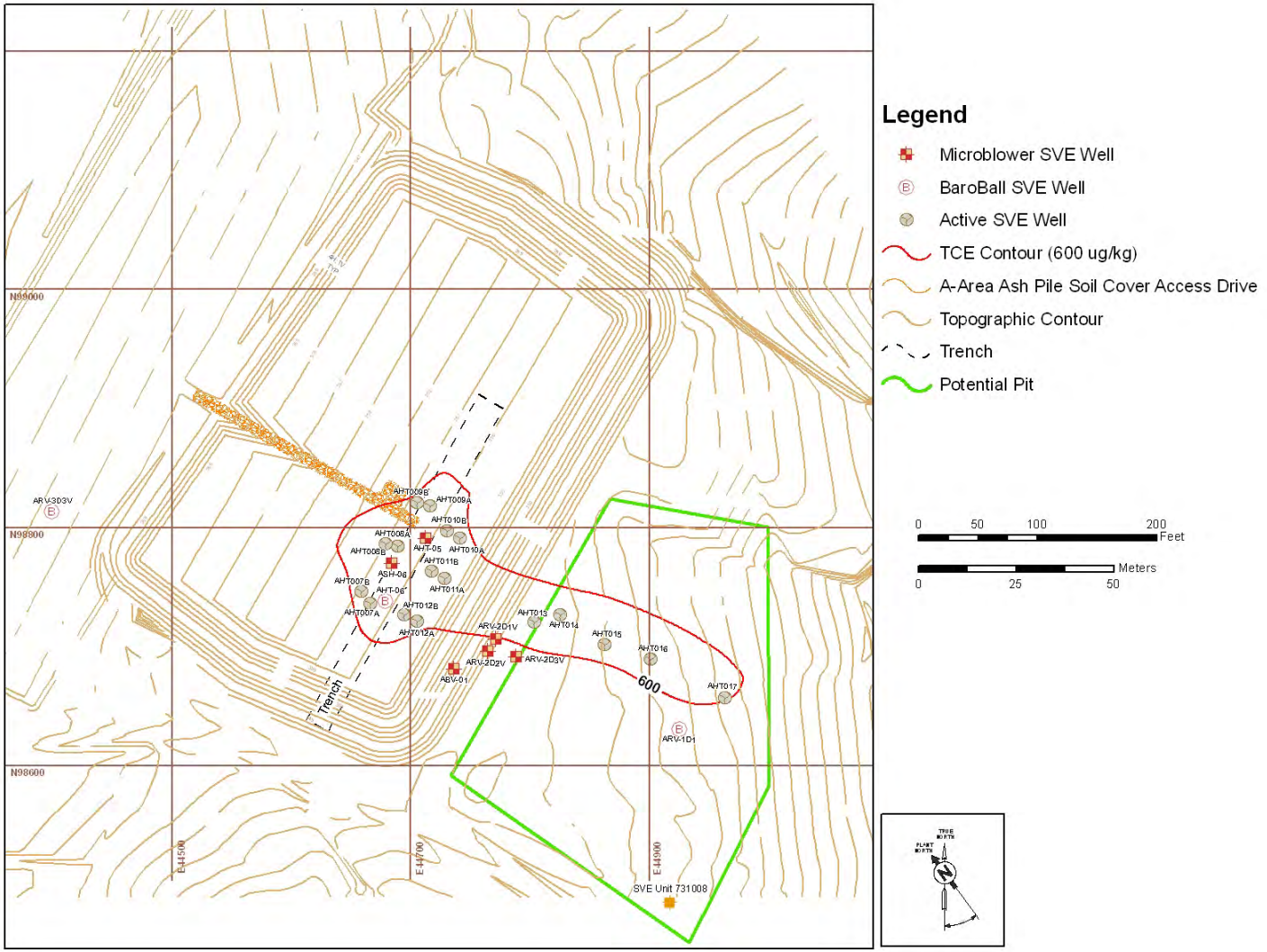


Figure C-7. ABRP Trench Subunit SVE System with Pre-Startup Vadose Zone Contamination (2008)



Figure C-8. Miscellaneous Chemical Basin during Operations



Figure C-9. Miscellaneous Chemical Basin after Halting Operations, prior to Final Action



Figure C-10. Miscellaneous Chemical Basin after Final Action



Figure C-11. TCE Extraction at ABRP Over Time

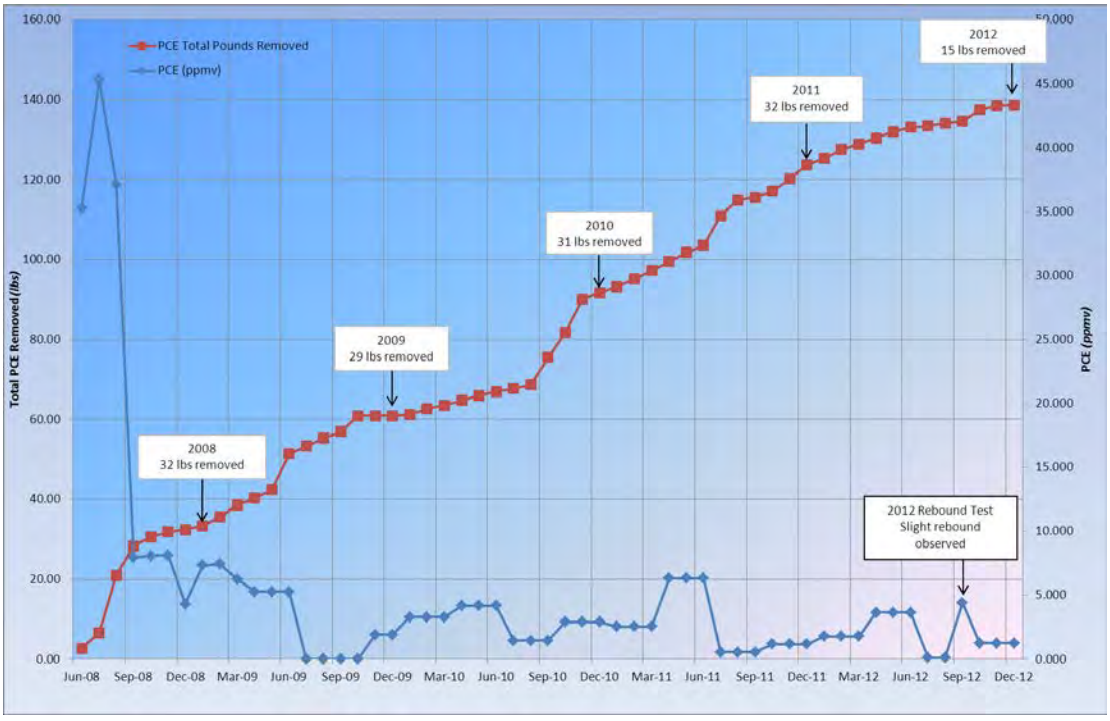


Figure C-12. PCE Extraction at ABRP Over Time

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Table C-1. Chronology of OU Events

Event	Date
IROD for MCB/MBP	January 6, 2000
Interim Remedial Action Construction Start / Completion – MCB/MBP	February 17, 2000 / February 6, 2002
Interim Remedial Action Operations Start / Completion – MCB/MBP	October 29, 2001 / Ongoing
IROD for ABRP	November 17, 2000
Interim Remedial Action Construction Start / Completion – ABRP	September 28, 2000 / December 12, 2001
Interim Remedial Action Operations Start / Completion – ABRP	September 26, 2001 / Ongoing
RFI/RI Field Start / Completion	March 22, 2001 / March 8, 2005
ESD - ABRP	May 29, 2002
ABRP/MCB/MBP ROD issuance	July 24, 2007
Remedial Action Construction Start / Complete	August 21, 2007 / February 23, 2009
Remedial Action Operations Start / Complete	June 25, 2008 / Ongoing
Previous Five-Year ROD Reviews	February 12, 2004 / February 4, 2009

Table C-2. Summary of Remedial Action Objectives and Remedial Goals for Soil

Area/Media of Concern	Refined COCs	Type of COC				Final Remedial Goal Option	Final Remedial Goal Option Basis
		ARAR	CM	HH	ECO		
MCB Vadose Zone **Remedial Action Objectives** ▪ Prevent migration of TCE and PCE contamination in soil to groundwater at a concentration above its MCL	TCE		X			344 µg/kg	Contaminant Migration Final RG – WSRC 1999
	PCE		X			344 µg/kg	Contaminant Migration Final RG – WSRC 1999
ABRP Trench Subunit **Remedial Action Objectives** ▪ Prevent migration of TCE contamination in soil to groundwater at a concentration above its MCL.	TCE		X			610 µg/kg	Contaminant Migration
A-Area Ash Pile Subunit **Remedial Action Objectives** ▪ Prevent human exposure to COCs that present a risk to future industrial workers ▪ Prevent ecological exposure to COCs that present a hazard to ecological receptors	Arsenic			X	X	9,753 µg/kg	Background[1]
	Selenium				X	15,280 µg/kg	Background[1]
	Potassium-40					1.60 pCi/g	Background[1]
	Radium-226			X		0.0255 pCi/g	HH-industrial
	Radium-228			X		1.83 pCi/g	Background[1]
	Thorium-228			X		1.69 pCi/g	Background[1]
	Uranium-238			X		1.79 pCi/g	HH – Industrial

1. Background value is two times average site-specific background concentration from Table 4-3 of the RFI/RI with BRA (WSRC 1997). The activities of the daughter products of some of the radiological COCs identified in the table were used to establish the activity of the parent since these constituents are in secular equilibrium. Specifically, the two times background mean of Actinium-228 was used to establish the Radium-228 concentration and the two times background mean of Lead-212 was used to establish the Thorium-228 background concentration.
2. Actual soil sampling in the vadose zone at the points of greatest contamination will be conducted to determine when the RGs have been achieved, and no change in the operation of the SVE process will be allowed without the concurrence of the Core Team.

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

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	27,700	88,000	174,700	209,000	254,000	753,000
Total ROD Estimated Direct O&M Costs	252,908	224,600	224,600	57,100	57,100	816,308

Table C-4. Summary of Before and Current Soil Concentrations

Subunit	COC	RGs in ROD (µg/kg)	Maximum Historical Soil Concentration (µg/kg)	Maximum Soil Concentration Post-Remedy Completion (µg/kg)*
MCB Vadose Zone Subunit	TCE	344	372	Ongoing
	PCE	344	10,736	
ABRP Trench Subunit Vadose Zone	TCE	610	487,000	Ongoing

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Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A)

I. SITE INFORMATION			
Site Name:	**A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A)**	**Date of Inspection:**	**06/27/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #28**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Clear 70°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Soil Vapor Extraction (active and passive)

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

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

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

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

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

Problems/Suggestions: ☐ Report Attached

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. **O&M Documents:**

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

Remarks:See Waste Unit Inspection and Maintenance, ER-SOP-019 and *Field Inspection Checklist for A-Area Burning Rubble/Pits and Rubble Pit and A-Area Ash Pile*, ER-IDS-019-010, and *Field Inspection Checklist for Miscellaneous Chemical Basin/Metals Burning Pit*, ER-IDS-019-014 _____

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(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 an SSHASP under 29 CFR 1910.120, HAZWOPER. An SSHASP is prepared in needed.

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: _____

B. Signs

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

Remarks: Signs at this site are in good condition. _____

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(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.) Walk-throughs

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(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:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

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

Areal extent Depth

Remarks: Soil covers at A-Rubble Pit, 731-2A, A-Ash Pile, 788-2A, MCB, 731-4A and MBP, 731-5A are complete and in good condition.

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.

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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

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

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

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

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

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

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

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

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

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

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

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

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

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: Active and passive SVE systems are in service_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment C-1. Five-Year Review Site Inspection Checklist – A-Area Burning/Rubble Pits (731-A/731-1A), and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A) *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

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

The remedial action for ABRP/MCB/MBP OU is removal, soil covers and ASVE/PSVE to remove unacceptable risk, to prevent exposure to hazardous materials and to reduce contaminant mass. The actions have proven to be effective as documented in Annual Performance Evaluation Reports, which detail the contaminant mass removed as well as the condition of the underlying groundwater plume. Characterization activities have adequately identified the type and extent of contamination requiring action. The actions identified in the ROD are expected to be effective in addressing the RAOs. The removal of contaminated soils at the MBP and the MCB has been completed and meets the RGs. The A-Area Ash Pile soil cover and the expanded SVE system are protective of human health and the environment.

B. Adequacy of O&M

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

The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the integrity of the ASVE, which in turn maintains the effectiveness of the ASVE to mitigate leaching. There are no issues requiring corrective actions

C. Early Indicators of Potential Remedy Failure

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

N/A

D. Opportunities for Optimization

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

N/A

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A-AREA MISCELLANEOUS RUBBLE PILE (731-6A) OPERABLE UNIT

I. Introduction

This report is the second five-year review for the A-Area Miscellaneous Rubble Pile (731-6A) (ARP) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the ARP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the ARP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

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

III. Background

The ARP OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement for Savannah River Site (SRS) (FFA 1993). The media of concern is soil. Groundwater is not of concern at the ARP OU because investigations have determined that groundwater beneath ARP OU has not been impacted by the unit.

The scope of the ARP OU remedial action includes three subunits: the Piles Area, the Ash Area, and the Trenches Area.

Physical Characteristics

ARP OU is located in the northwest part of the SRS within A Area and immediately east of M Area (Figure D-1). The unit covers approximately 2.3 hectares (5.8 acres) and is bounded on the southwest and southeast by outfall drainages that coalesce on the south side of the unit (Figure D-2).

The subunits that comprise ARP OU are described below (WSRC 2003):

The Piles Area consisted of many small mounds of construction debris including shingles and siding, concrete, brick, electrical boxes, roofing and wall board materials, empty paint cans, empty drums and buckets, building materials, scrap metal, insulation, tar, plastic, glass, timbers, and transite containing non-friable asbestos. The Piles Area comprises approximately 0.9 hectares (2.3 acres).

The Ash Area is located in the south-central portion of the unit and is approximately 0.7 hectares (1.8 acres). It is comprised of buried construction debris (including transite) and an ash layer. The ash layer was primarily in the upper 1.2 m (4 ft) and consisted of a dark-gray, low-density material.

The Trenches Area is located in the westernmost portion of the ARP OU. It consists of a T-shaped trench that covers approximately 0.6 hectares (1.6 acres).

Land and Resource Use

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

History of Contamination

Beginning in the early 1950s ARP OU was used as a disposal location for construction debris and ash material. In the Piles Area construction debris was disposed of in small mounds (0.6 to 1.5 m [2 to 5 ft] high) directly on the ground surface. Soil investigations conducted during Phases I (1997) and II (1998) for the development of the RFI/RI/BRA report (WSRC 2000) determined that metals (arsenic and lead), polychlorinated biphenyl (Aroclor 1254) and polycyclic aromatic hydrocarbon (PAH) (benzo[a]pyrene) were present in surface soils and identified as constituents of concern (COC). In the Ash Area,

construction debris was buried under an ash layer of approximately 1.2 m (4 ft) thick. Arsenic was identified as a COC for the Ash Area in surface soil. In the Trenches Area, construction debris was disposed of in the T-shaped trench. The exact dates of operation and specific materials disposed are unknown. PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[a]fluoranthene, dibenzo[a,h]anthracene) were identified as COCs in surface soil. No records of subsurface disposal or burial are known to exist. However, volatile organic carbons (VOCs), including trichloroethylene (TCE) and tetrachloroethylene (PCE), were identified as contaminant migration COCs in subsurface soil in the Trenches Area.

Initial Response

The results of soil and groundwater investigations indicated that the contaminated soil has not contributed to groundwater contamination adjacent to or beneath the ARP OU. Groundwater beneath this unit has been impacted by SRS operations not associated with this unit and is being addressed under the RCRA corrective action program for A/M Area. After disposal operations ceased at the ARP OU, the area was naturally re-vegetated predominantly by trees.

Basis for Taking Action

The findings from the risk assessment and contaminant fate and transport analysis indicate that concentrations of metals, PAHs, PCBs, PCE, and TCE in the soils at the ARP OU pose unacceptable risks to human health and the environment and are discussed in the following text.

At the Piles Area, refined COCs include arsenic (human health - $2x10^{-6}$ risk), lead (ARAR and human health), Aroclor 1254 (ARAR and human health - $4x10^{-6}$ risk), and benzo[a]pyrene (PTSM). All of these constituents are associated with the PCB/PAH waste pile (benzo[a]pyrene and Aroclor 1254), lead “hot spot” (lead and arsenic), or the PCB “hot spot” (Aroclor 1254).

At the Ash Area, human health refined COCs include arsenic and benzo[a]pyrene. Both of these COCs are associated with the ash in the soils at the unit. The surface soil

contains levels of arsenic associated with the ash source that pose a risk of $2x10^{-6}$ risk to the future industrial worker.

At the Trenches Area, refined COCs include arsenic (human health - $3x10^{-5}$ risk), benzo[a]pyrene (human health - $5x10^{-5}$ risk), benzo[a]anthracene (human health- $6x10^{-6}$ risk), benzo[b]fluoranthene (human health - $7x10^{-5}$ risk), dibenzo[a,h]anthracene (human health - $8x10^{-6}$ risk), PCE (contaminant migration), TCE (contaminant migration). The concentrations of PCE and TCE in fill material in the Trenches Area were predicted to impact groundwater above MCLs in approximately 504 and 226 years, respectively, and were identified as contaminant migration COCs (WSRC 2000).

The results of the soil and groundwater investigation indicate that the contaminated soil has not contributed to groundwater contamination adjacent to or beneath the ARP OU. Groundwater beneath this unit has been impacted by SRS operations not associated with this unit. The groundwater contamination is being addressed under the RCRA corrective action program for A/M Area.

The specific remedial goals (RGs) identified for the ARP OU are based on the future industrial worker scenario and achieving applicable or relevant and appropriate requirements (ARARs). The RGs established in the Record of Decision (ROD) for the ARP OU (WSRC 2003) are listed in Table D-2.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 2003), the remedial action objectives (RAOs) for the ARP OU are as follows:

Piles Area

- Protect the future industrial worker or resident from exposure to arsenic and lead in the lead hot spot above the RGs of 4.4 mg/kg and 400 mg/kg, respectively; and

- Protect the future industrial worker or resident from exposure to Aroclor 1254 (PCB) and benzo[a]pyrene (PAH) in the PCB/PAH waste pile above the RGs of 1 mg/kg and 0.052 mg/kg, respectively.

Ash Area

- Protect the future industrial worker from exposure to elevated levels of arsenic in the surface soil above the RG of 4.4 mg/kg.

Trenches Area

- Protect the future industrial worker from exposure to arsenic and PCBs/PAHs in the soil above their respective RGs;
- Prevent leaching of TCE and PCE to groundwater above the MCL (5 µg/L).

As stated in the ROD (WSRC 2003), the following remedial actions were selected for ARP OU to meet the RAOs:

Piles Area

- Removal of the two lead hot spot and transportation from SRS to a permitted offsite disposal facility.

Ash Area

- Implement institutional controls (i.e. land use controls [LUCs]).

Trenches Area

- Placement of a 0.3-m (1-ft) soil cover over the contaminated area;
- Implement the active soil vapor extraction (SVE) system;
- Implement institutional controls (i.e., LUCs).

LUCs are required for the Ash Area and the Trenches Area to prohibit future residential land use, restrict access to and activities at the ARP OU by future workers, and prevent access by trespassers. In addition, LUCs are required to maintain the integrity of the soil cover and SVE system at the Trenches Area.

Remedy Implementation

The selected remedies were implemented to meet the RAOs and included the following activities:

Piles Area

- Removing a PCB/PAH hot spot (16.8 m^3 [22 yd^3]) and a lead hot spot (1.3 m^3 [1.7 yd^3]) and transported from SRS to a permitted offsite disposal facility. Residential RGs were achieved and no LUCs are needed for the Piles Area.

Ash Area

- Establishing LUCs for approximately 0.7 hectares (1.8 acres).

Trenches Area

- Installing a 0.49-hectare (1.2-acre) soil cover over the contaminated area consisting of 0.3-m (1-ft) thick common fill material, except for southwest leg of the T-shaped trench where a 0.6-m (2-ft) thick low permeability soil was placed to enhance the soil vapor extraction process.
- Installing an active SVE system consisting of seven SVE wells connected to the existing 782-3M SVEU located between the subunit and the A-014 Outfall. The active SVE is designed to treat approximately 4,590 m^3 (6,000 yd^3) of TCE- and PCE-contaminated media and leave approximately 12,393 m^3 (16,200 yd^3) of soil and ash contaminated with low levels of arsenic and PAHs. Additionally, 12 wells were installed along the trench perimeter to monitor the zone of influence of the active SVE.
- Establishing LUCs for 1.25 hectares (3.08 acres).

LUCS for the Ash Pile and Trenches Area include the following:

- Installation of signage located at the OU boundaries to alert on-site workers to the presence of hazardous substances and to prevent unauthorized entry and unrestricted use.

- Institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements.
- SRS access controls to prevent exposure to trespassers, as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.
- Notifying the USEPA and SCDHEC in advance of any changes in land use or excavation of waste.
- In the long term, if the property or an portion thereof, is ever transferred from DOE, notice of the type and quantity of any hazardous substances that were known to have stored (for more than one year), released, or disposed of on the property will be provided. In addition, if the property or any portion thereof, is ever transferred by deed, the U.S. Government will satisfy the requirements of CERCLA 120(h)(3) to include a description of the remedial action taken, a covenant, and an access clause.

Figures D-3 and D-4 show photographs of ARP OU before remediation and as it currently appears (2012).

System Operation/Operation and Maintenance

The active SVE (782-3M) started full operation in 2004 and is required until soil sample results for TCE and PCE are below the RGs established in the ROD (WSRC 2003) (Table D-2).

The following maintenance activities have been implemented for both the Ash Area and the Trenches Area:

- Visual inspections for evidence of damage to the cover system due to erosion or intrusion by burrowing animals and to address upkeep of the vegetative cover and access control barriers (e.g., the warning signs) are performed annually.

- 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.

The estimated operation and maintenance (O&M) costs associated with the selected remedy for ARP OU include O&M costs of the soil cover and LUCs has a present worth of $580,000 discounted at 7% per year for 30 years of maintenance activities. The O&M cost estimate was based on five years of active SVE operation. As of FY11, the active SVE was in its seventh year of operation because RGs have not been achieved. The actual O&M cost since the remedial action was completed in FY04 until FY11 is $755,000. The actual O&M costs (Table D-3) are higher than expected because the operational life of the active SVE exceeded the estimated five-year life and the cost to operate the 784-3M is no longer shared by the A-014 Outfall project.

V. Progress since Last Review

The previous protectiveness statement concluded that the remedial actions at ARP OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being controlled by the operation of an active SVE along with institutional controls that have been functioning properly.

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Reviewed all process and performance monitoring data provided by the annual PERs and provided a technical assessment of whether the active SVE are functioning as intended by the ROD and whether the shutdown criteria has been achieved;

- 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

At the ARP OU Trench Area, full scale operation of the seven ASVE wells began on April 26, 2004. The seven ASVE wells are alternated between the odd and even numbered wells, monthly, to optimize the mass removal from the subunit. Compliance, performance, and process monitoring is conducted quarterly at the seven ASVE wells and twelve monitoring wells. This data is reported annually in a performance evaluation report. Since operation began, mass removal rates have fluctuated (Figure D-5), but the system is operating as designed and continues to remove mass from the subsurface. The cumulative mass removed is estimated to be 93 pounds of VOCs (Figure D-6).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M Staff member, on May 24, 2012 by phone and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The ARP OU was inspected by SRNS and the USDOE personnel on September 17, 2012. No issues were identified for the ARP OU during this inspection and interviews.

On January 29, 2013, a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by the USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspections.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

The Land Use Control Implementation Plan for ARP OU is included as Appendix C of the Post Construction Report and governs LUC implementation, maintenance,

monitoring, reporting, and enforcement of LUCs (WSRC 2004). The LUC objectives are being met through the following actions. The removal and disposal actions at the Piles Area are effective in preventing the future industrial worker or resident from exposure to arsenic, lead, Aroclor 1254, and benzo[a]pyrene in soils. The cover system maintenance program for the Trenches Area, and LUCs for the Trenches Area and the Ash Area have been effective in maintaining the integrity of the cover system. The annual inspection reports indicate no significant deficiencies.

A Performance Evaluation Report is submitted annually to the U.S. Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) and provides the results and analysis of the baseline sampling prior to active SVE operation and all process and performance monitoring during operation. The active SVE system in the Trenches Area is effective in preventing the leaching of TCE and PCE to groundwater above MCLs (Figures D-5 and D-6). The extraction well network continues to remove contaminant mass from the subsurface although mass removal rates have dropped significantly (SRNS 2012).

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

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

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 under CERCLA.

X. Protectiveness Statement(s)

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

Exposure pathways that could result in unacceptable risks are being controlled by the active SVE and institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated media. All threats to contaminated media at the ARP OU have been addressed through implementation of the active SVE, 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

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

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

SRNS, 2009. *Performance Evaluation Report for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit: April 2008 through April 2009 (U),* SRNS-RP-2009-00988, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Performance Evaluation Report for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit: April 2009 through April 2010 (U),* SRNS-RP-2010-01113, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Performance Evaluation Report for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit: April 2010 through April 2011 (U),* SRNS-RP-2011-01121, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Performance Evaluation Report for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit: April 2011 through April 2012 (U),* SRNS-RP-2012-00211, 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, 1998. *Resource Conservation and Recovery Act (RCRA) Facility Investigation/ Remedial Investigation Report Workplan Addendum for the A-Area Miscellaneous Rubble Pile (731-6A) (U)*, WSRC-RP-96-835, Revision 1.2, 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, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2000. *RCRA Facility Investigation / Remedial Investigation with Baseline Risk Assessment for the A-Area Miscellaneous Rubble Pile (731-6A) (U)*, WSRC-RP-98-4208, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Record of Decision for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit (U)*, WSRC-RP-2001-4197, Revision 1.3, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Post-Construction Report (PCR) for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit (U)*, WSRC-RP-2004-4088, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005. *Performance Evaluation Report for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit: April 2004 to April 2005 (U)*, WSRC-RP-2005-4049, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006. *Performance Evaluation Report for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit: April 2005 to April 2006 (U)*, WSRC-RP-2006-4040, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007. *Performance Evaluation Report for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit: April 2006 through April 2007 (U)*, WSRC-RP-2007-4046, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Performance Evaluation Report for the A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit: April 2007 through April 2008 (U)*, WSRC-RP-2008-4061, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various – Inspection Data Sheets - *Field Inspection Checklist for A-Area Miscellaneous Rubble Pile OU (731-6A)*, ER-IDS-019-029, Inspection Period 2007 through 2011 (annually)

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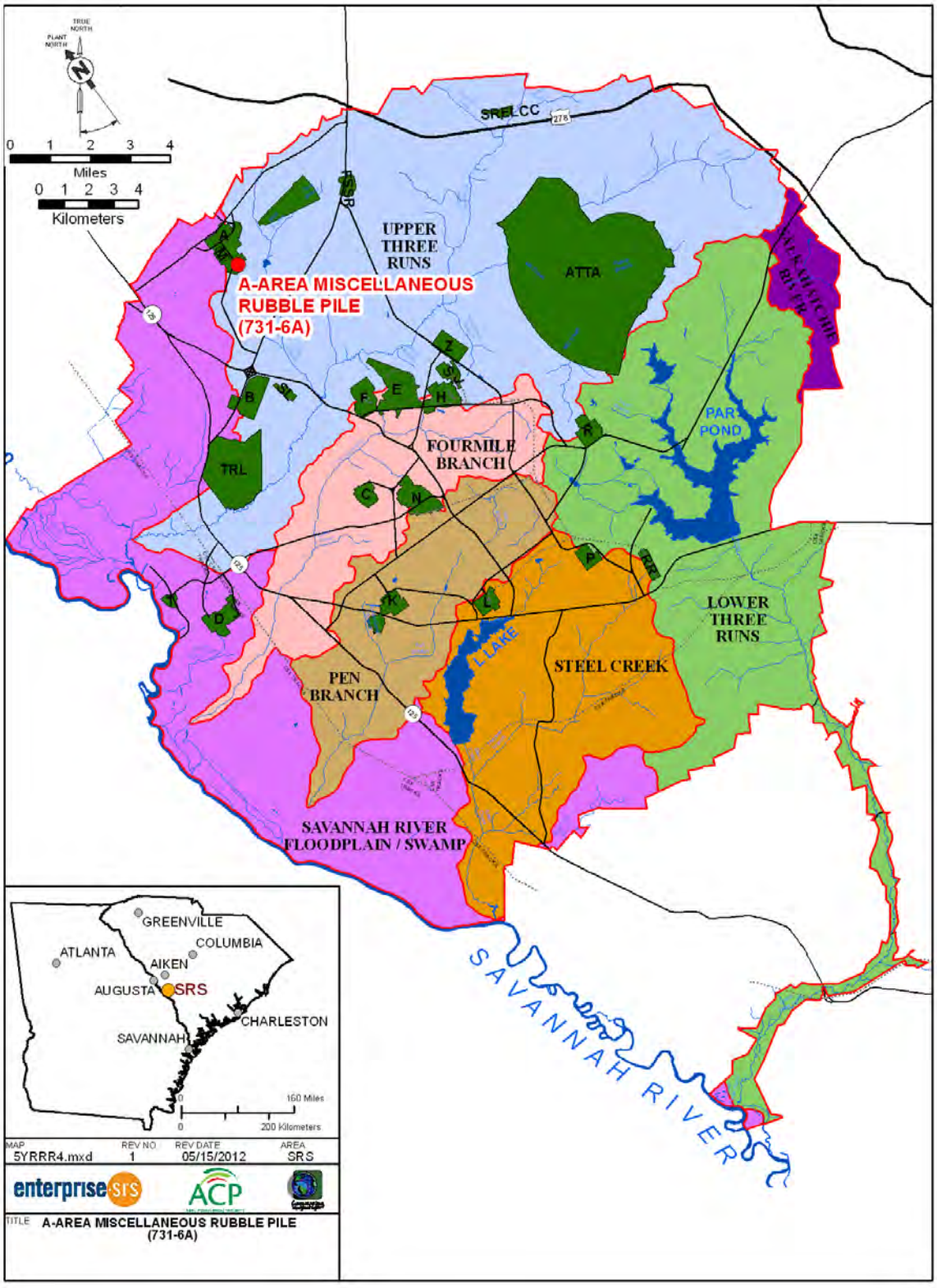


Figure D-1. Location of ARP OU at Savannah River Site

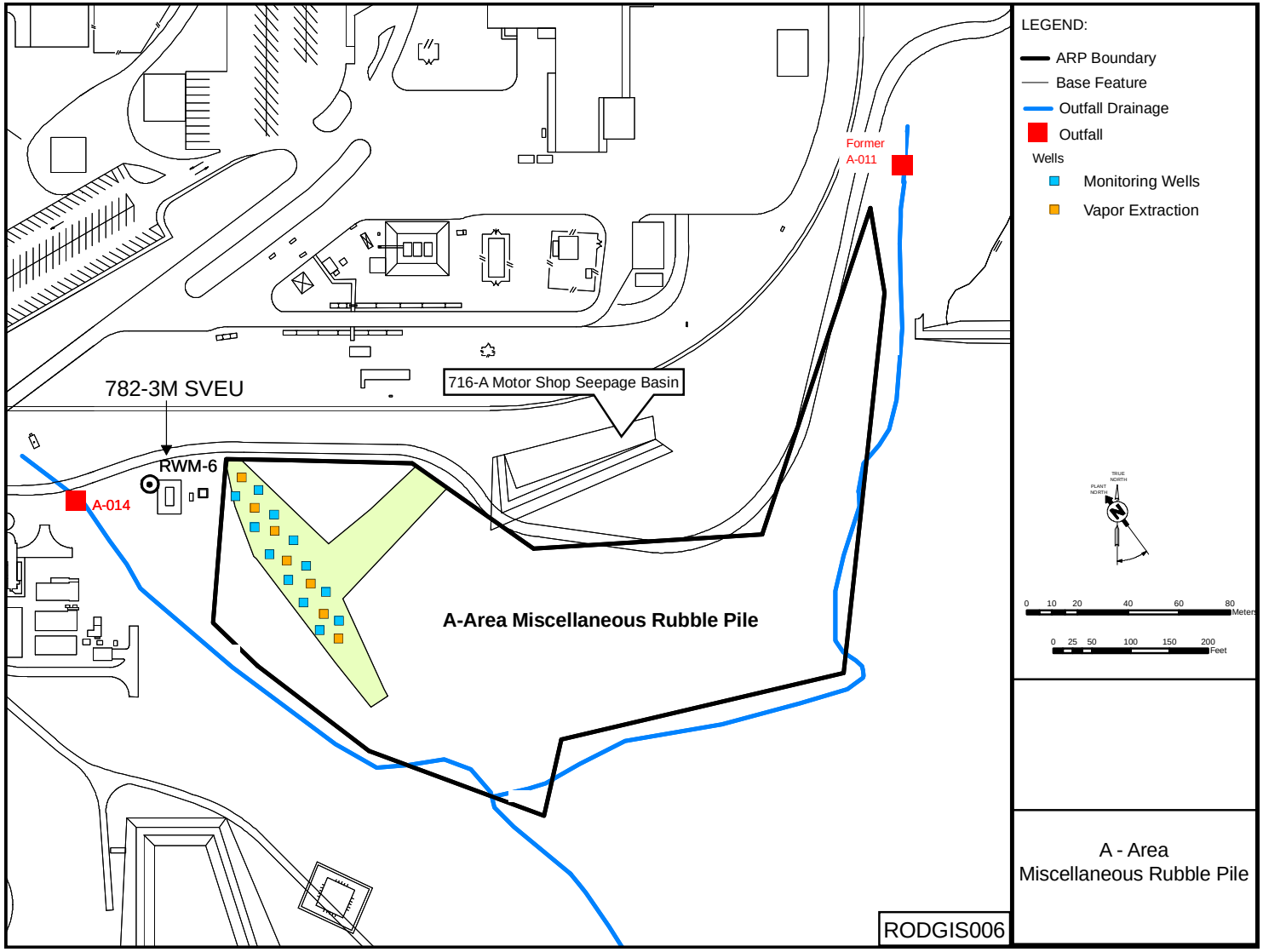


Figure D-2. ARP Operable Unit (731-6A)

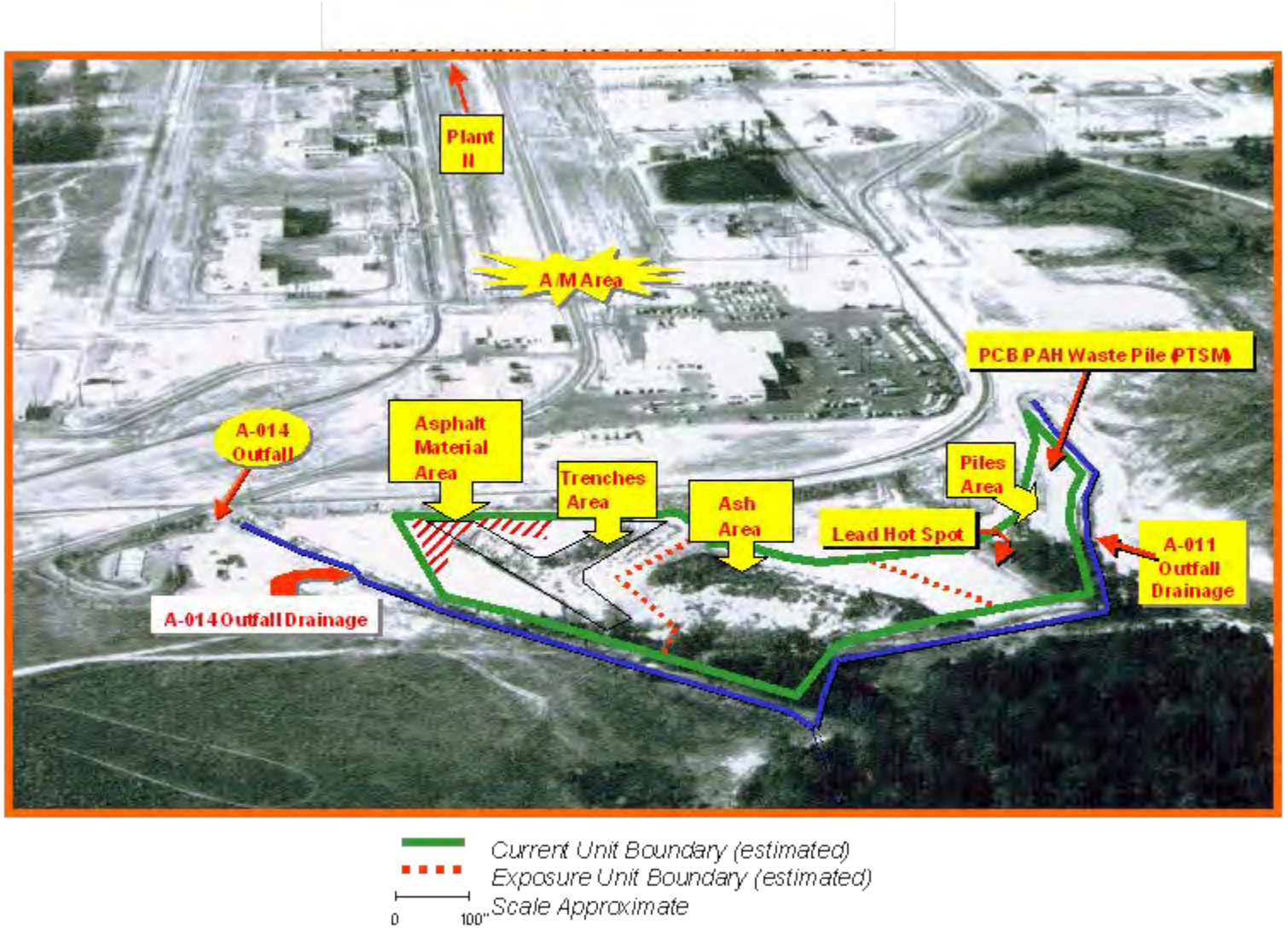


Figure D-3. 1953 Aerial Photograph Showing ARP OU



Figure D-4. Current Photographs of ARP OU (2012)

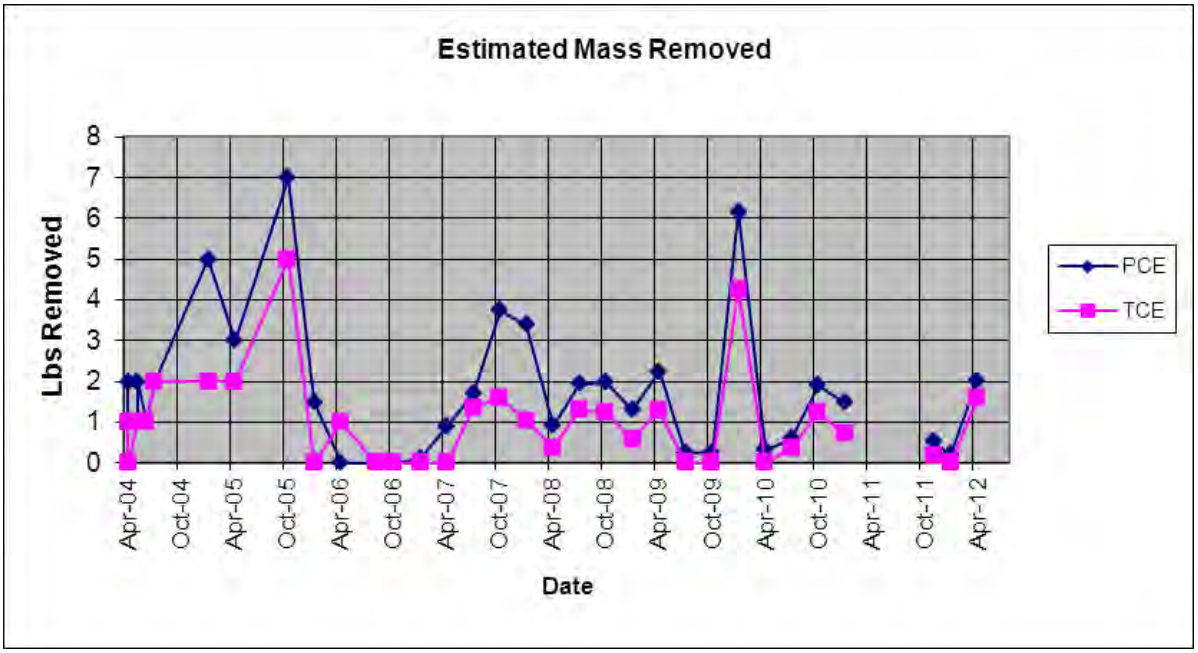


Figure D-5. ARP OU Performance Monitoring – Estimated Mass Removed

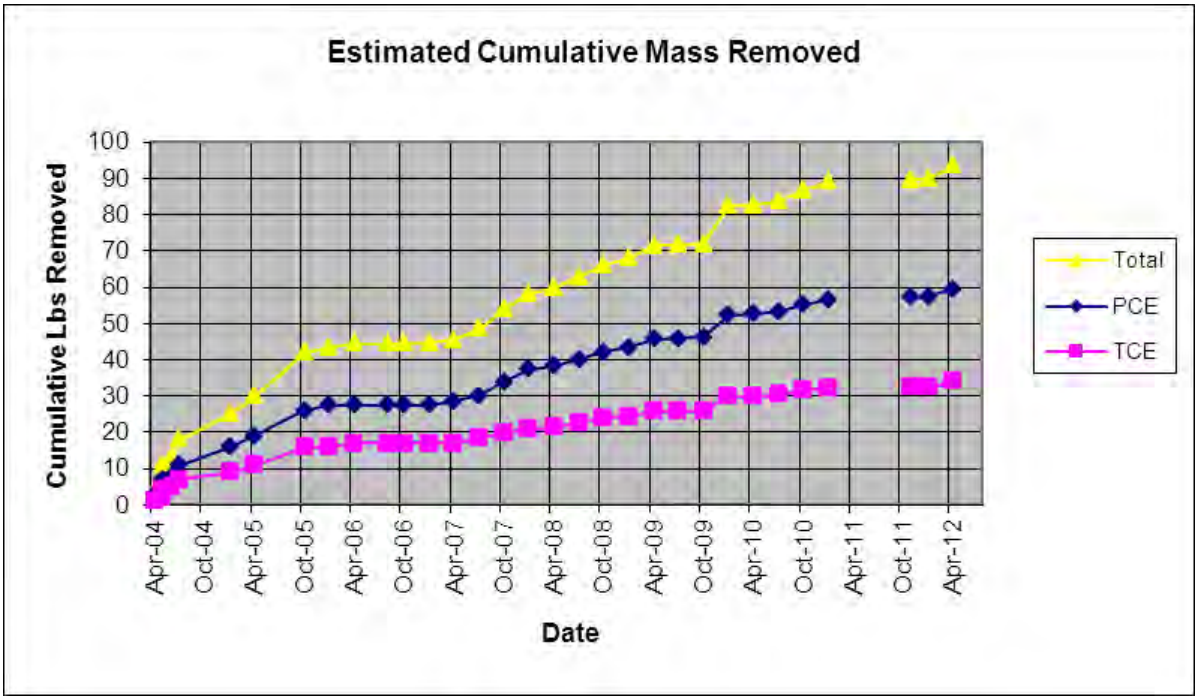


Figure D-6. ARP OU Performance Monitoring – Estimated Cumulative Mass Removal

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Table D-1. Chronology of OU Events

Event	Date
RFI/RI Field Start	November 10, 1997
Record of Decision (ROD) issuance	August 7, 2003
Remedial Action Construction Start / Complete	September 8, 2003/ June 30, 2004
Remedial Action Operations Start	April 26, 2004
Previous Five-Year Reviews	February 4, 2009

Table D-2. Remedial Goals for OU Soil under Industrial Land Use

Subunit	Refined COCs	RG (mg/kg)	Basis
Piles Area	Arsenic	4.4	2X average background
	Lead	400	USEPA TBC criteria
	PCB-1254	1	TSCA action level
	Benzo[a]pyrene	0.052	$1x10^{-6}$ risk level*
Ash Area	Arsenic	4.4	2X average background
Trenches Area	Arsenic	4.4	2X average background
	Benzo[a]anthracene	2.56	$1x10^{-6}$ risk level
	Benzo[a]pyrene	0.256	$1x10^{-6}$ risk level
	Benzo[a]fluoranthene	2.56	$1x10^{-6}$ risk level
	Dibenzo[a,h]anthracene	0.256	$1x10^{-6}$ risk level
	TCE	0.0877	CM soil clean up level
	PCE	0.656	CM soil clean up level

CM – contaminant migration
COC - constituent of concern
RG – remedial goal
TBC – to be considered
TSCA - Toxic Substances Control Act, 1976
*The $1x10^{-6}$ risk level is based on a resident, consistent with unrestricted use in the Piles Area

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

	FY07	FY08	FY09	FY10	FY11	Five-Year Total
Total Actual O&M Costs	137,000	122,000	157,000	113,000	149,900	679,000
Total ROD Estimated Direct O&M Costs	98,700	48,700	48,700	33,200	33,200	262,500

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Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit

I. SITE INFORMATION			
Site Name:	**A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit**	**Date of Inspection:**	**08/16/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #48**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 94°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☒ Other Excavation, disposal, soil vapor extraction
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers

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

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) Post Closure Manager (Title) 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O & M Staff** Richard Feagin (Name) Post-Closure Waste Site Inspector/Maintenance Coord. (Title) 05-24-2012 (Date)
   Interviewed: ☐ at site ☐ at office × by phone Phone No. 952-4416
   Problems, suggestions: ☐ report attached

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

Remarks: See *Waste Unit Inspection and Maintenance*, ER-SOP-019 and *Field Inspection Checklist for A-Area Miscellaneous Rubble Pile OU*, ER-IDS-019-029

_____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) 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 an SSHASP under 29 CFR 1910.120, HAZWOPER. An SSHASP is prepared if needed.

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: _____

B. Signs

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

Remarks: Signs are in good condition. _____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) 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.) Walk-throughs

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks: Survey markers 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 D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) 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:_____

VII. COVER SYSTEMS ☒ 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: Vegetative cover is mowed routinely_____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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

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

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

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

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☒ Active ☐ Passive
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks: Soil Vapor Extraction wells

2. Gas Monitoring Probes:
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks: Pressure monitoring wells

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

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

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

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

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

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

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

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

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

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

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

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

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

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

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: Active SVE systems in service_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment D-1. Five-Year Review Site Inspection Checklist – A-Area Miscellaneous Rubble Pile (731-6A) Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

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

The remedial action for the Piles Area is removal and disposal to remove all unacceptable risk (PTSM) from small-localized hot spots of lead and PCB/PAH. The remedial action chosen for the Ash Area is Institutional Controls to protect future industrial workers and potential residents from exposure to elevated levels of arsenic. Institutional controls have been established for this subunit. The remedial action chosen for the Trenches Area is active soil vapor extraction to permanently remove TCE and PCE from the soil and institutional controls and a soil cover to protect remedial workers and future industrial workers from unacceptable exposure to arsenic and PAHs (benzo[a]pyrene) in the surface soil. Annual Performance Evaluation Reports demonstrate that these actions are effective and that the remedies are functioning as designed.

B. Adequacy of O&M

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

The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the integrity of the active SVE, which in turn maintains the effectiveness of the active SVE to mitigate leaching. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

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

N/A

D. Opportunities for Optimization

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

N/A

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A/M GROUNDWATER OPERABLE UNIT

I. Introduction

This is the fourth five-year review for the A/M Area Groundwater Operable Unit (OU). This review was conducted from August 2012 through September 2012. This report documents the results of the review. The review for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) review requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document. Contaminants remaining at the A/M-Area Groundwater OU are at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the A/M Area Groundwater OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table E-1 lists the chronology of site events for the A/M Area Groundwater OU.

III. Background

A/M-Area Groundwater OU, a media-specific OU, is listed as a RCRA unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the A/M-Area Groundwater OU is the groundwater associated with the M-Area Hazardous Waste Management Facility (HWMF) OU, the Metallurgical Laboratory (Met Lab) HWMF OU and the A-Area Burning/Rubble Pits and Rubble Pit (ABRP) and the Miscellaneous Chemical Basin/Metals Burning Pit (MCB/MBP) OU.

Physical Characteristics

The 142-hectare (350-acre) A/M Area is located near the northwest edge of SRS, approximately 1.6 km (1 mi) from the nearest SRS boundary (Figure E-1). The A/M-Area Groundwater OU encompasses impacted groundwater from M-Area HWMF OU,

Met Lab HWMF OU, and ABRP/MCB/MBP OU. This integration was a result of the comingling of the plumes associated with these sources. Figure E-2 shows the plume extent, which covers about 812 hectares (2,000 acres). The A/M-Area Groundwater OU is located within the Upper Three Runs Watershed, bounded to the south by Tims Branch, to the southwest by Upper Three Runs Creek, and to the west by wetlands and ultimately the Savannah River. Groundwater flow is generally to the southwest. Depth to groundwater over much of the plume is greater than 30-m (100 ft).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the SRS (WSRC 1999a) designates the M- Area and Met Lab HWMF OU as being within an industrial area. The future land use for the M-Area and Met Lab HWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land. Although the groundwater plumes associated with these sources extend beyond the industrial area boundaries, it is also reasonably expected that the USDOE will maintain industrial uses and control of the land.

History of Contamination

The A/M Area contained manufacturing facilities for nuclear fuel components, offices and research facilities. From 1952 to 1981, chlorinated solvents were used in the M-Area process facilities. These facilities manufactured aluminum fuel and target assemblies that were used in the SRS reactors. The manufacturing process utilized conventional metal fabrication technologies and included cleaning and degreasing of components and final assemblies. Purchasing records indicate that approximately 13-million lbs of solvents were used within the process facilities with an estimated 50 to 90 percent of the solvents lost to the atmosphere by evaporation. Used solvents were discharged as waste to process sewer systems that led to the A-014 Outfall from the M-Area Settling Basin. Additional contamination originated at a solvent transfer station in Building 313-M, the solvent storage tank area, laboratory facilities, and at the Met Lab Basin, which received process wastewaters from the Met Lab HWMF (723-A). Disposal estimates compiled in

1982 and 1984 indicate that approximately 2.1 million lbs of solvent were released to the M-Area Settling Basin and approximately 1.4 million lbs of solvent were released to the A-014 Outfall. The principal contaminants are trichloroethene (TCE), tetrachloroethene (PCE), and lesser quantities of 1,1,1-trichloroethane.

Initially, ABRP and MCB/MBP were separate OUs under the FFA. These units were later combined in the FFA as the ABRP/MCB/MBP OU. Prior to combining the OUs, separate investigations associated with the ABRP OU and MCB/MBP OU found surface soil, vadose zone, and groundwater contamination. The soil and vadose zone contamination are addressed by remedial activities for the ABRP/MCB/MBP OU as discussed in Appendix C.

Residual contaminants migrating downward from the vadose zone of the MCB/MBP and ABRP subunits have resulted in the contamination of the underlying groundwater with TCE and PCE. The groundwater plume from these subunits has comingled with the A/M-Area groundwater plumes from the upgradient source areas. In 2006, the South Carolina Department of Health and Environmental Control (SCDHEC) and the United States Environmental Protection Agency (USEPA) agreed that the groundwater impacts associated with the ABRP and the MCB/MBP subunits would be transferred to the RCRA program through the submittal of a modification to the 2000 RCRA Part B Permit Renewal Application.

Initial Response

The remedial investigation of the A/M-Area Groundwater OU began in June 1981 when solvent contamination was discovered in the groundwater beneath the M-Area Settling Basin. In 1983, SRS voluntarily instituted a groundwater cleanup program within the A/M Area. The initial response involved the installation of a pilot groundwater pumping well and experimental air stripping technology. This pilot-program was one of several across the United States that demonstrated groundwater extraction and air stripping as a viable groundwater remediation technology for volatile organic compounds (VOCs). In 1985, a full-scale pump-and-treat system (i.e., M-1 Air Stripper), which comprised 11

groundwater recovery wells and a 610-gallon-per-minute (gpm) air stripper column, was constructed to treat contaminated groundwater from the shallow aquifer.

Currently, a groundwater corrective action is performed under the 2003 RCRA Permit Renewal which became effective October 30, 2003 (SC Permit Number SCI 890 008 989). SCDHEC has approved the existing A/M Area Groundwater Corrective Action Plan as an intermediate step leading toward a complete RCRA corrective action program.

Basis for Taking Action

The groundwater beneath A/M Area has been contaminated with the organic solvents in both the dissolved state and, in limited occurrences, as concentrated dense non-aqueous phase liquids (DNAPLs). The two primary constituents of concern (COCs) that significantly exceed drinking water standards or maximum contaminant limits (MCLs) are TCE and PCE. Other constituents that have recently (SRNS 2010) exceeded primary MCLs include 1,1- dichloroethene (DCE), 1,4-dioxane, chloroethene, and lead. Two main aquifers, the Steed Pond Aquifer Unit and the Crouch Branch Aquifer Unit, are impacted. The Steed Pond Aquifer Unit contains the water table (i.e., M-Area Aquifer Zone [MAAZ]), and the Lost Lake Aquifer Zone (LLAZ). These two aquifer units are separated by the Crouch Branch Confining Unit, which contains the Middle Sand Aquifer Zone. All four aquifer zones contain TCE and PCE above MCLs. A hydrostratigraphic column for the A/M-Area Groundwater OU is shown in Figure E-3. The extent of TCE contamination in the LLAZ is shown in Figure E-2.

The three COCs that exceed drinking water standards or MCLs at the ABRP subunit are TCE, PCE, and dichloromethane in the MAAZ and the LLAZ. The three COCs that exceed drinking water standards or MCLs at the MCB/MBP subunit are TCE, PCE, and lead. However, USDOE, USEPA, and SCDHEC agreed not to treat lead because elevated levels are sporadic and are judged to be caused by natural geologic conditions. Similarly, the two aquifer zones impacted above MCLs at the MCB/MBP subunit are the MAAZ and the LLAZ.

IV. Remedial Actions

Three interim remedial actions have been issued for the A/M-Area Groundwater OU. The first was the Interim Action Record of Decision (IROD) for the A/M-Area Groundwater OU, dated June 1992 (WSRC 1992). The second IROD, dated December 1999, addressed the groundwater contamination associated with the MCB/MBP subunit. The third IROD, dated April 2000, addressed the groundwater contamination associated with the ABRP subunit. Each IROD is discussed below. The location and spatial relationship of these areas are illustrated in Figure E-2.

The final actions for the A/M-Area Groundwater OU will be documented by modifications to the RCRA permit.

Remedy Selection

As stated in the IROD for the A/M-Area Groundwater OU (WSRC 1992), the purpose of the interim action was to:

- Prevent further groundwater plume migration and initiate groundwater restoration while risk assessment activities are being planned and conducted; and
- Obtain further information about the response of the aquifer to remediation.

The preferred interim remedy for groundwater within the A/M-Area Groundwater OU was groundwater recovery with treatment by air stripping. The components of the remedy included the following:

- Installing strategically located groundwater recovery wells;
- Extracting groundwater and processing it through an air stripper to release VOCs;
- Discharging the treated water to an National Pollutant Discharge Elimination System (NPDES) permitted outfall; and
- Conducting a treatability study to evaluate technologies to control air stripping tower gaseous emissions.

As stated in the IROD for the MCB/MBP (WSRC 1999b), the purpose of the interim action was to:

- Treat contaminated groundwater to prevent further VOC plume growth;
- Demonstrate the effectiveness of in situ air stripping wells in achieving significant contaminant mass removal; and
- Obtain necessary site-specific run data to determine a final remedial goal.

Interim remedial goals are shown in Table E-2. The preferred interim remedy for the MCB/MBP subunit groundwater was in situ air stripping and monitoring. The components of the remedy included the following:

- Installing three series (banks) of in situ air stripping wells located to address groundwater concentrations exceeding 500 µg/L, 200 µg/L, and 50 µg/L, respectively;
- Groundwater monitoring to evaluate and report the effectiveness of the in situ air stripping wells; and
- Conducting a treatability study to evaluate technologies to control air stripping tower gaseous emissions.

As stated in the IROD for ABRP (WSRC 2000), the interim remedial action objectives were to:

- Mitigate any further plume growth;
- Reduce concentration of the contaminant plume within the 100 µg/L VOC contaminant plume isopleth;
- Evaluate the effectiveness of the remedial system and its impact on the aquifer system; and
- Reduce the uncertainty of commingling of plumes between the two aquifer systems.

Interim and final remedial goals are shown in Table E-2.

The preferred interim remedy for the ABRP subunit groundwater is air sparging with soil vapor extraction (SVE). The components of the remedy include the following:

- A two-staged approach with stage one including the installation of ten active air sparging wells, each with three Baroball™ passive SVE wells to be operated for about 12 months;
- Evaluation of enhanced bioremediation; and
- Stage two will incorporate the operating and effectiveness data obtained from stage one to design a more extensive system to address the >100 µg/L VOC plume.

Final remedial action objectives for all A/M Area groundwater are to prevent exposure to contaminated groundwater above MCLs and restore groundwater to its beneficial use.

Remedy Implementation

A/M Area Groundwater OU

The remedial action for the A/M Area Groundwater OU was implemented through the following activities:

- Removing the dissolved plume contaminants using a recovery well system connected to an air stripper, designated the M-1 Air Stripper (Figures E-2 and E-4). This system was designed to hydraulically contain and capture the high concentration VOC plume. The original recovery well network (11 wells) began operations in September 1985. Two additional recovery wells were installed near the Met Lab and began supplying groundwater to the M-1 Air Stripper in July 2000. The recovery wells are screened predominantly in the Lost Lake Aquifer Unit, with a few of the wells also having screens in the MAAZ and the Middle Sand Aquifer Zone of the Crouch Branch Confining Unit.
- Conducting an evaluation of off-gas treatment options for the air strippers.
- Monitoring of air stripper off-gas and treated water discharge, recovery well flow rates and concentrations, and groundwater concentrations in nearby monitoring wells to evaluate the effectiveness of the system.

In addition, multiple remediation strategies and technologies have been implemented in response to discussion provided in the A/M Area Groundwater IROD, along with the collection of further characterization data.

The groundwater recovery well system has been complemented with the use of SVE technology to address known source areas in the vadose zone. Four sites with elevated concentrations of PCE and TCE in the vadose zone were initially chosen for vadose zone remediation using vacuum extraction: the abandoned process sewer line leading to the M-Area Basin, the M-Area Settling Basin, the A-014 Outfall, and the former 321-M Solvent Storage Tank Area. The SVE units are connected to vertical and/or horizontal soil vapor extraction wells, effectively reducing the VOC mass in the vadose zone preventing future impacts to the groundwater. In the A-014 Outfall area, residual VOCs in lower permeability soils were addressed by soil hydraulic fracturing at seven locations, which allowed for improved rates of mass removal using a high vacuum SVE unit (Figure E-5) for those wells.

As contaminant levels have decreased in the vadose zone, several of the larger active systems have reached shutdown criteria as established by the RCRA permit application. To continue to provide mass removal the SVE wells associated with these units are often transitioned to passive SVE wells. Recent strategies have employed renewable energy (solar) powered blowers (MicroBlowers™) or passive barometric pumping using BaroBalls™. These passive technologies are proving beneficial in aiding cleanup when contaminant removal becomes limited by the rate of diffusion from fine-grained sediments.

Recognizing that a significant amount of solvents remains trapped in the subsurface in the form of DNAPLs, SRS has evaluated and implemented DNAPL specific remedies where appropriate. The most effective DNAPL specific remedy used within the A/M Groundwater OU has been the use of thermal heating using the Dynamic Underground Stripping (DUS) process. Under this process steam is injected into the subsurface using multiple injection wells with the objective to provide a total steam flood throughout the DNAPL source zone. The steam flood promotes the enhanced removal of volatile compounds using vapor and groundwater extraction wells.

DUS was first deployed at the M-Area Solvent Storage Tank Area beginning in March 2000 and ending in September 2001. Approximately 70,000 lbs of VOCs were removed from the 30 m x 30 m x 48 m (100 ft x 100 ft x 160 ft) deep target area during the 12 months of operation. The second deployment of DUS targeted DNAPL beneath the closed M-Area Settling Basin to address the main source of the groundwater contamination in this area. The second DUS project commenced operation on August 8, 2005, and operated through September 2009. Nearly 450,000 pounds of VOCs have been removed.

In addition to the M-1 Air Stripper and recovery well system, other groundwater remediation activities were undertaken to reduce the dissolved contaminant mass and reduce the spread of the groundwater plume in other portions of A/M Area. The northern portion of the VOC groundwater plume is associated with historical solvent use and disposal in laboratory facilities. The strategy for control of VOC contaminants is to restrict migration within the shallow aquifer system, thereby preventing future downward migration into the deeper aquifer system. The A-2 Air Stripper, which began operations in 1996, was installed for this purpose. It processes at a rate of approximately 300 gallons per minute (gpm) and is fed by six recovery wells screened in the LLAZ and the Middle Sand Aquifer Zone of the Crouch Branch Confining Unit. Both the M-1 and A-2 air strippers currently comply with their air emissions permit without treatment.

In addition, two process water production wells located in the deeper aquifer system are operated to provide mass removal and plume control.

The southeastern portion of the plume is associated with discharges from the A-014 Outfall. The plume, which covers and an area of approximately 325 hectares (800 acres), is being treated by a series of twelve in situ air stripping wells [airlift recirculation wells (ARW)] that were brought online in the late 1990s. Due to high contaminant concentrations in the plume on the north end of the ARW line, multi-stage in-well aerators (MIAs) were installed in wells SSR-009 through 012 to enhance removal efficiency from 70% to 90% in 2001. Additional treatment of the high concentration portion of the plume near the A-014 Outfall using in situ chemical oxidation (ISCO) has been demonstrated twice under temporary authorizations. Although some VOC

destruction was observed, ISCO (using persulfate) was determined to not be the most effective remedial option for this area. Monitored natural attenuation (MNA) has been proposed to address the dilute plume fringe area, which is located between the line of ARWs and Tims Branch, the predicted point of exposure of the dilute VOC plume. Anaerobic biological degradation has been observed in the groundwater discharge zone by Tims Branch.

MCB/MBP Subunit

The remedial action for the groundwater portion of the MCB/MBP subunit was implemented through the following activities:

- Treating the plume using an in situ air stripping system consisting of a total of 11 wells arranged in three banks, with five in the first bank and three in the next two banks. These ARWs became operational on February 28, 2002. The vertical and horizontal flow fields modeled during the operation of these wells was predicted to result in a 90% contaminant concentration reduction in one pass through the well field at 40 gallons per minute. Seventeen new and existing monitoring wells were identified to assist in determining the effectiveness of the system.
- Monitoring of ARW off-gas will be conducted to provide information on the amount of VOCs removed.

ABRP Subunit

Stage one of the remedial actions for the groundwater portion of the ABRP subunit was implemented through the following activities:

- Installing and operating ten air sparging wells to address the areas of the VOC plume in the M-Area Aquifer in excess of 500 µg/L. Each well had a discrete 0.3-m (1-ft) upper and lower screen separated vertically by about 10 feet. All wells became operational by October 2001. Due to reduced water tables levels, only the lower screens were operated. Each air sparge well had three passive SVE wells located at distances of 5, 10, and 15 feet away, screened across the vadose zone above the water table (M-Area Aquifer) to capture off-gas from the air sparging system.

- Groundwater monitoring and vapor monitoring of off-gas was conducted to evaluate the effectiveness of the remediation system and provide data to design and implement stage two of the remedy. The monitoring data also provided information on the amount of VOCs removed.

Stage two of the remedial action was not implemented based on the limited effectiveness of the stage one system. The presence of a low permeability zone above the lower air sparging target zone did not allow for the effective recovery of sparge air with entrained VOCs, and led to the lateral expansion of the groundwater plume in the M-Area Aquifer. Operating in pulsed mode and venting the middle sand of the Green Clay Confining Unit were evaluated and determined to likely not result in significant improvement in system performance. Thus, USDOE, USEPA, and SCDHEC agreed to discontinue operation of the system (WSRC 2003).

System Operations/Operation and Maintenance

The IROD for the A/M Area Groundwater OU remediation indicated that testing would continue in an effort to further increase recovery of groundwater. Periodic redevelopment of the recovery wells and pump replacements have been conducted to optimize recovery rates. However, decreases in overall recovery are expected and have been observed over time. Current average recovery rates are 423 gpm (SRNS 2011). In addition, the two process water production wells are required under the permit to operate actively at least 50% of the time.

The in situ air stripping wells also required similar notification to SCDHEC upon shutdown.

Routine and preventative maintenance is conducted on all operating systems, along with comprehensive monitoring of groundwater, effluent discharge, and off-gas associated with the treatment systems.

Institutional controls have been implemented through the SRS Site Use/Site Clearance program to preclude inadvertent access or use of contaminated groundwater.

Costs associated with the selected remedy for A/M Groundwater include operation and maintenance costs of air strippers, SVE units, and institutional controls. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost comparison cannot be provided in this remedy review.

V. Progress since Last Review

The previous protectiveness statement concluded that the interim remedial actions at A/M-Area Groundwater OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being maintained by several treatment systems and are monitored by the groundwater monitoring network which has been functioning properly.

Data from background, plume definition, airlift recirculation, and recovery wells, as applicable, are used to assess the effectiveness of the corrective action program. Background and plume definition wells monitor the horizontal and vertical extent of groundwater contamination and groundwater quality. Recovery wells pump contaminated groundwater to air strippers, which remove VOCs from the water before it is discharged to the appropriate outfall. ARWs perform in-situ air stripping to reduce VOC mass in the plume.

A summary of the operation and performance data over the last five years for the various remediation systems associated with the A/M-Area Groundwater OU and MCB/MBP subunit is presented in Table E-3.

M-1 Recovery wells and Air Stripper

The M-1 recovery wells and air stripper have removed 36,953 lbs of VOCs over the last five years, with a decrease in mass of about 30% between the last and first year of the period. During 2011 the average monthly influent VOC concentration was 3,502 µg/L. The average monthly effluent total VOC concentration was 0.00 µg/L. The M-1 Air Stripper has removed a cumulative total of approximately 495,324.5 lbs of VOCs since the beginning of operation in 1984.

A-2 Recovery wells and Air Stripper

The A-2 recovery wells and air stripper have removed 2,163 lbs of VOCs over the last five years, with a decrease in mass of about 30% between the last and first year of the period. During 2011 the average monthly influent VOC concentration was 324.2 µg/L. The average monthly effluent total VOC concentration was 0.1 µg/L.

Southern Sector ARWs

During the last five years the recirculation wells removed approximately 1,552 lbs of solvent, with a decrease of about 50% between the last and first year of the period. Four of the twelve wells (SSM-008, SSM-009, SSM-011, and SSM-012), the northern end of the remediation line, are removing over 98% of the solvent mass extracted by the entire recirculation well line. SCDHEC approved a temporary authorization (TA) on November 8, 2011 to suspend operations of the other eight Southern Sector ARWs (SSM-001 through SSM-007 and SSM-010). SRS has proposed MNA to address the distal portion of the plume.

DUS at the M-Area Settling Basin

The second DUS project commenced operation on August 8, 2005 and targeted DNAPL source zones associated with the M-Area Settling Basin. Steaming operations were conducted through October 2008 and again from May 2009 until September 2009 when shutdown criteria (WSRC 2006) had been met. The DUS project has removed 144,593 lbs of VOCs over the last five years, and 442,892 lbs of VOCs have been removed from the target area since project startup. The SVE unit at the M-Area Settling Basin DUS project removed a total of 2,650 lbs of solvent during 2011. In addition, approximately 1,203.3 lbs of solvent were removed from the groundwater near the DUS project during 2011 and was treated at the M-1 Air Stripper.

The DUS active SVE system will remain operational at least until extraction vapor temperatures are at 145°F or less and VOC removal is 40 lbs/week or less, respectively.

Other SVE Units

Subsequent to completion of DUS at the 321-M Solvent Storage Tank Area in 2001, active SVE was continued, and eventually converted to a MicroBlower™ system using solar power in November of 2010. These SVE systems have removed 2,987 lbs of VOCs over the last five years, with a decrease in mass of about 30% between the last and first year of the period.

Two SVEUs have been in operation at the A-014 Outfall area over the last five years. The 782-3M unit targets the deep vadose zone, and has removed 4,149 lbs of VOCs over the last five years. A high vacuum SVE unit is used for the shallow vadose zone, which is lower permeability and was hydraulically fractured to improve air flow through the contaminated zone. It has removed 6,939 lbs of VOCs over the last five years. Considering both units, the mass removed in the last year is only about 5% of the mass removed in first year of the period.

In addition, BaroBall™-equipped wells near the Met Lab HWMF and along the abandoned process sewer line leading to the M-Area Basin continue to operate passively.

MCB/MBP subunit

Operational and performance data for the eleven (11) MCB/MBP ARWs is presented in Table E-3. During the review period, the ARWs removed approximately 34 lbs of solvent. Low production values led to the proposal to discontinue the ARWs and use MNA as the final corrective action (WSRC 2007b). Although SCDHEC did not approve this approach as a final corrective action, they approved a TA request for operational suspension of the ARWs in November 2011, with additional groundwater monitoring.

There were no recommendations or follow-up actions from the last 5-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial actions;

- Reviewed all process and performance monitoring data provided by the annual groundwater monitoring and corrective action reports and provided a technical assessment of whether the treatment systems are functioning as intended by the MCB/MBP subunit IROD and whether the shutdown criteria has been achieved;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment E-1; and
- Assured that all actions required under the RCRA Permit were implemented.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

Each of the three interim remedies effectiveness in meeting the interim remedial action objectives is described below:

A/M-Area Groundwater OU

The zone of influence of the M-1 recovery well network was designed to capture the high concentration regions of the TCE/PCE plumes present, thus preventing significant plume migration. The system has been very effective, with nearly 500,000 lbs of VOCs removed since 1984. However, recent groundwater monitoring data from the LLAZ indicate that a portion of the high concentration part of the plume is located to the west of the recovery well zone of capture (SRNS 2012). This will result in plume expansion towards the west and southwest and a longer time for groundwater concentrations to reach MCLs. The recovery wells are primarily screened in the LLAZ; however residual contamination within the MAAZ would ultimately also be captured by these wells. Any contamination in the Crouch Branch Aquifer is not affected by this system.

MCB/MBP Subunit

The recirculation wells were placed in service in February 2002. The wells have operated as designed, significantly reducing concentrations within the well. However, actual mass removal rates have been low (less than 10 lbs/year). Operating data from the wells and additional groundwater sampling have established that the groundwater plume

is more dilute than originally believed, but also extends beyond the recirculation well line at higher concentrations than expected based on the theoretical zone of treatment for the wells. This indicates that the recirculation well system has not been as effective as planned in treating the entire plume. Therefore, a comprehensive set of remedial alternatives were evaluated including a comparison of the effectiveness of MNA to other active remedies (WSRC 2007a). The analysis indicated that active groundwater treatment alternatives were more effective than MNA to some extent. For example, the time to reach MCLs was reduced from 43 to 24 years, and the predicted time to reach 50 ppb, the goal established for the last line of recirculation wells, is ten years for MNA, and five years for an expanded line of treatment wells. Considering the magnitude of these differences as compared to the additional cost to install and operate an expanded system, SRS proposed to discontinue the ARWs and use MNA as the final corrective action (WSRC 2007b). Although SCDHEC did not approve this approach as a final corrective action, the agency approved a TA request for operational suspension of the ARWs with additional groundwater monitoring in November 2011. SRS will submit a schedule for corrective action for the ABRP/MCB/MBP groundwater within nine months of the effective date of the 2013 RCRA Permit Renewal for the M-Area and Metallurgical Laboratory HWMFs. Subsequent to additional characterization of the distal extent of the plume, corrective action alternatives that include remedial options in addition to MNA will be considered.

ABRP Subunit

Operation of the air sparging system began in 2001. The presence of a low permeability zone above the lower air sparging target zone did not allow for the effective recovery of sparge air with entrained VOCs, and led to the lateral expansion of the groundwater plume in the M-Area Aquifer. Operating in pulsed mode and venting the middle sand of the Green Clay Confining Unit were evaluated and determined to likely not result in significant improvement in system performance. Thus, USDOE, USEPA, and SCDHEC agreed to discontinue operation of the system (WSRC 2003).

Groundwater concentrations in the MAAZ and the upper LLAZ in the vicinity of the system have been declining; current concentrations are below 200 µg/L. Due to the

comingling of this plume with the MCB/MBP plume downgradient, both source zones were considered in the proposal recommending MNA as described for the MCB/MBP subunit (WSRC 2007b). Modeling indicates that MCLs should be reached in groundwater within 50 years and that surface water will not be impacted above MCLs.

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

The exposure assumptions and toxicity data used at the time of the three interim remedy selections are still valid. Exposure to groundwater is still controlled by institutional controls. The MCLs for PCE and TCE have remained at 0.005 mg/L. A Preliminary Remediation Goal (PRG) of 0.006 mg/L has been established for 1,4-dioxane, which is monitored for under the RCRA permit. The remedial action objectives are discussed above.

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

Recent groundwater data collected for the A/M-Area Groundwater OU indicate that the interim remedy is not meeting all of the interim remedial action objectives.

VIII. Issues

After successfully reducing VOC concentrations in the main source area of the plume, the highest dissolved concentrations of VOCs currently are located outside of the zone of capture zone of the recovery system.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions for the A/M-Area Groundwater OU are presented in Table E-4.

X. Protectiveness Statement(s)

The remedies at the A/M-Area Groundwater OU currently protects human health and the environment because groundwater removal and treatment, in situ treatment, and

contaminant source treatment have been successful in removing VOC contamination in groundwater and exposure pathways that could result in unacceptable risks are being controlled through institutional controls. However, in order for the remedy to be protective in the long-term, optimization of the M-1 recovery system and/or other remediation technologies must be implemented to treat the high concentration part of the plume located outside of the recovery well zone of capture.

Currently, controls to prevent exposure to or ingestion of contaminated groundwater include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the A/M-Area Groundwater 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

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

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WSRC, 1999a. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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WSRC, 2002. *1992 RCRA Part B Permit Application, Volume III, M-Area Hazardous Waste Management*, WSRC-IM-91-53, Revision 17, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC 2003. *Performance Evaluation Report for the A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Interim Remedial Action: September 2001-September2002 (U)*, WSRC-RP-2002-00534, Revision 1.1, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

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WSRC 2007a. *RCRA Corrective Action Plan Addendum with Updated Summary Results to the Flow and Transport Modeling to Support the Corrective Measures Study/Feasibility Study (CMS/FS) for the A-Area Burning/Rubble Pits and Rubble Pit/Miscellaneous Chemical Basin/Metals Burning Pit (ABRP/MCB/MBP) Operable Unit (OU)*, WSRC-RP-2007-4012, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC 2007b. *2000 Part B Permit Renewal Application: for M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities Postclosure*, WSRC-IM-98-30, Volume III, Revision 3, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Annual 2007 M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities Groundwater Monitoring and Corrective Action Report (U),* WSRC-RP-2007-4086, Washington Savannah River Company, Savannah River Site, Aiken, SC

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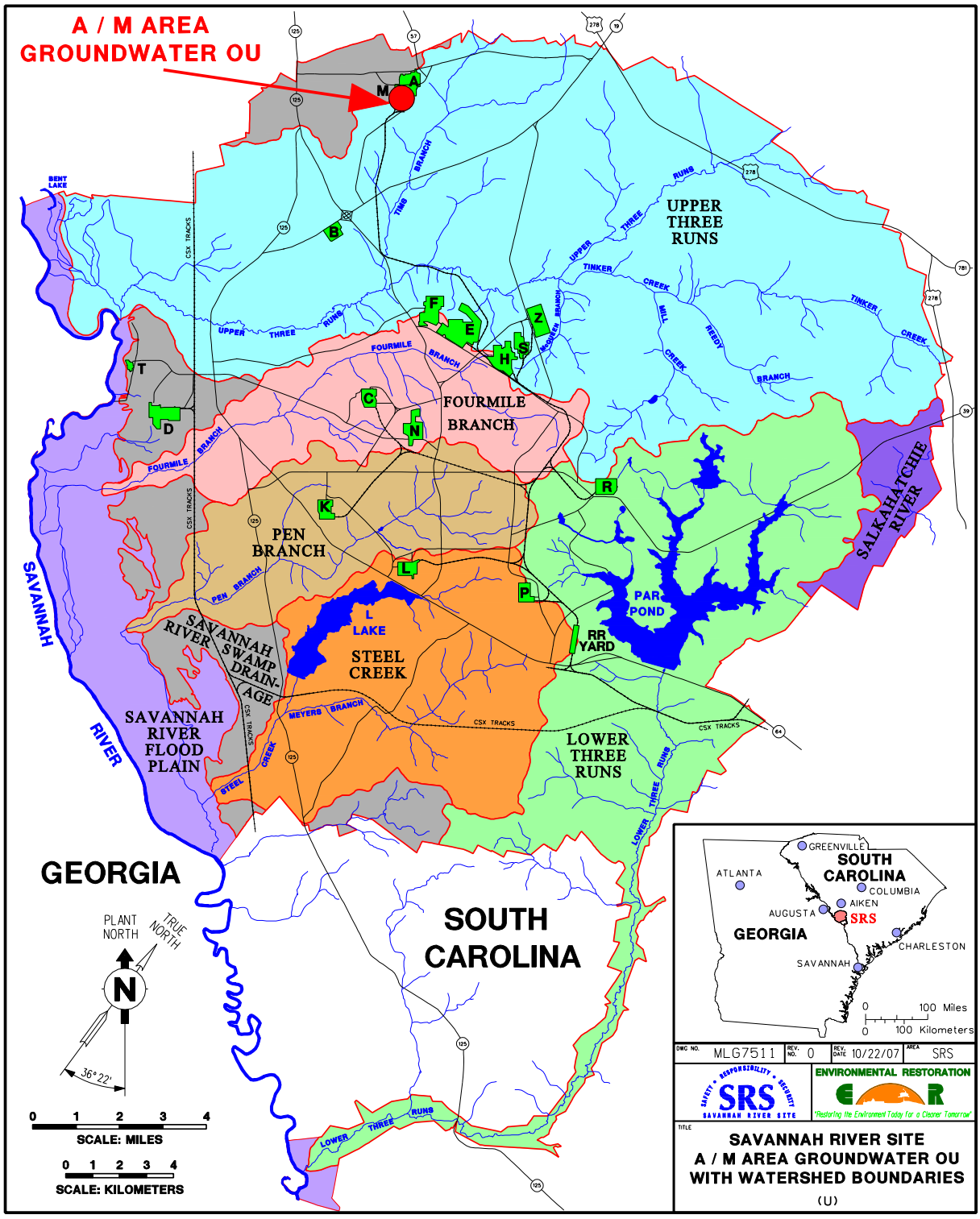
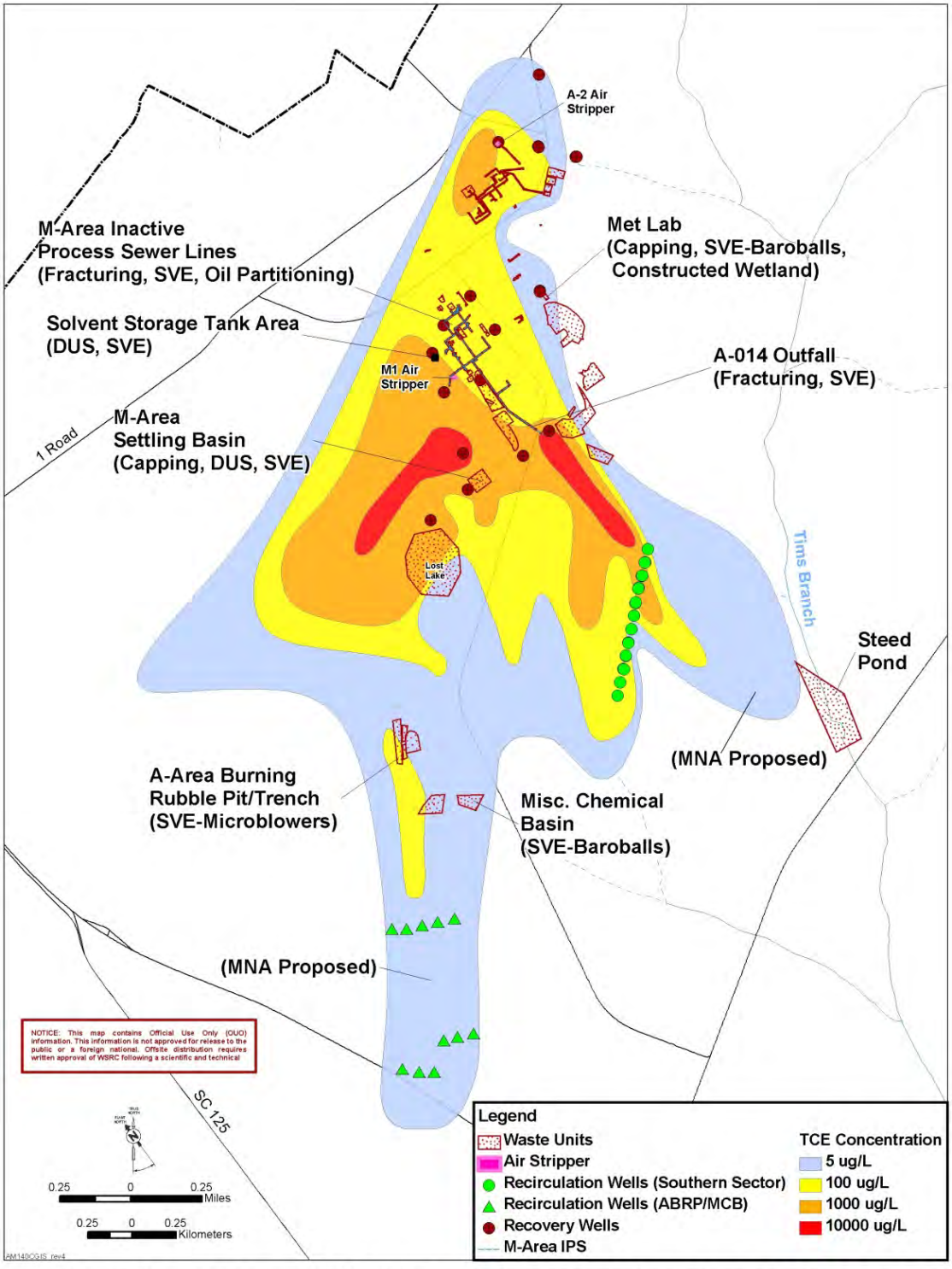


Figure E-1. Location of A/M Groundwater at Savannah River Site



A/M-Area Composite LLAZ TCE Plume with Sources and Remediation Technologies

Figure E-2. A/M Area Groundwater OU Plume and Treatment Systems Locations

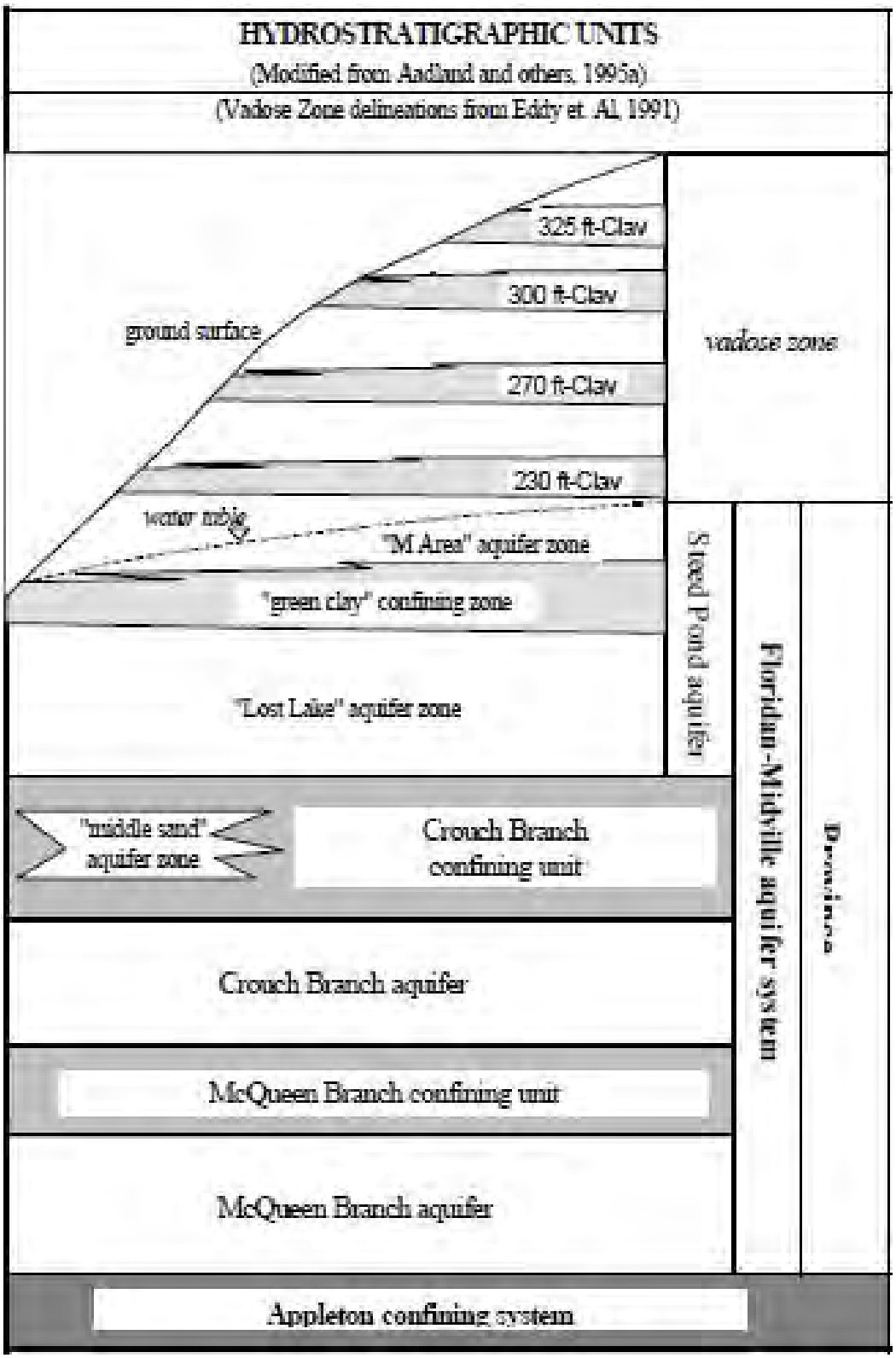


Figure E-3. A/M-Area Groundwater OU General Hydrostratigraphy



Figure E-4. M-1 Recovery Well System Air Stripper



Figure E-5. High Vacuum SVE Unit at A-014 Outfall

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Table E-1. Chronology of OU Events

Event	Date
Interim Status Groundwater Monitoring Start / Complete	September 29, 1980 / November 1, 1987
Pilot / Prototype Air Stripper System Testing and Operation Start / Complete	February 1983 / March 1985
M-1 Air Stripper Full Scale Operation Start / Complete	September 9, 1985 / Ongoing
Interim Record of Decision (IROD) Issuance – A/M Area Groundwater OU	June 29, 1992
IROD Issuance for the Miscellaneous Chemical Basin (MCB)/Metals Burning Pit	November 17, 2000
IROD Issuance for the A-Area Burning/Rubble Pits (ABRP) and Rubble Pit	December 7, 2000
Interim Remedial Action Start / Complete - ABRP Air Sparging Wells	September 26, 2001 / March 2003
Interim Remedial Action Start / Complete - MCB In Situ Air Stripping (Recirculation) Wells	February 28, 2002 / November 8, 2011 (Operational Suspension)
Transfer of ABRP/MCB/MBP OU Groundwater Plume to RCRA Program	July 19, 2006*
RCRA Permit Renewals (Effective Dates)	October 30, 1987 / October 5, 1995**
Previous Five-Year Reviews	June 30, 1997, February 12, 2004, February 4, 2009

* Submittal date of the 2000 RCRA Part B Permit Renewal Application (WSRC 2006).

** Remains effective due to timely submission of the 2000 RCRA Part B Permit Renewal Application (WSRC 2007b) in March 2000.

Table E-2. COCs and Interim and Final RGs for ABRP and MCB/MBP subunits

Groundwater COCs and RGs for the ABRP subunit		
COC	**Final RG, MCL µg/L**	**Interim RG µg/L**
TCE	5	100*
PCE	5	100*
Dichloromethane	5	100*

Groundwater COCs and RGs for the MCB/MBP subunit				
COC	**Final RG, MCL, Action Level (µg/L)**	**Interim RG, High VOC Concentration Wells (>500 µg/L)†**	**Interim RG, Medium VOC Concentration Wells (ca 200 µg/L)†**	**Interim RG, Low VOC Concentration Wells (<50 µg/L)†**
TCE	5	20	41	20
PCE	5	20	41	20
Carbon tetrachloride	5	20	41	20
Lead	15 (Action Level)	15	15	15

* Interim RGs specified in IAPP for ABRP.
† Interim RGs based on modeling results.
COC - constituent of concern
MCL – maximum contaminant level
RG – remedial goal

Table E-3. Summary of Remediation Performance for 2007 – 2011 (Pounds of VOCs Removed)

	2007	**2008**	**2009**	**2010**	**2011**
Groundwater Recovery & Treatment					
M-1 Air Stripper	8,520	8,004	7,443	6,958	6,028
A-2 Air Stripper	508	469	439	404	343
Groundwater Recirculation Wells					
Southern Sector ARWs	450	396	288	180	238
MCB ARWs	6	7	6	5	10
Soil Vapor Extraction					
A-014 Outfall (3M)	1,692	1,228	722	444	62.5
A-014 High Vacuum	2,685	1,636	1102	1,127	389
Solvent Storage Tank (Post-DUS)	846	980	426	135	600
Source (DNAPL) Zone Remediation					
DUS at M-Area Basin	86,700	46,000	3,532	4,508	3,853

Table E-4. Recommendations and Follow-up Actions for A/M-Area Groundwater OU

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date*	Affects Protectiveness? (Y/N)	
					Current	Future
The highest dissolved concentrations in the LLAZ are west of the recovery well capture zone, which will result in plume expansion towards the west- southwest and a longer time for groundwater concentrations to reach MCLs.	Optimize the M-1 recovery system and/or consider other remediation technologies to treat this high concentration area.	USDOE	SCDHEC	June 2017	N	Y
Optimization – Reporting*	Reduce reporting frequency from semiannual to annual.	USDOE	SCDHEC	9/18/12	N	N
Optimization – Well Sampling	Remove/Add wells to monitoring network based on current plume configuration. Reduce sampling frequency for remedial systems.	USDOE	SCDHEC	2/28/13	N	N
A final corrective action has not been selected for the ABRP/MCB/MBP plume that remains above MCLs	Submit a schedule for corrective action, including additional characterization of the distal portion of the plume	USDOE	SCDHEC	4/11/14	N	N

* This optimization item was included in the WSRC-IM-98-30 Volume III Revision 6 2000 RCRA Part B Permit Renewal Application M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities Post-Closure Permit Application Modification Request, submitted on 9/18/2012.

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Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater

I. SITE INFORMATION			
Site Name:	**A/M-Area Groundwater**	**Date of Inspection:**	**08/16/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #CNA**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 93°F**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☒ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Active and passive Soil Vapor Extraction, Dynamic Underground Stripping, Airlift Recirculation Wells

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

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: _____ (Name) _____ (Title) _____ (Date)

Interviewed: ☐ At Site ☐ At Office ☐ By Phone Phone No.: _____

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Stuart Crosby (Name) SGW-Operations Engineer (Title) 8/16/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: _____

Problems/Suggestions: ☐ Report Attached _____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

Remarks: _____

_____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

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

2. Health and Safety Plans (HASPs):

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

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

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: _____

B. Signs

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

Remarks: Signs are in good condition. _____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(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.) Walk-through

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(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:_____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

VII. COVER SYSTEMS *(Continued)*

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

Remarks:_____

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

Areal extent_____ Depth_____

Remarks:_____

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

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

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

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☐ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:_____
E. Gas Collection and Treatment ☐ Applicable ☐ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:_____
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:_____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

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

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

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

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☒ Good Condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☒ Good Condition ☐ Needs Maintenance Remarks:
3. Spare Parts and Equipment: ☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☒ Good Condition ☐ Needs maintenance
☒ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☒ Equipment properly identified
☒ Quantity of groundwater treatment annually Approximately 375,000,000 gallons at the M-1 and A-2 Air Strippers_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☒ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☒ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☒ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☒ Good Condition (especially roof and doorways ☐ Needs repair
☒ Chemicals and equipment properly stored
Remarks:_____

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:

X. OTHER REMEDIES

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

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: Active and Passive SVE systems in service.

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

Attachment E-1. Five-Year Review Site Inspection Checklist – A/M-Area Groundwater *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedies at the A/M Area Groundwater OU currently protects human health and the environment because groundwater removal and treatment, in situ treatment, and contaminant source treatment have been successful in removing VOC contamination in groundwater and exposure pathways that could result in unacceptable risks are being controlled through institutional controls. However, in order for the remedy to be protective of the environment in the long-term, the M1 groundwater recovery system should be optimized, After successfully reducing VOC concentrations in the main source area of the plume, the highest dissolved concentrations of VOCs currently are located outside (west) of the zone of capture zone of the recovery system. This will result in plume expansion towards the west- southwest and a longer time for groundwater concentrations to reach MCLs.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Operating and Maintenance programs are well established and functioning to ensure that remedial systems remain in effective service.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Optimize the M-1 recovery system and/or consider other remediation technologies to treat this high concentration area Remove/Add wells to monitoring network based on current plume configuration. Reduce sampling frequency for remedial systems.

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C-AREA BURNING/RUBBLE PIT OPERABLE UNIT (131-C) AND OLD C-AREA BURNING/RUBBLE PIT (NBN)

I. Introduction

This report is the third five-year review for the C-Area Burning/Rubble Pit (131-C) and Old Burning/Rubble Pit (No Building Number [NBN]) Operable Unit (CBRP OU). This review was conducted from August 2012 through September 2012. Contaminants have been left in place at the CBRP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the CBRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

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

III. Background

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

The scope of the CBRP OU remedial action includes seven subunits: CBRP disposal pit (surface and subsurface soil), vadose zone (soil beneath CBRP), Old CBRP (surface and subsurface soil), the Mounded Area north of CBRP, concrete drainage ditch south of CBRP (adjacent surface soil), groundwater plume, and surface water.

Physical Characteristics

The CBRP OU comprises approximately 53 hectares (130 acres) including all groundwater contaminated above maximum contaminant levels (MCLs). Figure F-1 shows the location of the CBRP OU at Savannah River Site (SRS). Figure F-2 presents the site layout.

A description of the CBRP OU subunits is as follows:

- CBRP was a shallow, unlined excavation, approximately 7.5 m (25 ft) wide by 105 m (350 ft) long with depths ranging between 2.4-3.6 m (8-12 ft). It had a volume of approximately 2,477 m^3 (3,240 yd^3).

- Old CBRP was constructed in 1951 for use as a burning pit. Aerial photographs indicated that Old CBRP was located approximately 165 ft northeast of the CBRP. The Old CBRP was replaced by CBRP in the early 1960s. No surface expression of the old CBRP OU remains.

- The Mounded Area is located directly north of CBRP and is approximately 9 m (30 ft) high. This man-made mound contains rubble from the construction of the C-Reactor Building (105-C). It is covered with soil from the excavation of the C-Reactor Retention Basin (904-89G), which included 70% of the Old CBRP.

- The concrete drainage ditch south of CBRP (adjacent surface soil) may have carried overflow water from the CBRP OU, which is located south of the Pit Area. It is not known whether overflow water from the pit ever actually entered the drainage ditch.

- The surface water in Fourmile Branch and Twin Lakes receives contaminated groundwater from the CBRP. CBRP is a source of volatile organic compound (VOC) groundwater contamination, primarily trichloroethylene (TCE). The plume extends to a section of Fourmile Branch and the entire reach of the unnamed tributary in the Twin Lakes area, where contaminated groundwater seeps into the stream.

- Past activities associated with C-Reactor operations have resulted in groundwater contamination beneath CBRP OU. The groundwater plume extends from CBRP to the surface waters of Twin Lakes and Fourmile Branch. During operations at CBRP, TCE and tetrachloroethylene (PCE) were released to the environment, resulting in a groundwater contamination plume beneath CBRP OU. Past activities associated with C-Reactor operations have resulted in tritium contamination beneath the CBPR OU. However, the tritium contamination is being addressed as part of the C-Area Groundwater (CAGW) OU.

Land and Resource Use

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

History of Contamination

The CBRP disposal pit began operation during the early to mid-1960s to replace the Old CBRP. During operation, the CBRP disposal pit served as a repository for organic materials of unknown use and origin, which included scrap lumber, rubber drive belts, waste oils, organic solvents, paper, and plastics. Disposal records, including composition, origin, and use of materials disposed, were not kept for this unit during its period of operation. The collected materials were burned periodically to reduce the overall waste volume. SRS suspended burning of waste in open pits in October 1973. At this time, the pit contents were covered with a thin layer of soil. The pit was then used for the disposal of inert rubble. Rubble pit operations were terminated prior to 1981 and SRS backfilled CBRP with approximately 0.6 m (2 ft) of native soil to grade level. Figures F-3 and F-4 present photographs of the CBRP OU before remediation and currently (2012).

The VOC groundwater plume originated beneath the west end of CBRP and migrated west toward Twin Lakes and Fourmile Branch. TCE is the principal VOC in the groundwater. PCE, cis-1,2-Dichloroethylene (cDCE), 1,1-Dichloroethylene (DCE) and vinyl chloride (VC) also exceeded MCLs. Contaminant levels in groundwater emerging along Twin Lakes and Fourmile Branch seeplines exceeded MCLs during the RFI/RI investigation.

Initial Response

There were no initial responses prior to the decision document for this OU.

Basis for Taking Action

Releases of VOCs (predominantly TCE and PCE) have occurred to the environment at CBRP OU resulting in a groundwater plume with contaminant concentrations above MCLs. Contaminant levels in groundwater emerging along Twin Lakes and Fourmile Branch seeplines exceeded MCLs during the RFI/RI investigation. Dioxins, in the form of 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD), were found in the surface soils of the CBRP disposal pit as a result of burning activities. In addition, a TCE source was found in vadose zone soils between 7.5 and 9 m (25 and 30 ft) below ground surface (bgs) at the west end of the CBRP disposal pit. The refined contaminants of concern (RCOCs) and remedial goals (RGs) for the CBRP disposal pit, groundwater, and surface water (Twin Lakes and Fourmile Branch) are listed in Table F-2. A remedial action was needed at this OU because dioxins in soil at the CBRP Disposal Pit may pose an unacceptable risk to future residents and ecological receptors. In addition, VOCs in groundwater and surface water above MCLs may pose an unacceptable risk to future residents.

The RFI/RI with Baseline Risk Assessment (BRA) for CBRP did not identify any RCOCs for the Old CBRP, the mounded area or the concrete drainage ditch. No Action was the selected remedy for these three subunits.

IV. Remedial Actions

Remedy Selection

An interim remedial action was initiated at the CBRP OU in 1999 (WSRC 2001) and included:

- Placement of a 0.6 acre cover system over the CBRP disposal pit consisting of 0.9-m (3-ft) thick, 1 x 10^{-5} cm/s low permeability soil layer covered by 0.15 m (0.5-ft) thick topsoil/vegetative layer to provide a barrier to human and ecological receptors and to reduce infiltration though the waste.
- Installation and operation of an active Soil Vapor Extraction (SVE) system, consisting of 43 SVE wells, which operated from September 1999 to 2004 to treat the vadose zone. The system removed over 2,100 lbs of VOCs and subsequently,

reduced groundwater concentrations from greater than 130,000 µg/L to approximately 100 µg/L at well CRP-27DU located adjacent to the source zone.

- Installation and operation of an Air Sparging (AS) network consisting of 17 AS wells, which operated from June 2000 to August 2002 to strip VOCs from the local groundwater. The AS network contributed to the reduction of groundwater TCE concentrations below CBRP until the water table dropped below the well screens due to drought conditions during 2002.

- Natural attenuation parameters were evaluated using three existing surface water stations and 26 monitored natural attenuation (MNA) wells that were installed between September 2000 and March 2001.

Based on Effectiveness Monitoring Reports (EMRs), the core team agreed, in September 2004, that the Interim Remedial Action had achieved its remedial goals. In December 2004, the SVE/AS systems were shut down, and replaced with an active solar-powered MicroBlower™ system in order to continue residual vapor extraction. Concentrations of the primary solvents (PCE and TCE) and their degradation products in the emerging groundwater along the Fourmile Branch and Twin Lakes wetlands seeplines have remained below MCLs since December 2006.

As stated in the Biennial EMR (SRNS 2011), the remedial action objectives (RAOs) for the CBRP OU are:

- Treat and / or mitigate groundwater contaminated above MCLs;

- Prevent human exposure to groundwater contaminated with TCE and PCE above MCLs;

- Reduce the concentration of VOCs in the groundwater to levels at or below MCLs, and attenuate the groundwater plume to the extent practicable;

- Prevent discharge of contaminated groundwater to surface water resulting in concentrations exceeding their MCLs; and

- Reduce the levels of VOCs in surface water at or below the MCLs.

Remedy Implementation

The selected final remedy for the CBRP OU is a combination of the preferred alternatives for each of the subunits that provide the greatest level of protection to human and ecological receptors. As part of the Declaration for the issued ROD, the interim actions for the soil cover cap, the active soil vapor extraction and the air sparging were accepted as a final remedial action. The final remedy, as documented ROD (WSRC 2008) includes the following:

- Continued maintenance of the installed 0.6-acre $1x10^{-6}$ cm/sec soil cover system installed during the interim remedial action;
- Continued operation of the four active MicroBlowers™ SVE system installed during the interim remedial action;
- Installation of a groundwater monitoring network to support MNA consisting of eighteen monitoring wells, twelve MNA monitoring wells and five surface water stations;
- Abandonment of the no longer needed SVE and AS wells from the interim remedial action in accordance with SRS Manual 3Q5 and R.61-71 South Carolina Well Standards. Three AS wells were not abandoned due to their geologically significant location relative to plume geometry and the waste unit; and
- Expanded land use controls (LUCs) to 141.2 acres to include the groundwater plume area consisting of general site access controls, groundwater use restrictions, the SRS Site Use/Site Clearance program, and deed restrictions and notifications.

System Operations/O&M

The following system operations are ongoing:

Operation and Maintenance (O&M) of the MicroBlower™ SVE system will continue until the vadose zone source is no longer a threat to increase groundwater contamination levels above MCLs.

The following maintenance activities are ongoing:

- Annual sampling of the wells and surface water stations. Sampling will continue until MCLs have been attained, the MNA has achieved its RAOs and the remedial action is complete. In 2011, an agreement was reached to decrease reporting to biennially. The MNA remedy will be evaluated biennially based on groundwater monitoring data as defined in the approved CMI/RAIP for the CBRP OU (WSRC 2009). The results are being reported via annual EMRs since April 2001. The MNA remedy is expected to reduce groundwater concentrations to below MCLs within a reasonable time frame (70 years).
- Annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs).
- Site controls and land use restrictions via the SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the CBRP OU.

The estimated O&M costs associated with the selected remedy for the CBRP OU, including O&M costs for the SVE systems, soil cover, MNA and institutional controls (i.e., LUCs), has a present worth cost of $1,222,000 discounted at 3.9% per year for 70 years (WSRC 2007). The total actual O&M cost from project support and other post-construction expense, since becoming operational to fiscal year 2011, is $261,000, which is higher than expected due to increased costs associated with MNA monitoring and reporting (Table F-3).

V. Progress since Last Review

The previous protectiveness statement concluded that the remedial actions at the CBRP OU are expected to be protective of human health and the environment. Exposure

pathways that could result in unacceptable risks are being addressed through the low permeability soil cover system with low-energy SVE, MNA, and institutional controls (i.e., LUCs).

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed documents listed in Section XII (References)
- Reviewed the groundwater monitoring data (Table F-4);
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment F-1, 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 Interim Action for the CRBP OU was initialed started in January 1999 and included a soil cover cap over the disposal pit, installation of an SVE system and installation of an air sparging system. The ROD issued in July 2008 suspended the air sparge system, but continued the SVE system (MicroBlowers™ only), inspections of the soil cover, and added Monitored Natural Attenuation (MNA) for the groundwater plume. The last two years of available data show the MicroBlowers™ system has removed approximately 31.8 kg/yr (70 lbs/yr) of TCE which exceeds the minimal recovery rate necessary to prevent migration of TCE to the groundwater (0.8 kg/yr [1.8 lbs/yr]). The MNA wells and surface water sampling show decreasing contaminants over time, with the exception of two wells (CRW 12C and CRW010CU) which display concentrations exceeding the TCE trigger level. TCE degradation products (i.e., cDCE, VC and ethylene) are observed

in monitoring wells and are proof of a MNA degradation scheme, especially in the wetlands of Twin lakes.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M Staff member, on June 13, 2012 at the CBRP OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The CBRP OU was inspected by SRNS and USDOE personnel on September 17, 2012. No issues were identified for the CBRP OU during this inspection and interviews.

On January 29, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspections.

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 is effective in preventing ecological exposure to HpCDD in the pit surface soils and human exposure to TCE and PCE in the groundwater. The cover system maintenance program and LUCs have been effective in maintaining the integrity of the cover system. The annual inspection reports indicate no significant deficiencies.

- The MicroBlower™ system and cover system have been effective in preventing the migration of VOCs to the groundwater above MCLs; and TCE, PCE and VC to the surface water. The MicroBlower™ system has been recovering over the 1.8 lbs per year minimum extraction rate needed to control the TCE source. Both groundwater and surface water monitoring data indicate a decreasing trend of TCE concentration over time (Table F-3).

- The MNA program and monitoring well network provides sufficient data to assess the progress of natural attenuation within the groundwater as evidenced by the decreasing concentrations of TCE and PCE in the groundwater (Table F-3). The surface water sampling locations provide sufficient data to monitor groundwater outcropping to Fourmile Branch and Twin Lakes and report trend data below MCLs. The LUCs are sufficient to prevent human exposure to groundwater contaminated with VOCs above MCLs.

The above remedial activities are meeting the RGs established for the CBRP OU, as discussed in Section II, 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. The MCLs for TCE, PCE, cDCE, DCE, DCM, and VC have remained the same since the remedies were implemented. There have been no changes in standards or physical conditions of the CBRP OU that would affect the protectiveness of the remedy.

More stringent 2012 PRGs/RSLs do not impact the protectiveness of the remedy because the soil cover prevents exposure of human and ecological receptors to remaining soil contaminants left in place. There have been no changes in the MCLs for TCE and PCE that would impact SVE operation in the vadose zone. In addition, more stringent PRGs/RSLs would not impact the LUCs that are in place to prevent exposure to or ingestion of contaminated groundwater and soil media at the CBRP OU.

Due to the presence of chlorinated solvents at the site, there is a potential that 1,4-dioxane may also exist because it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. SRS has performed a review of recent groundwater data for 1,4-dioxane in C Area (including CBRP OU). In 2010 and 2011, 98 groundwater and surface water samples were analyzed using a low detection limit method (EPA8260BSIM) for

1,4-dioxane. Only five results were above detection, with three of the results from surface water samples in Fourmile Branch, which can be associated with an upgradient OU. The maximum result (6.35 µg/L) was from a background (upgradient) C-Area well sample, and the last result from a well sample downgradient of the CRSB OU. Based on the low frequency of results above the detection limit, the scattered locations of those results, and the very low levels of the results, 1,4-dioxane is not a contaminant of concern for the CBRP OU that requires additional monitoring.

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 CBRP OU from being protective.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

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

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 2011. *Biennial Effectiveness Monitoring Report for Monitored Natural Attenuation at the C-Area Burning/Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) Operable Unit with Post-Construction Report Data (U) – October 2009 through December 2010*, SRNS-RP-2011-01116, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

WSRC, 1998. *Interim Record of Decision for the C-Area Burning/Rubble Pit Operable Unit (131-C) (U)*, WSRC-RP-98-4039, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2001. *Interim Post-Construction Report (PCR) for the C-Area Burning/Rubble Pit (U)*, WSRC-RP-2000-4094, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *RCRA Facility Investigation (RFI)/Remedial Investigation (RI) Report with Baseline Risk Assessment (BRA) for the C-Area Burning/Rubble Pit (OU)*, WSRC-RP-96-170, Revision 1.4, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Record of Decision for Remedial Alternative Selection for the C-Area Burning/Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN)*

(U), WSRC-RP-2007-4082, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2009. *Corrective Measures Implementation/Remedial Action Implementation Plan for the C-Area Burning/Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) (U)*, WSRC-RP-2008-4051, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist C-Area Burning Rubble Pit (131-C) (U)*, ER-IDS-019-016, Inspection period 2007 through 2011 (annually)

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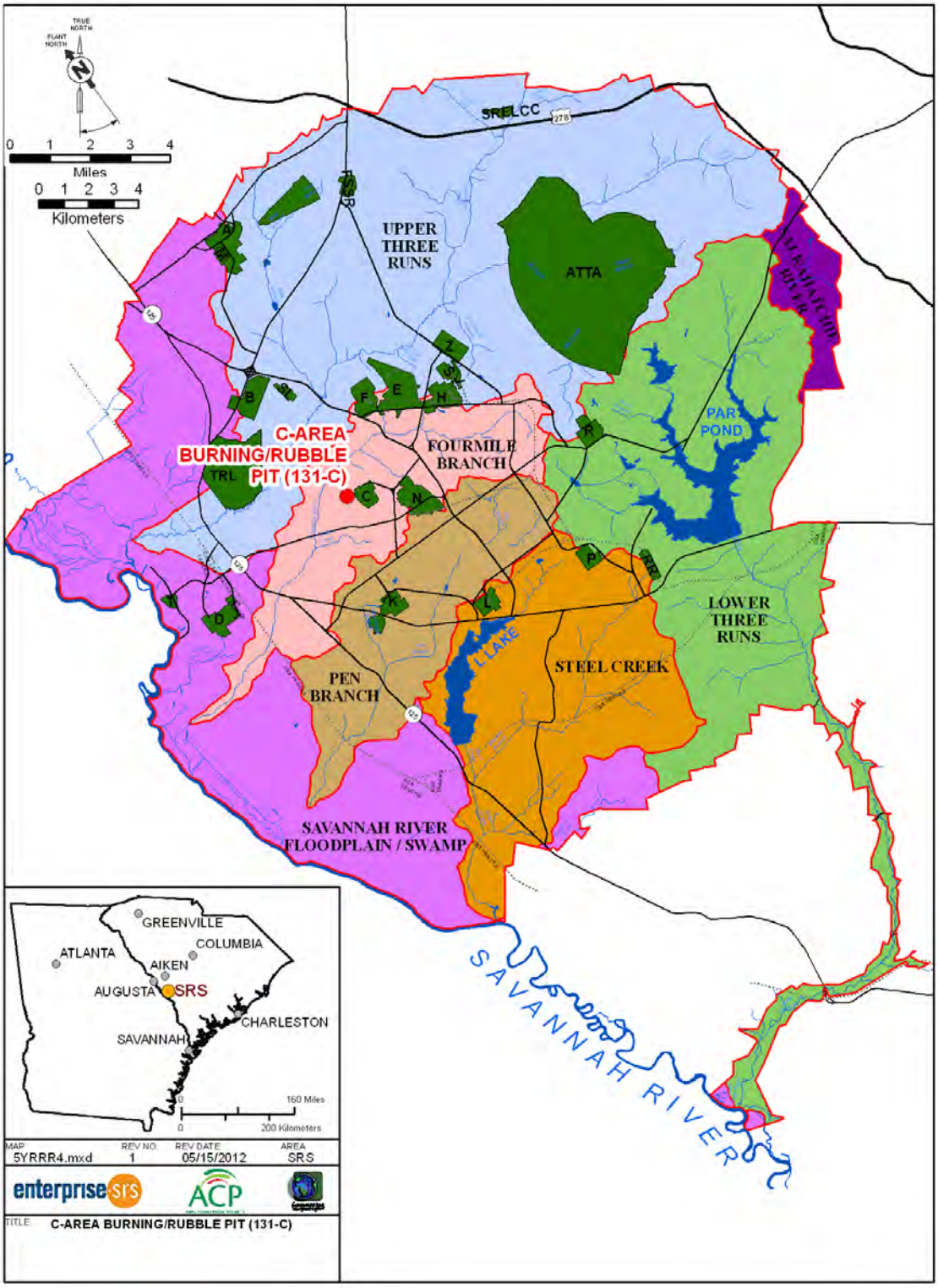


Figure F-1. Location of C-Area Burning/Rubble Pit Operable Unit (131-C) at SRS

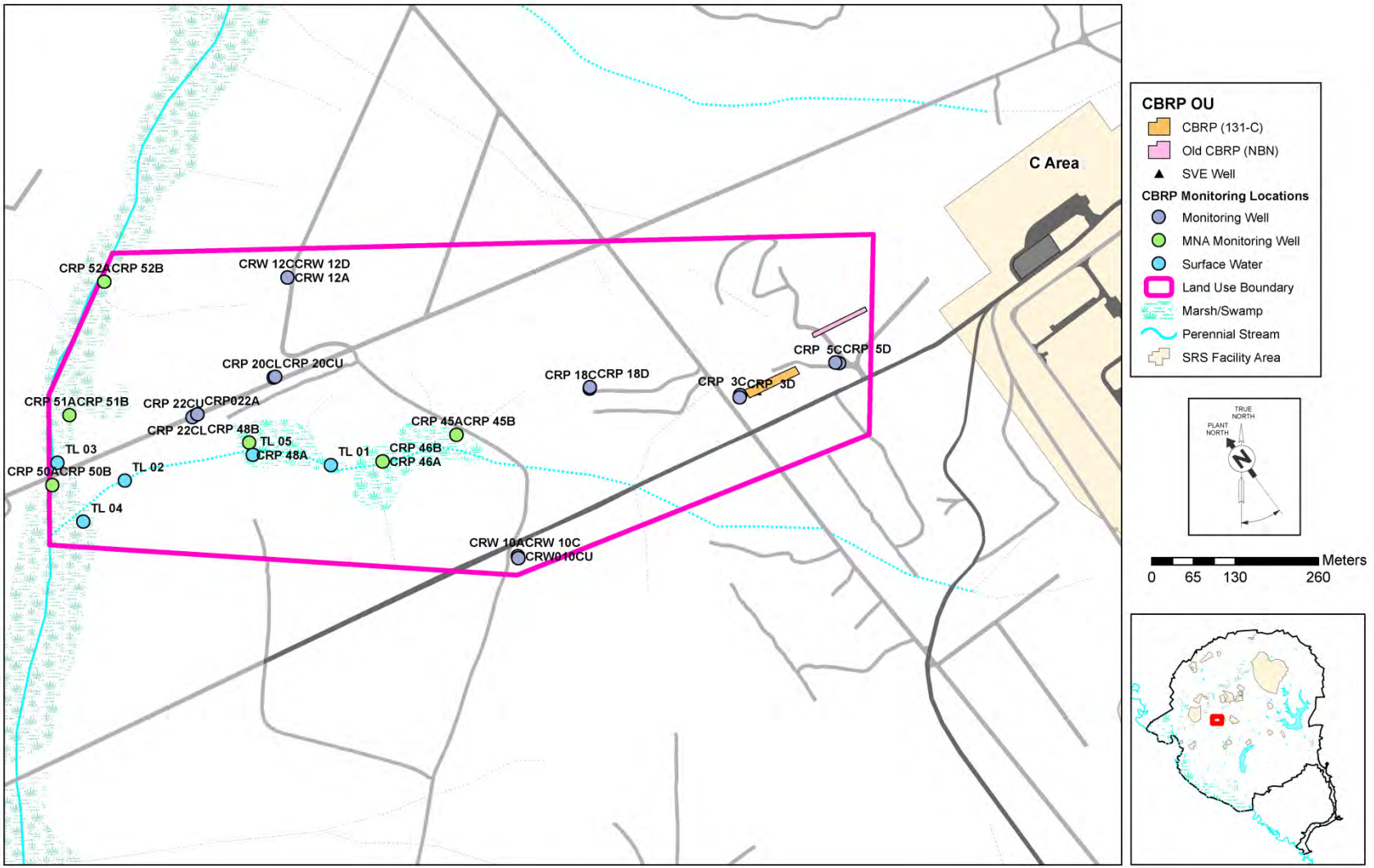


Figure F-2. Site Layout for the CBRP OU



Figure F-3. Photo of CBRP Before Remediation Activities



Figure F-4. Current Photo of CBRP (2012)

Table F-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	August 22, 1995/ July 2001
Interim Record of Decision (ROD) Issuance	March 4, 1999
Interim Remedial Action Start/Complete	January 12, 1999/June 2000
Interim RA Operations Start / Complete	September 1999 / ongoing
ROD Issuance	July 9, 2008
Remedial Action Start/Complete	May 13, 2009/June 2009
Remedial Action Operations (MNA) Start / Complete	December 2009 / ongoing
Previous Five-Year Reviews	February 12, 2004/February 4, 2009

Table F-2. CBRP RCOCs

Media	Subunits	RCOCs	Basis/Receptor	RG
Soil	Disposal Pit	HpCDD	Ecological hazard to small burrowing animals (shrew)	0.07 µg/kg
	Vadose Zone	TCE	CM RCOC, exceeds MCL in <10 yrs	58 µg/kg
Groundwater	Groundwater Plume	PCE	ARAR RCOC, exceeds MCL	5 µg/L
		TCE	Risk/hazard to future industrial worker, exceeds MCL	5 µg/L
		DCM	ARAR RCOC, exceeds MCL	5 µg/L
		DCE	Risk to future industrial worker	7 µg/L
		cDCE	Hazard to future industrial worker	70 µg/L
		VC	Risk to future industrial worker	2 µg/L
Surface Water	Twin Lakes	PCE	Exceeds surface water ARAR (MCL)	5 µg/L
		TCE	Exceeds surface water ARAR (MCL)	5 µg/L
		VC	Exceeds surface water ARAR (MCL)	2 µg/L
	Fourmile Branch	VC	Exceeds surface water ARAR (MCL)	2 µg/L

Risk and hazard for most likely future human health exposure scenario (future industrial worker)
* CM RCOC, determined based on MCL exceedance, not risk-based
** ARAR RCOC due to MCL exceedance, not risk-based

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

Project Cost	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$36,800	$52,600	$47,000	$65,600	$64,200	$266,100
Total Plug-In ROD Estimated Direct O&M Costs	$64,000	$50,000	$24,000	$24,000	$24,000	$186,000

Table F-4. Summary of the Monitoring Data for the CBRP OU (2007-2011)

RCOC	% Detect	Number of Detects	Total Samples	Maximum Concentration (µg/L)	RG (µg/L)
Surface Water					
Chloroethene (Vinyl Chloride)	12.8%	5	39	7.51	2
Trichloroethylene (TCE)	46.2%	18	39	22.8	5
Groundwater					
1,1-Dichloroethylene	1.3%	2	152	1.32	7
Chloroethene (Vinyl Chloride)	24.3%	37	152	66.2	2
cis-1,2-Dichloroethylene	38.2%	58	152	164	70
Dichloromethane (Methylene Chloride)	9.0%	9	100	6.36	5
Tetrachloroethylene (PCE)	29.6%	45	152	14.2	5
Trichloroethylene (TCE)	50.0%	76	152	1400	5

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN)

I. SITE INFORMATION			
Site Name:	**C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN)**	**Date of Inspection:**	**06/13/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #31**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**83°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Operation of existing active MicroBlowers™ Soil Vapor Extraction System

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

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** Gregory Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-7927
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 06/13/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for C-Area Burning/Rubble Pit, 131-C*, ER-IDS-019-016._____

_____

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

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

2. Health and Safety Plans (HASPs):

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

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

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

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

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

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks:_____

B. Signs

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

Remarks: Signs at this site are in good condition._____

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(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.) Walk-throughs

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks: Survey orange balls are present and in good condition.

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(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:
VII. COVER SYSTEMS ☒ 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.

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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

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

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

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

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☒ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

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

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

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

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

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

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

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

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

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment F-1. Five-Year Review Site Inspection Checklist – C-Area Burning/ Rubble Pit Operable Unit (131-C) and Old C-Area Burning/Rubble Pit (NBN) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is maintain the integrity of the soil cover system, operating the existing active MicroBlowers™, implementing institutional controls, and treating the groundwater by MNA. The remedy seems to be fully established and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The protectiveness of the remedy is maintained through effective treatment of the groundwater by MNA, effective containment source removal by soil vapor extraction and prevention of contaminant leachate by minimizing infiltration through the contaminants by a low permeability soil cover system. Institutional controls effectively prevent unauthorized access to the OU: physical access controls to SRS (fences, guards, security patrols, etc.); administrative controls (SRS is a secured government facility with land use restrictions); and warning signs and use controls (SRS Site Use/Site Clearance Program).
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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C-AREA GROUNDWATER OPERABLE UNIT

I. Introduction

This is the second five-year review for the C-Area Groundwater (CAGW) Operable Unit (OU). This review was conducted from August 2012 through September 2012 and documents the results of the review. Contaminants have been left in place at the CAGW OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the CAGW OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

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

III. Background

CAGW OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media associated with the CAGW OU is the vadose zone soil (source area), surface water, and groundwater.

Physical Characteristics

CAGW OU is located in the west-central portion of the SRS, entirely within the Fourmile Branch watershed (Figure G-1). CAGW OU encompasses groundwater below C Area, north to unnamed tributaries of Fourmile Branch, west to Fourmile Branch, and south to Castor Creek (Figure G-2), which comprises approximately 3.29 km^2 (1.27 mi^2).

The hydrogeologic conceptual site model (CSM) for the interim action for the CAGW OU depicts trichloroethylene (TCE) contamination above its respective maximum contaminant level (MCL) originating in C Area from reactor operations and migrating through the vadose zone to the Transmissive Zone (TZ) of the Upper Three Runs Aquifer

(UTRA). Contaminants in the TZ are readily transported west toward Fourmile Branch and to the south towards Castor Creek. Below the TZ is the Tan Clay Confining Zone (TCCZ), which is composed of the Upper Tan Clay Layer, the Middle Aquifer Zone (MAZ), and a Tan Clay Lower Clay layer. The TCCZ inhibits downward migration of contaminants into the Lower Aquifer Zone (LAZ) of the UTRA. However, the Upper Tan Clay Layer is discontinuous in places and downward contaminant migration does occur, primarily contaminating the MAZ, and to a lesser extent the LAZ. The contaminated groundwater in the MAZ and LAZ discharges into Fourmile Branch or Castor Creek. TCE does not exceed the MCL in surface water in either Castor Creek or Fourmile Branch. However, tritium levels do exceed MCLs in both Castor Creek and Fourmile Branch. Upgradient sources form H Area, E Area, and F Area are the principal contributors to tritium contamination in Fourmile Branch.

CAGW OU is currently monitored by the following:

- Forty-eight groundwater monitoring wells;
- Five seepline monitoring stations; and
- Thirteen surface water sampling stations.

Periodic groundwater monitoring in CAGW OU began in 1983 and continues to present. The volatile organic compound (VOC) contamination in C Area groundwater that originated from the C-Area Burning Rubble Pit (CBRP) OU, mainly TCE and tetrachloroethylene (PCE), is addressed by the CBRP OU (Appendix F).

Land and Resource Use

The CAGW OU sources are located within an industrial use area, but the distal portion of the groundwater plume extends beyond the industrial use boundary. However, shallow groundwater and surface water at SRS are not used for drinking water, hygiene, recreation, or process water. According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future

land use for the CAGW OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

C-Reactor operated from March 1955 until June 1985; C-Reactor was placed in cold standby in 1987. TCE was released to the soil at a manhole along a storm sewer line south of the C-Reactor building. Characterization during 1998-2002 determined the TCE plume extends from the manhole and forms a groundwater plume that ultimately discharges to Castor Creek south of C-Area. Figure G-3 shows the location of the TCE vadose zone (the unsaturated zone above the water table) source relative to the reactor building, the location of soil borings, and recent monitoring well data. An IROD for the TCE vadose zone source area was issued in 2004. The IROD interim remedial action was implemented June through September in 2006 to specifically reduce vadose zone TCE concentrations to levels that, if leached into the groundwater, would not exceed the MCL (5 μg/L). Soil data collected in October 2006 determined the ERH/SVE interim action was successful, and 2011 verified that the ERH/SVE interim remedial action continues to be protective of the groundwater. Groundwater monitoring during 2010-2012 found TCE concentration are declining, but still above the MCL (5 μg/L) (Figure G-4). PCE has been below the MCL (5 μg/L) since 2006.

Tritium was produced during the operation of the reactor and was released from numerous sources. No tritium has been produced since C-Reactor was shut down in June 1985. Other than atmospheric releases, the two primary discharge areas for tritium were the C-Area Discharge Canal and the C-Area Reactor Seepage Basins (CRSBs). Recent characterization data indicate contaminants released to the C-Area Discharge Canal from C-Reactor operations were carried by high discharge flows to Fourmile Branch. The CRSBs, a known historical source of tritium and other radionuclides, were remediated using low-permeability grout stabilization of basin soils as documented in the *Post-Construction Report/Final Remediation Report for the C-Area Reactor Seepage Basins (904-66G, -67G, and -68G) Operable Unit* (WSRC 2003). Although groundwater monitoring during 2010-2012 found declining tritium concentrations, tritium

concentrations were still above the MCL (20 pCi/mL) in both groundwater and surface water (Figure G-5). The decreasing trend in surface water is shown in Figure G-6. Although the IROD does not address tritium in the groundwater, tritium will continued to be monitored to document the decreasing trend, and will be addressed in the final CAGW OU ROD scheduled to be issued in March 2020.

Initial Response

The nature and extent of groundwater contamination within the CAGW OU was comprehensively investigated between 1998 and 2002. The results were presented in the RCRA Facility Investigation (RFI)/Remedial Investigation (RI) Report (WSRC 2004c).

Basis for Taking Action

Characterization data indicated that the MCL for TCE in the groundwater was exceeded by 2,600 times in the vicinity of the manhole along a storm sewer line south of the C-Reactor Building (105-C). The TCE plume (Figure G-4) extends over 1.6 km (1 mi) downgradient to Castor Creek. Residual TCE (maximum = 51.846 mg/kg) in the vadose zone soil was present at levels that were still impacting groundwater. Although shallow groundwater aquifers at SRS are not used as a drinking water source, the potential for unacceptable human exposure to contaminated groundwater exists as long as TCE remains above the MCL. Thus, control of the migration of TCE was necessary through a source control action. The geometry of the TCE vadose zone source is a vertical cylinder approximately 18 m (60 ft) in diameter extending 70 ft below ground surface (bgs).

IV. Remedial Actions

Remedy Selection

As stated in the Interim Record of Decision (IROD) for the CAGW OU, the interim remedial action objective (RAO) is to reduce TCE concentrations in the vadose zone so that any leaching of the contaminant will not cause groundwater to exceed the MCL (5.0 μg/L). The IROD was issued on October 12, 2004.

As stated in the IROD, the selected interim action remedy to achieve the interim RAOs for TCE was electrical resistance heating (ERH) with soil vapor extraction (SVE). The constituents of concern (COCs) and remedial goals (RGs) selected for the interim action are provided in Table G-2.

The final remedial action for the tritium and TCE contamination at the CAGW OU will be documented in the final ROD scheduled to be issued in March 2020. This remedy review is designated for the interim action to address the TCE contamination.

Remedy Implementation

Implementation of the interim remedial action consisted of the following activities:

- Installed ERH system with a single six-phase heating array consisting of six input electrode/SVE wells equally spaced around the circumference of a 9-m (30-ft) diameter circle. A central neutral electrode/SVE well was centered on the highest contaminant levels in the TCE source. Two SVE wells and two electrodes were installed in a single large well boring at each of the seven locations. An electrolyte addition system was installed.

- Installed an active SVE unit skid consisting of a 300 ft^3/min blower, condensate tank, knockout pot, water/vapor separator, heat exchanger and cooling tower.

ERH uses the electrical resistance of soil to heat the soil in situ using an electrical current. The electrolyte drip tube was used to provide the means to inject an electrolyte solution into the electrode to increase conductivity between the electrode and the soil interface. The heat vaporizes VOCs in the soil. These vapors are withdrawn by the SVE system, via manifold to a vacuum pumping system, treated and discharged per an air quality control permit. Figure G-7 is a generalized graphic of an ERH-SVE system.

Systems Operations/Operation and Maintenance

Currently, there are no remedial systems operating. ERH-SVE operated from June 15, 2006 until the IROD shutdown criterion was met on September 7, 2006. The SVE system continued to operate until September 28, 2006. The shutdown criterion was met

when the temperature in the treatment zone exceeded 189ºF (boiling point of TCE) for at least 30 days cumulatively.

The following actions will be conducted until the 2021 scheduled start of a final remedial action at the CAGW OU:

- The Interim Remedial Action Implementation Plan Effectiveness Monitoring Plan (WSRC 2005b) includes groundwater monitoring of wells CRW-1D, CRW020D, and CRW021DR for TCE to track the effects of ERH on the plume concentrations near the treatment zone.

Costs associated with the selected interim remedy for the CAGW OU include operation and maintenance (O&M) costs. The estimated O&M cost associated with the ERH-SVE remedy is $1,229,940. The actual operation and maintenance cost since the remedial action operations was started in FY06 until FY11 is $1,151,000. The actual O&M costs (Table G-3) for ERH-SVE operation was as expected. The O&M costs for performance/groundwater monitoring was less than expected because the required length of monitoring of the ERH-SVE system was shortened from six years to one year.

V. Progress since Last Review

The previous protectiveness statement concluded that the interim remedial action at CAGW OU is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled by SRS institutional controls, environmental monitoring , and site inspection and maintenance.

Soil data collected in 2011 determined that the interim remedial action of ERH/SVE at CAGW OU continues to be protective of the groundwater. Recent groundwater monitoring data indicates decreasing TCE and tritium trends, and the groundwater monitoring network has been functioning properly.

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

VI. Five-Year Review Process

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

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed implementation and completion of the interim remedial action;
- Reviewed all process and performance monitoring data provided by the annual effectiveness reports and provided a technical assessment of whether the ERH/SVE functioned as intended by the IROD and whether the shutdown criteria has been achieved;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist, provided in Attachment G-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Groundwater and surface water data collected in 2011 and 2012 indicate the concentration of the CAGW OU TCE plume has significantly decreased relative to the original 1998-2002 characterization. However, the TCE plume has approximately the same extent in 2012 as it had in 2002. Groundwater monitoring wells (CRW 20D and CRW021DR) near the TCE vadose zone source area indicate decreasing TCE concentrations since the completion of the ERH-SVE interim remedy (Figure G-8). The recent surface water data indicate TCE has not exceeded MCLs in Castor Creek or in Fourmile Branch since 2002 when monitoring began.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on April 9, 2013 at the CAGW OU and with George Joyner, O&M Site Manager, on April 9, 2013 at the O&M organization offices. The CAGW OU was inspected by SRNS and DOE personnel

on April 9, 2013. No issues were identified for the CAGW OU during this inspection and interviews.

On January 29, 2013 a site inspection was conducted by US EPA and SCDHEC personnel, accompanied by DOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The interim remedy is functioning as intended as demonstrated below:

- The ERH/SVE system was effective at reducing TCE concentrations in the vadose zone to a level that prevents TCE leaching from exceeding MCLs in the groundwater. The ERH/SVE system exceeded its shutdown criteria by operating longer (56 days) than the required minimum 30 days with soil temperatures above 189°F. After ERH was shutdown, SVE continued operating for an additional 21 days, to further decrease TCE levels. ERH/SVE removed a total of 730 lbs of TCE. Follow up soil sampling indicated that TCE removal efficiency from the vadose zone source was better than 99.2% after 85 days of ERH operation and 106 days of SVE operation (WSRC 2007). Average concentrations were reduced from 6.31 mg/kg to 0.039 mg/kg. Soil data collected in 2011 from both inside and outside the ERH target zone indicated that residual TCE in vadose zone soil does not present a contaminant migration threat to groundwater.

- Semiannual groundwater water monitoring data collected since the last five-year remedy review indicate the TCE plume in the source area is decreasing in concentration (Figure G-8) relative to the RFI/RI characterization data (TCE maximum concentration = 13,100 µg/L) collected during 1998-2002.

A remedy has not been selected for tritium in the groundwater. However, groundwater and surface water monitoring data during 2010-2012 indicate the tritium plume is decreasing in size and concentration relative to the RFI/RI characterization data collected

during 1998-2002. Groundwater impacts to surface water from the CAGW OU tritium plume have also decreased over the past decade.

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

There have been no changes in MCLs that would impact the interim remedy. An evaluation of the changes in toxicity data and risk methods are not relevant at the time as the baseline risk assessment to support a final action has not been conducted.

Due to the presence of chlorinated solvents at the site, there is a potential that 1,4-dioxane may also exist because it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. SRS has performed a review of recent groundwater data for 1,4-dioxane. In 2010 and 2011 ninety-eight (98) groundwater and surface water samples were analyzed using a low detection limit method (EPA8260BSIM) for 1,4-dioxane. Only five (5) results were above detection, with three (3) of the results from surface water samples in Fourmile Branch (which can be associated with an upgradient OU). The maximum result (6.35 µg/L) was from a background (upgradient) C-Area well sample, and the last result from a well sample downgradient of the CRSB OU. Based on the low frequency of results above the detection limit, the scattered locations of those results, and the very low levels of the results, 1,4-dioxane is not a contaminant of concern for the CAGW OU that requires additional monitoring.

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 unit.

X. Protectiveness Statement(s)

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

The interim action of ERH with SVE to prevent TCE in the vadose zone from leaching to groundwater above MCLs is complete. Groundwater monitoring indicates the interim remedial action was successful in preventing further groundwater impact. Until the final ROD for CAGW OU is issued, the exposure pathways that could lead to unacceptable risk are being restricted through SRS land use controls to include implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the CAGW OU for industrial use only, and use restrictions via the SRS Site Use/Site Clearance Program. Protectiveness of the interim remedial action will be verified by continued groundwater monitoring.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

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

SRNS, 2012. *Annual Monitoring Report for the C-Area Reactor Groundwater (CAGW) Operable Unit (OU) (U)*, SRNS-RP-2012-00579, Revision 0, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

USDOE, 1995. *United States Department of Energy, Innovative Technology Summary Report: Six Phase Soil Heating; Demonstrated at U.S. Department of Energy; M Area Savannah River Site and 300-Area Hanford Site*, Tech ID 5 SCFA, USDOE Office of

Environmental Management and Office of Technology Development, Aiken, SC and Richland, WA

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, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2004a. *Interim Action Proposed Plan for Remediation of the Trichloroethylene Vadose Zone Source Unit at the C-Reactor Groundwater Operable Unit (U)*, WSRC-RP-2003-4141, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004b. *Interim Record of Decision for the TCE Vadose Zone Source Unit at the CRGW OU (U),* WSRC-RP-2004-4022, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004c. *RCRA Facility Investigation/Remedial Investigation Report for the C-Area Reactor Groundwater (CRGW) Operable Unit,* WSRC-RP-2003-4073, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005a. *Corrective Measures Study/Feasibility Study Report of the C-Reactor Groundwater Operable Unit* (U), WSRC-RP-2004-4113, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005b. *Interim Remedial Action Implementation Plan for the TCE Vadose Zone Source Unit at the CRGW OU (U),* WSRC-RP-2004-4114, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007a. *Interim Post-Construction Report for the TCE Vadose Zone Source Unit at the CRGW OU (U),* WSRC-RP-2006-4032, Revision 1.1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007b. R*eport on the Effectiveness of the TCE Vadose Source Unit at C Reactor Groundwater (CRGW) OU Interim Remedial Action*, WSRC-RP-2007-4006, Revision 1, Washington Savannah River Company, Aiken, SC

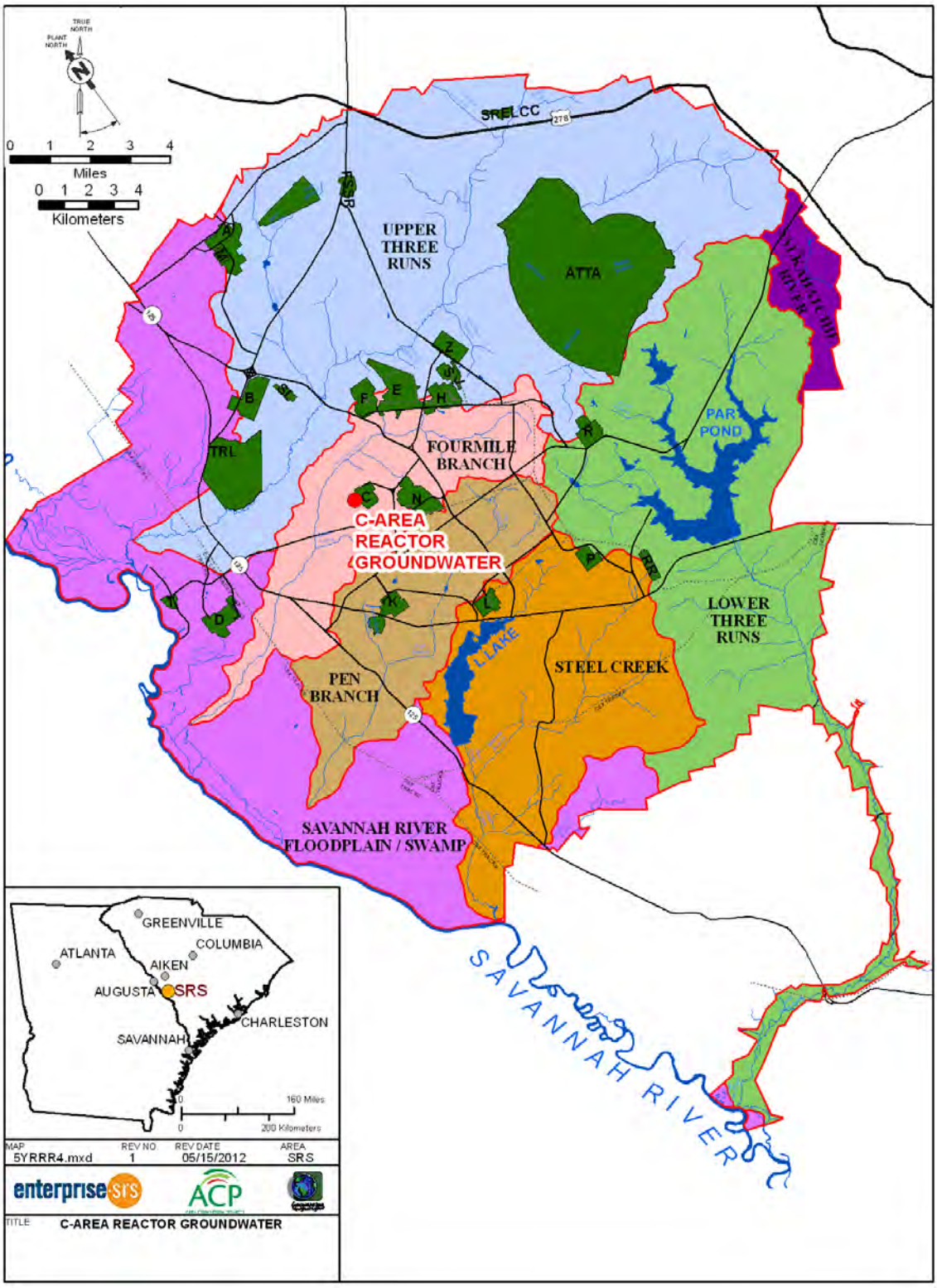


Figure G-1. Location of the CAGW OU within the Savannah River Site

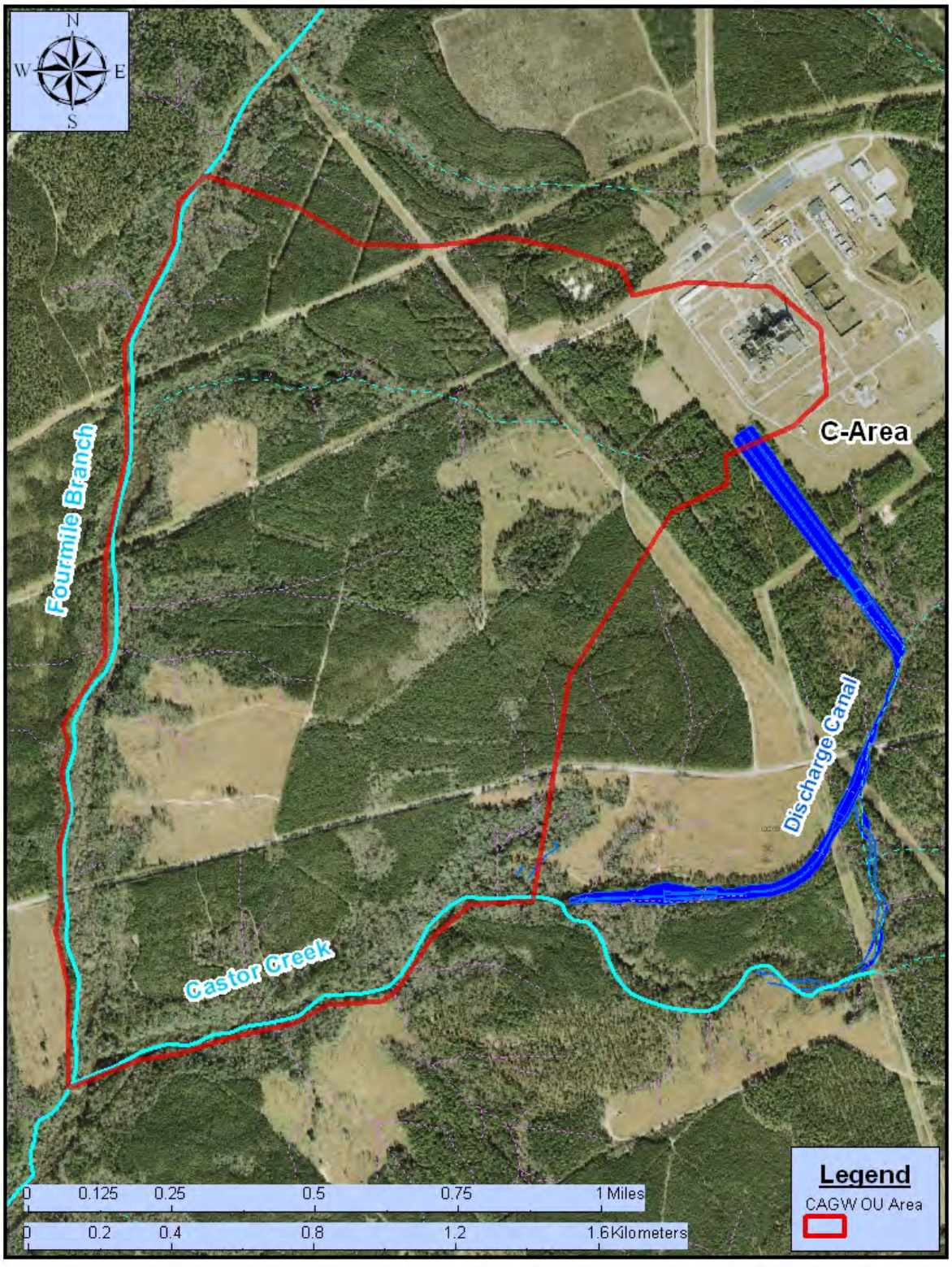


Figure G-2. CAGW OU 2012 Boundary Area and Plumes

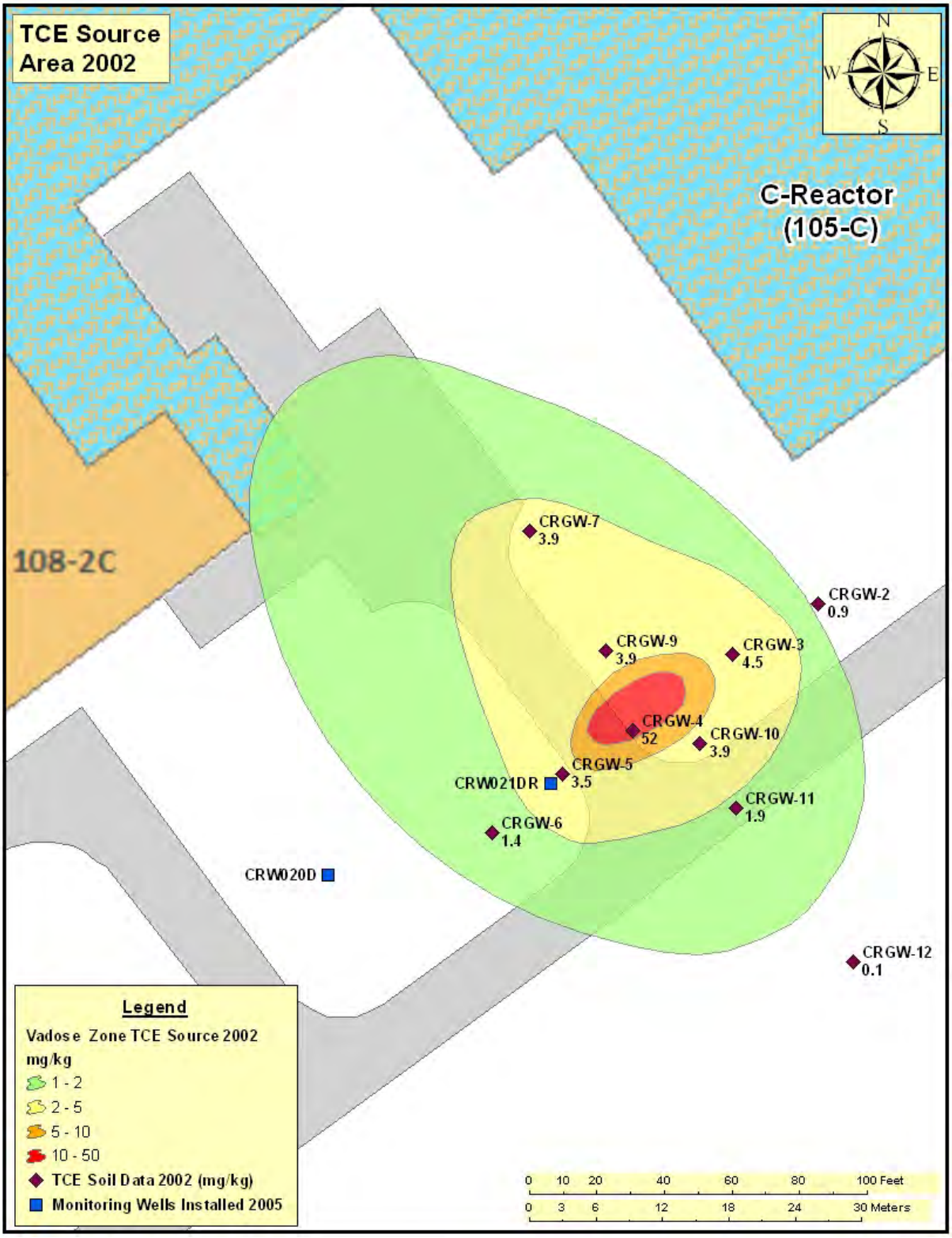


Figure G-3. CAGW OU TCE Vadose Zone Source Subunit 2002

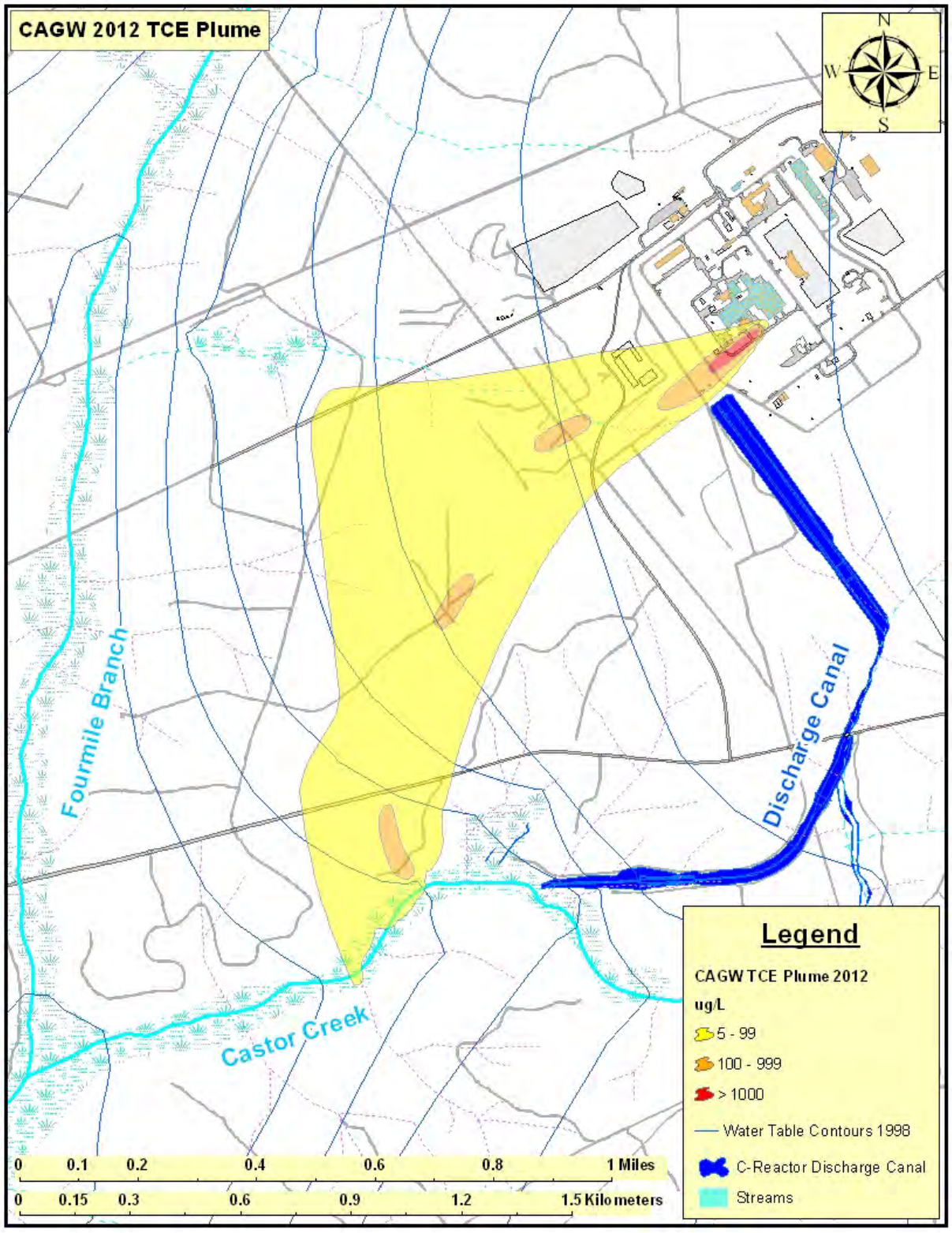


Figure G-4. CAGW TCE Plume Map for Upper Three Runs Aquifer

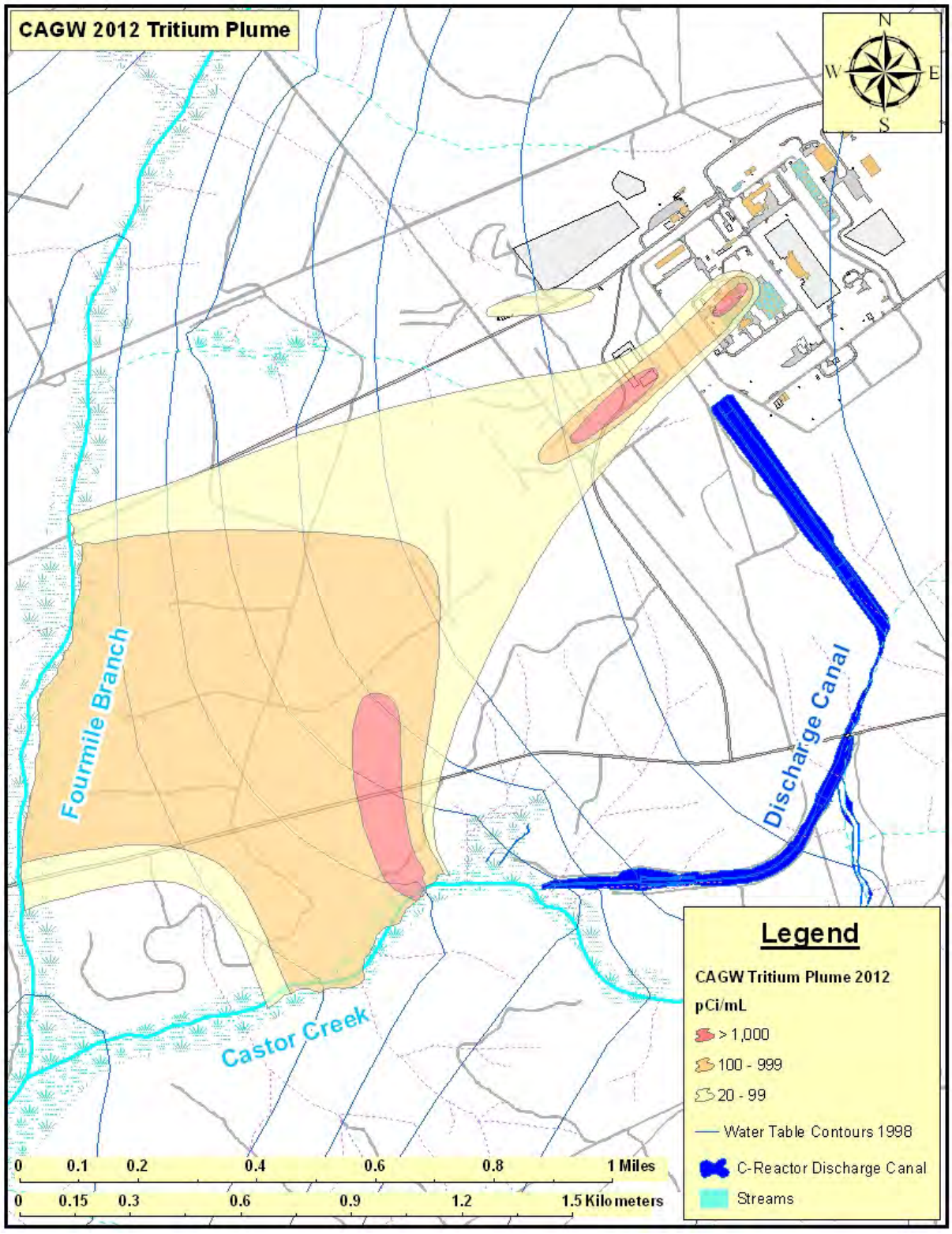


Figure G-5. CAGW Tritium Plume Map for Upper Three Runs Aquifer

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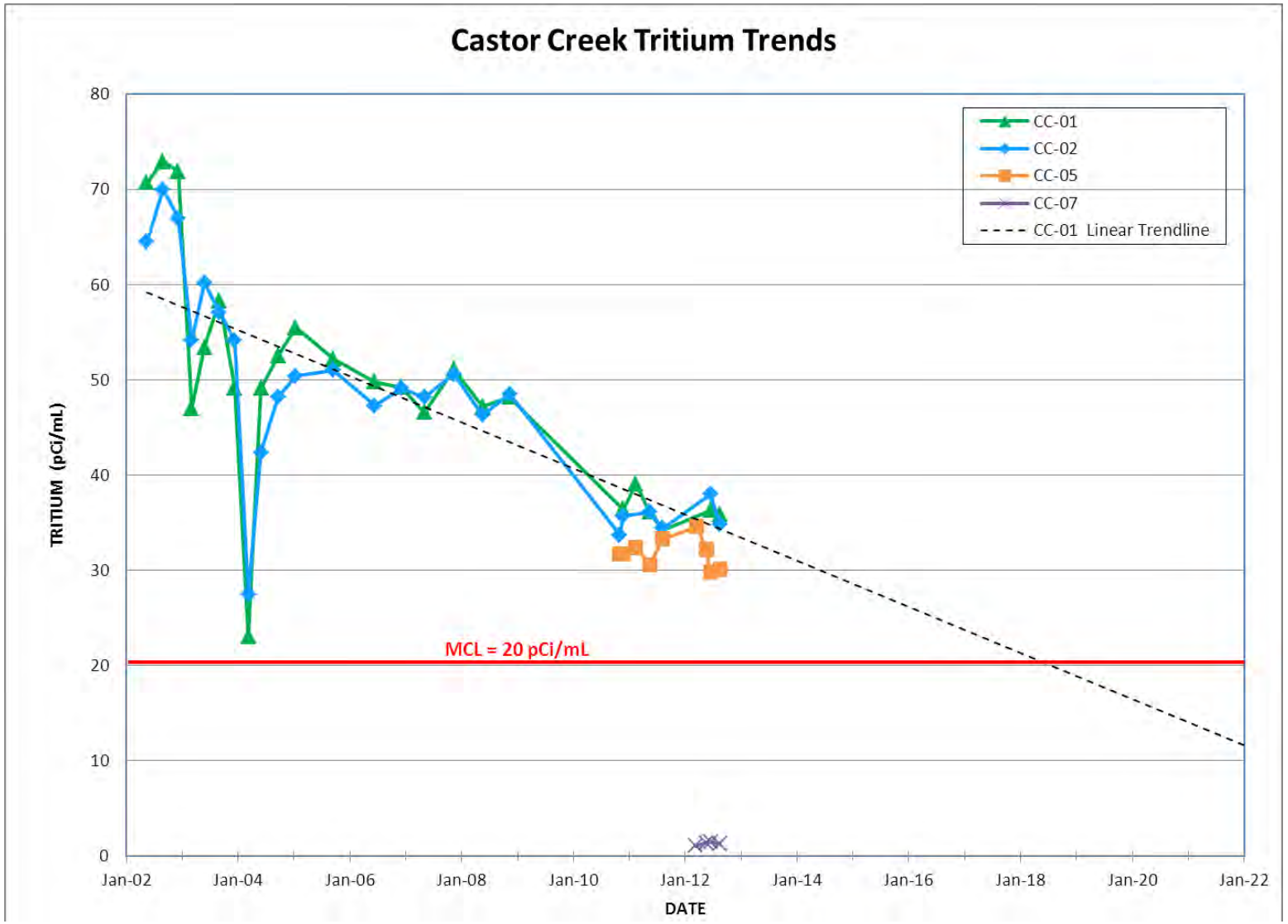


Figure G-6. Castor Creek Tritium Trends

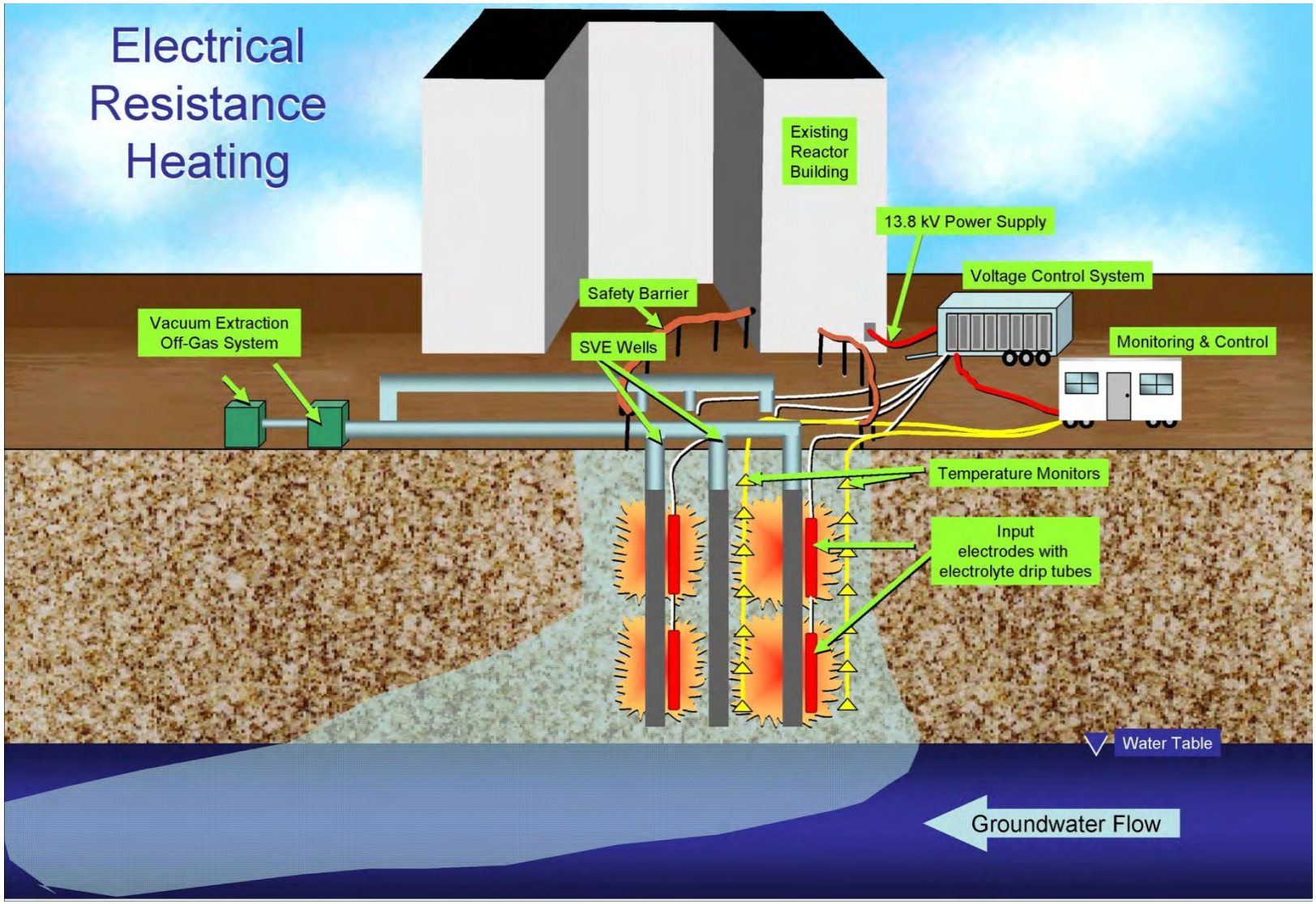


Figure G-7. Generalized Graphic of an ERH/SVE System

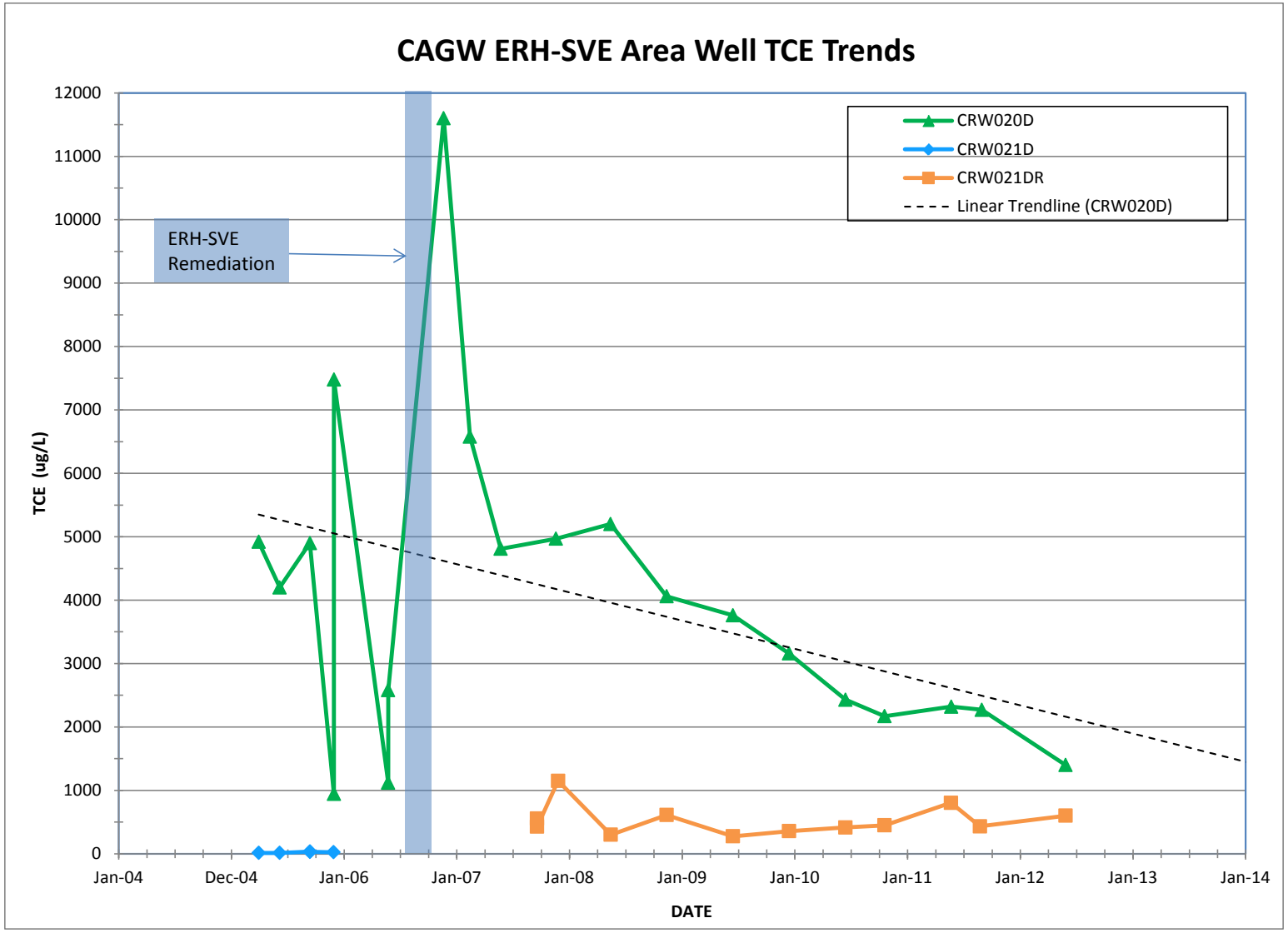


Figure G-8. TCE Source Area Groundwater Trends

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Table G-1. Chronology of OU Events

Event	Date
RFI/RI Field Start	February 20, 2002
Interim Record of Decision (ROD) issuance	September 13, 2004
Interim Remedial Action construction start / completion	September 30, 2005 / June 5, 2006
Interim Remedial Action operations start / completion	June 15, 2006 / September 28, 2006
FFA Scheduled ROD issue date	March 2020
Previous Five-Year Reviews	February 4, 2009

Table G-2. Summary of Constituents of Concern and Remedial Goals for CAGW OU

Medium of Concern	Constituent of Concern	Remedial Goal(MCL)
Groundwater	Trichloroethylene	5 µg/L
	Tetrachloroethylene*	5 µg/L
	Tritium*	20 ρCi/mL
Surface Water in Castor Creek	Tritium*	20 ρCi/mL

* The IROD only addressed trichloroethylene.

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

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	113,100	36,600	1,400	0	0	151,100
Total ROD Estimated Direct O&M Costs	94,000	80,000	80,000	80,000	80,000	414,000

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

I. SITE INFORMATION			
Site Name:	**C-Area Groundwater Operable Unit**	**Date of Inspection:**	**04/9/2013**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #31**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**75°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other ERH/SVE for vadose zone remediation of VOCs, periodic groundwater monitoring.

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

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 4/9/2013 (Date)

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

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 04/9/2013 (Date)

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

Problems/Suggestions: ☐ Report Attached

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

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

Remarks: Monitoring wells are inspected per ER-SOP-011, "ACP Monitoring Well Inspection (U)"

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

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

1. Health and Safety Plans (HASPs):

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

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

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

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

3. 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:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

8. Discharge Compliance Records:

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

Remarks:

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

Remarks:

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

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

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

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

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: _____

B. Signs

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

Remarks: _____

Attachment G-1. Five-Year Review Site Inspection Checklist – C-Area Groundwater 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.) Walk-throughs

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment G-1. Five-Year Review Site Inspection Checklist – C-Area Groundwater 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:_____
VII. COVER SYSTEMS ☐ 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._____

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

VII. COVER SYSTEMS *(Continued)*

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

Remarks:_____

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

Areal extent_____ Depth_____

Remarks:_____

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

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

Remarks:_____

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

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

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

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

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:_____

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks:_____

_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A

Remarks:_____

_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A

Remarks:_____

_____

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

1. Siltation:

Areal extent_____ Depth_____ ☐ N/A

☐ Siltation not evident

Remarks:_____

_____

2. Erosion:

Areal extent_____ Depth_____ ☐ N/A

☐ Erosion not evident

Remarks:_____

_____

3. Outlet Works: ☐ Functioning ☐ N/A

Remarks:_____

_____

4. Dam: ☐ Functioning ☐ N/A

Remarks:_____

_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement_____ Vertical displacement_____

Rotational displacement_____

Remarks:_____

_____

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

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

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

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

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

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

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

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

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

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

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

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: _____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks: _____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks: _____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks: _____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks: _____

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

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

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

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

X. OTHER REMEDIES

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

A. Electrical Resistance Heating with Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: ERH/SVE operations are now complete. The effectiveness of the treatment is being evaluated by groundwater monitoring.

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance ☒ N/A

Remarks: _____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks: _____

4. Monitoring Wells (ERH/SVE):

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: The effectiveness of the treatment is being evaluated by sampling monitoring wells, CRW-1, CRW-20 and CRW-21DR.

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

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Groundwater monitoring indicates the interim remedial action of ERH w/SVE was successful in preventing further groundwater impact. Until the final CAGW OU ROD is issued, the exposure pathways that could lead to unacceptable risk are being restricted through the SRS Site Use/Site Clearance Program and are being monitored by periodic groundwater sampling.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The protectiveness of the completed interim action of ERH w/SVE is being monitored by continued groundwater sampling. The O&M procedures are effectively maintaining the monitoring wells. The wells are properly secured/locked, functioning and are in good condition. Institutional controls effectively prevent unauthorized access to the groundwater and include physical access controls to SRS (fences, guards, security patrols, etc.); administrative controls (SRS is a secured government facility with land use restrictions); and use controls (SRS Site Use/Site Clearance Program).
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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C-AREA REACTOR SEEPAGE BASINS (904-66G AND 904-68G) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the C-Area Reactor Seepage Basins (904-66G and 904-68G) (CRSB) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the CRSB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the CRSB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table H-1 lists the chronology of site events for the CRSB OU.

III. Background

The CRSB OU is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The scope of the CRSB OU originally included all three C-Area reactor seepage basins (904-66G, 904-67G, and 904-68G). This report discusses Seepage Basins 1 (904-66G) and 3 (904-68G). Documentation pertaining to remedial actions at Seepage Basin 2 (904-67G) is included with L-Area Reactor Seepage Basin (904-64G) (Appendix II), since both basins were closed similarly without the need for soil stabilization (WSRC 2002).

The media of concern associated with Seepage Basins 1 (904-66G) and 3 (904-68G) is soil. Groundwater is included as part of the C-Area Groundwater (CAGW) OU.

Physical Characteristics

The CRSB OU is located in the central portion of SRS in the western portion of C Area (Figure H-1). The basins were constructed in 1957. Basin 1, (904-66G) was L-shaped with approximate dimensions of 75 x 10.5 m (250 x 35 ft) in the north-south direction; 180 x 35 ft in the east –west direction and a depth of approximately 2.1 m (7 ft) below

ground surface (bgs) Figure H-2). Basin 3 (904-68G) was approximately 54 x 27 m (180 x 90 ft) and a depth of 3.6 m (12 ft) bgs. These unlined earthen basins were designed to hold contaminated wastewater that was not appropriate for discharge to local streams due to elevated radiological activity (WSRC 1997). Prior to remediation, these basins were open and had not been backfilled to grade.

Land and Resource Use

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

History of Contamination

The CRSBs were constructed in the late 1950s and were active from 1957 until 1970 and again from 1978 until 1987 (WSRC 1997). From 1970 to 1978, disassembly basin water was mixed with large volumes of heat exchanger cooling water and discharged via the C-Area Discharge Canal to Castor Creek (WSRC 1998). After improvements in the treatment of disassembly basin water (i.e. deionization and filtering), discharge to the seepage basins resumed in 1978. No discharges to the basins have occurred since 1987.

Process purge water from the C-Reactor Disassembly Basin was discharged to the seepage basins to allow a significant portion of the tritium to decay before the water reached Fourmile Branch, eventually flowing to the Savannah River. Radionuclides in the wastewater included tritium, strontium-90, cobalt-60, cesium-137, and other beta-gamma, beta, and alpha emitters from the C-Reactor Disassembly Basin. The exact volume of water disposed in the CRSBs is unknown, but is estimated to be 27 million gallons (Du Pont 1987). Figures H-3 and H-4 present photographs of the CRSB OU before remediation and as they currently look (2012).

Initial Response

A time-critical removal action was performed in 1997 to remove and dispose of radiologically contaminated vegetation from the unit (USDOE 1998). The vegetation was placed in the seepage basins. As the vegetation died, the potential for contamination spreading due to wind and bioturbation increased, which warranted the time-critical removal action.

Basis for Taking Action

The Plug-In ROD states "COCs will be established in the technical evaluation report for each unit based primarily on principal threat source material (PTSM) criteria, and also considering the CSM, and comparison against the human health and contaminant migration remedial goals (RGs) established in this ROD" (WSRC 1999b). Review of the TER (WSRC 2000) for the CRSB OU did not identify an explicit description of contaminants of concern (COCs). Cesium-137 was identified as the main contributor to the PTSM in Basins 1 (904-66G) and 3 (904-68G).

The basis for taking action at the CRSB OU, as documented in the TER (WSRC 2000) and summarized in the ESD (WSRC 2000) for this OU, was the seepage basin soils presented a significant potential external exposure risk from radionuclides (cesium-137) to future industrial workers

Therefore, cesium-137 is considered a human health COC. No contaminant migration COCs were identified. PTSM was identified in the soils of Basins 1 and 3 to depths below the basin base of 1.8 m (6 ft) and 1.2 m (4 ft), respectively. PTSM is identified as media that poses a cancer risk to the future industrial worker equal to or greater than 1.0E-03. Evaluation of Basin 2 identified no PTSM.

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 in current industrial areas. In situ stabilization of

radiologically contaminated soil that represents PTSM) 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. The process streamlines the normal CERCLA documentation process for units that are similar and meet criteria defined in the plug-in ROD. A Technical Evaluation Report (TER) is prepared that uses characterization data to verify that the plug-in unit meets the plug-in ROD criteria. In lieu of Proposed Plan and ROD documents, an Explanation of Significant Difference (ESD) document is submitted. The approved ESD is the document that amends the approved plug-in ROD to include the individual plug-in operable unit. The CRSB was an approved candidate for the plug-in ROD process. An ESD to apply the plug-in ROD remedy at the CRSB OU was issued in August 2000.

As stated in the Plug-in ROD (WSRC 1999b), the following remedial action objectives have been established for the Basins 1 and 3 and are as follows:

- Prevent human exposure to contaminated basin soils (PTSM) by performing stabilization treatment to the extent practicable and filling the basins. Reduce risks to the future worker from surface soils (0 to 0.3 m [0 to 1 ft]) outside the basin by establishing remedial goals (RGs) for contaminants of concern (COCs) at concentrations equivalent to $1x10^{-6}$ for carcinogens and a hazard quotient of 1 for noncarcinogens or background (where background levels of COCs exceed $1x10^{-6}$);
- Prevent the release of COCs in soil to groundwater beneath the unit above maximum contaminant levels (MCLs) or risk-based concentrations (when MCLs are not available). The soil RGs are back-calculated based on these values; and
- Protect the ecological receptors indigenous to the area by preventing or limiting contact with contaminated basin soils and pipelines, and preventing plants and animals from bringing contaminants up towards the surface.

This plug-in remedy, in situ stabilization with the low-permeability soil cover system, consists of the following components: 1) land use controls (LUCs) (institutional controls) to prevent disturbance of the cover system and excavation into PTSM; 2) PTSM soils will

be stabilized in place using a cement-based grout mixture; 3) consolidation of contaminated soil outside of the basins and around the pipelines into the basin; 4) a low permeability soil cover system will be based over the basins; and 5) pipeline grouting.

As defined in the Plug-in ROD (WSRC 1999b), the primary LUC objectives necessary to ensure protectiveness include the following:

- Prevent contact, removal, or excavation of buried waste or pipelines; and
- Preclude residential or agricultural use of the area.

Remedy Implementation

Implementation of the selected remedy included the following:

- Consolidation of contaminated soil outside the basins exceeding PTSM criteria, leachability remedial goals, or surficial exposure remedial goals. In accordance with the Unit-Specific Plug-In Technical Evaluation (WSRC 2000c), this action was not performed because the contaminated soil outside the basins did not exceed PTSM criteria, leachability remedial goals or surficial exposure remedial goals;
- In situ stabilization by grouting was used to address long-term PTSM soil that posed a risk in excess of $1x10^{-3}$ for future industrial workers;
- Installation of a 1.8-m (6-ft) minimum thick low permeability soil cover system over the basins to reduce water infiltration and to provide shielding to potential receptors on the surface (WSRC 2003). Although no CMCOCs were identified that could impact groundwater in the future (1000 years), the soil cover system was designed with a 0.6 m (2-ft) minimum thick low permeability soil layer;
- Grouting of process piping to stabilize any potential contamination left inside and prevent access by small animals; and
- Establishment of institutional controls (i.e., LUCs) to include the following:
    - SRS boundary security gates to prevent exposure to intruders;

- Visible warning signs located at the most probable access points requiring contact of the custodian prior to entry to the OU;

- Site controls and land use restrictions via the Site Use/Site Clearance Program to prevent excavation in the area of the pipeline or cover system and restrict invasive and permanent installation activities at the CRSB OU; and

- Evaluation of the need for deed notification/restrictions if the property is ever transferred to non-federal ownership.

System Operations/Operation and Maintenance

There are no system operation requirements. However, the following maintenance activities are ongoing:

- Site inspections for evidence of damage to the cover system due to erosion or intrusion by burrowing animals and to address upkeep of the cover and access control barriers (e.g., the warning signs) are performed annually; and

- Necessary repairs (repair of erosion damage, cover maintenance, and warning signs) are performed as required.

The estimated operation and maintenance (O&M) costs associated with the selected remedy for CRSB OU, including O&M costs of the soil cover and institutional controls, has a present worth of $1,135,945, discounted at 3.9% per year for 30 years of maintenance activities. The actual O&M cost since the remedial action was completed in FY03 until FY11 is $261,000. During the last five years, the actual O&M costs for the CRSB OU (Table E-2) have been less than expected because cover system repairs have not been required.

V. Progress since Last Review

The previous protectiveness statement concluded that because the remedial actions at CRSB OU are protective, the site is protective of human health and the environment. 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 and documented the results on the Inspection Checklist provided in Attachment H-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

The Post Construction Report (PCR) (WSRC 2003) documents that contaminated soils associated with the CRSBs 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 3 followed by placement of a low permeability cover resulted in eliminating the exposure pathway for humans or ecological receptors. Review of semiannual maintenance inspection reports and a visual inspection of the CRSB OU indicate the structural integrity of the cap is intact in providing protection to human and ecological receptors. Groundwater associated with the CRSBs will be addressed as part of the C-Area Groundwater Operable Unit.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on June 13, 2012 at the CRSB, and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The CSRB OU was inspected by SRNS and USDOE personnel on

September 17, 2012. No issues were identified for the CRSB OU during this inspection and interviews.

On January 29, 2013, a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The cover system and soil stabilization via grouting are effective in preventing human and ecological receptor exposure to contaminated basin soils (PTSM). The cover system maintenance program and land use controls have been effective in maintaining the integrity of the cover systems. The annual inspection reports indicate no visible is signs of erosion, signs are legible, and Administrative Controls are still 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 standards or physical conditions of the CRSB OU that would affect the protectiveness of the remedy.

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

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, March 2013, 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 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000b. *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, 2000c. *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 LLC, 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-019-004, Inspection period 2007 through 2011 (annually)

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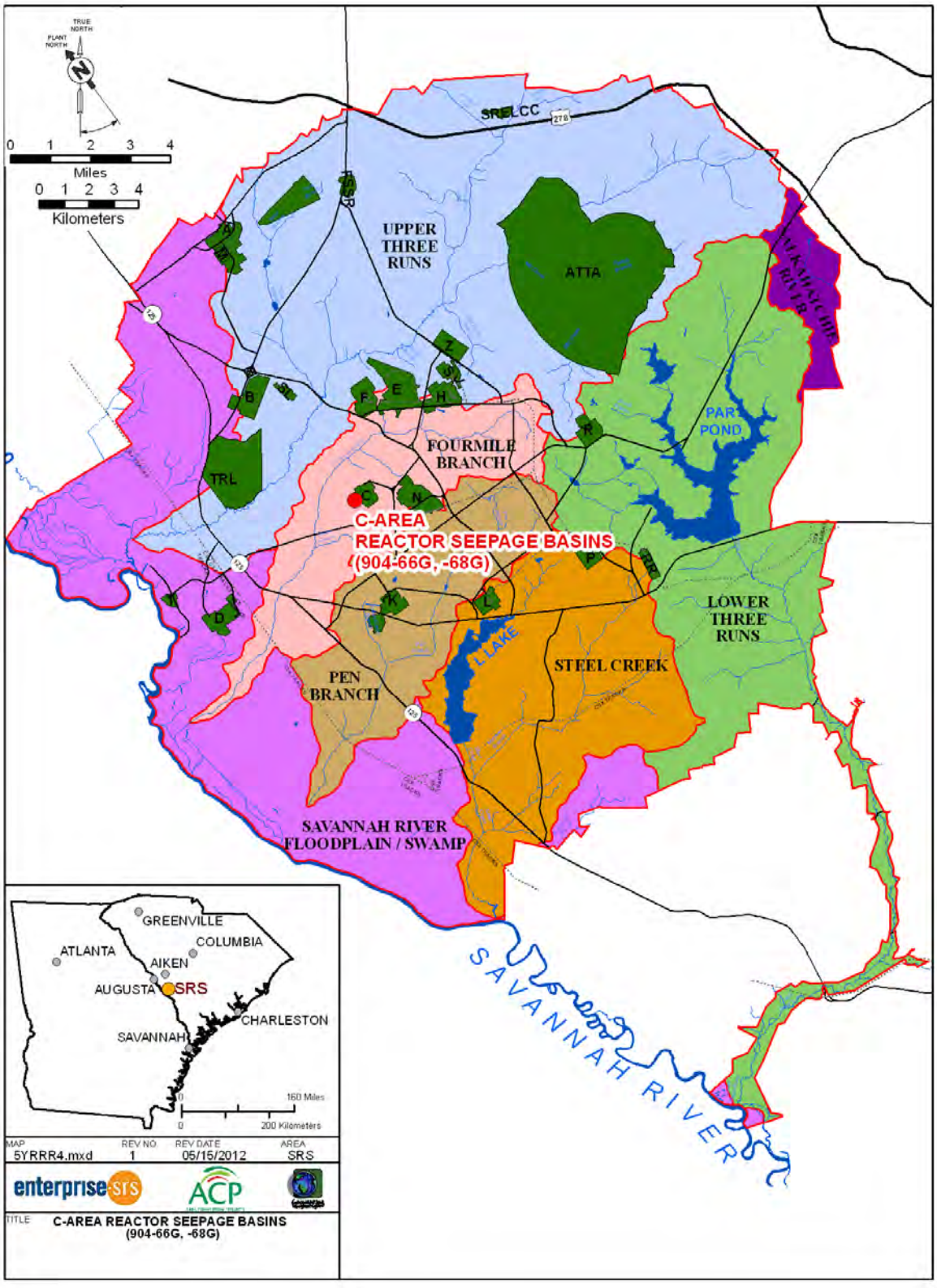


Figure H-1. Location of the C-Area Reactor Seepage Basins Operable Unit at SRS

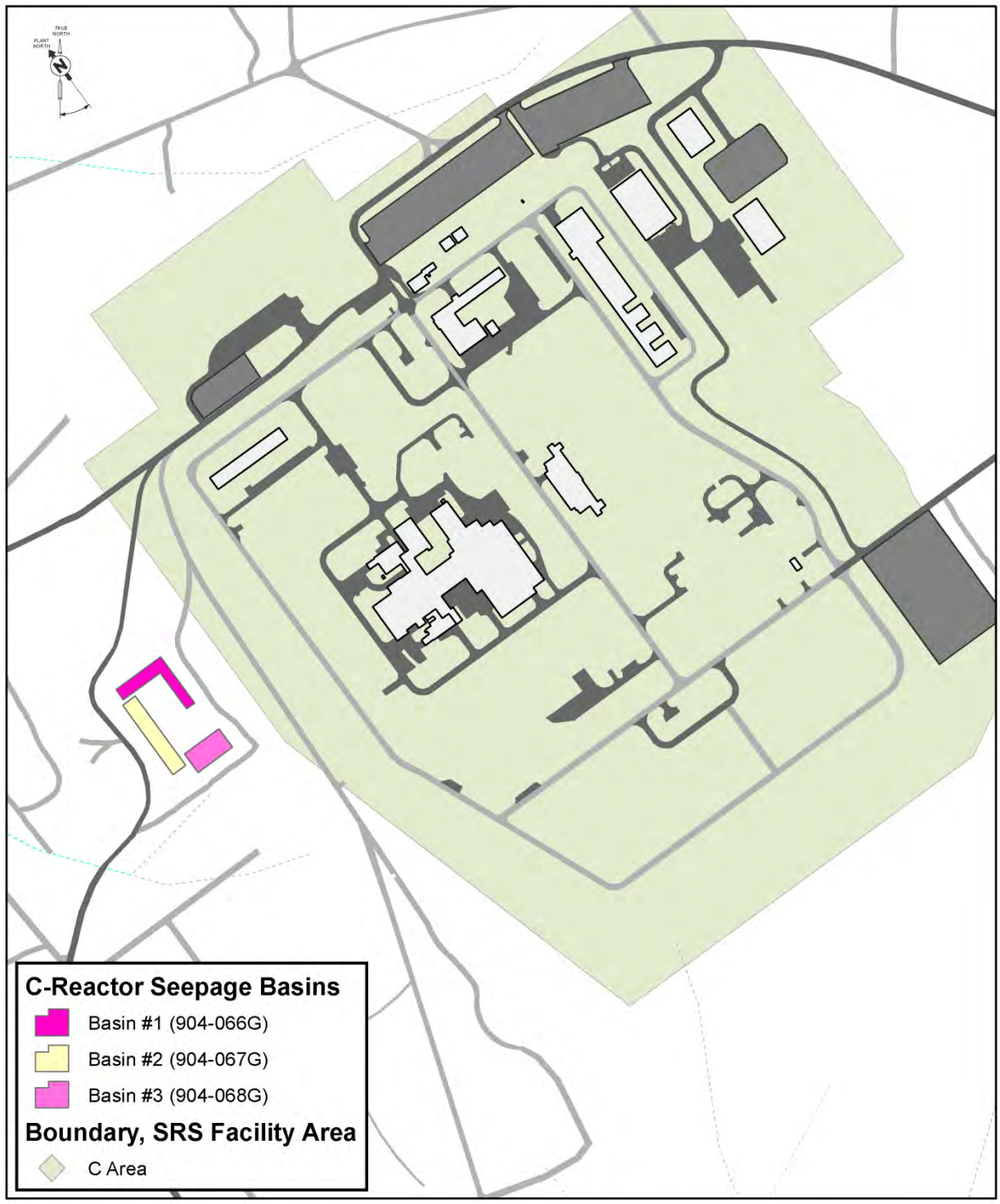


Figure H-2. Location of the C-Area Reactor Seepage Basins Operable Unit in C Area

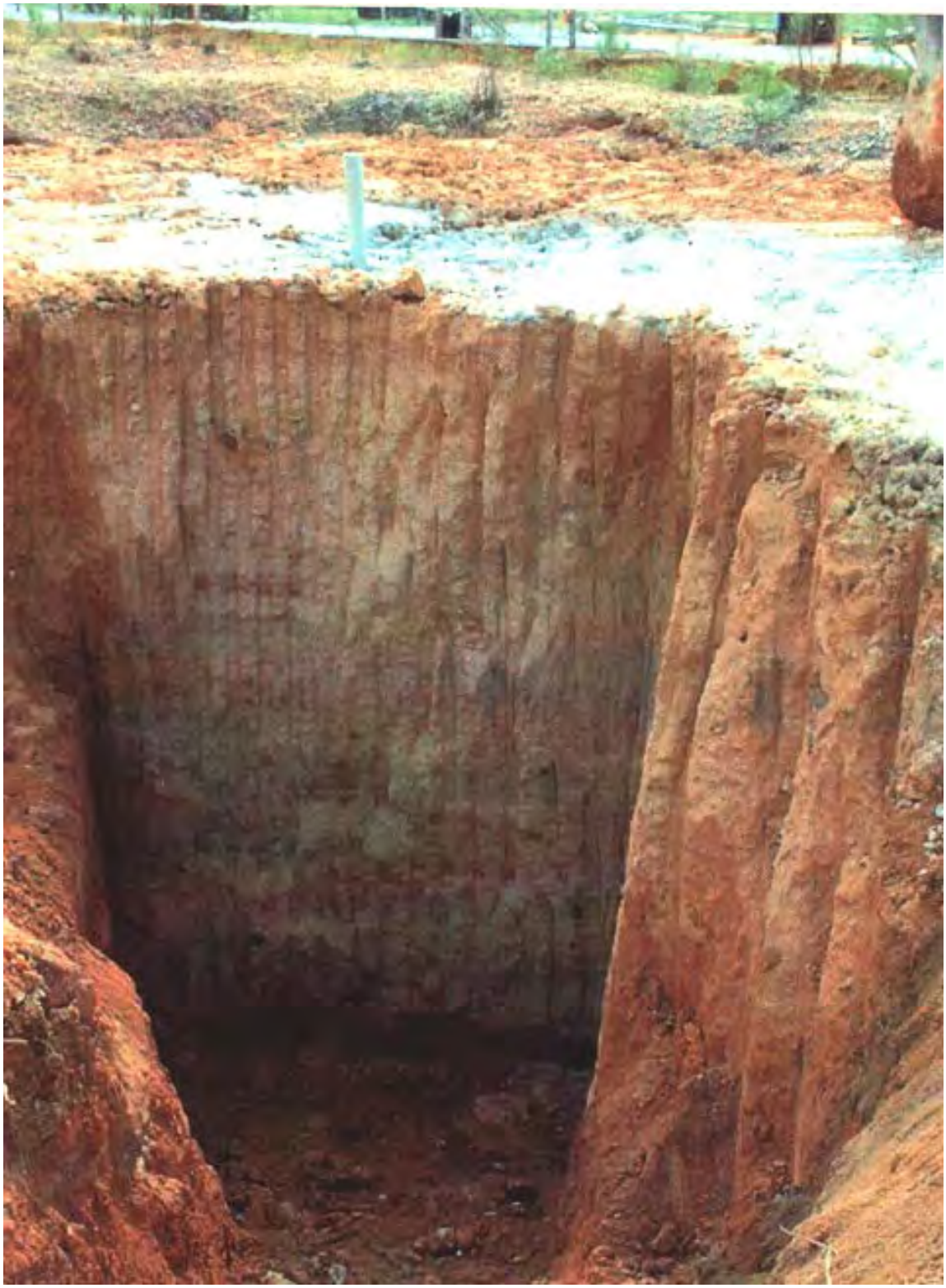


Figure H-3. Photo of CRSB OU Before Remediation Activities



Figure H-4. Current Photo of CRSB OU (2012)

Table H-1. Chronology of OU Events

Event	Date
Removal actions (Vegetation)	July 28 to December 9, 1997
RI Filed Start/Complete	January 3, 1997/June 15, 2000
Plug-In Record of Decision (ROD) issuance	November 29, 1999
ESD Issuance	August 31, 2000
Remedial Action Start/ Complete	February 5, 2001/June 12, 2002
ROD Amendment	November 11, 2002
Previous Five-Year Reviews	February 12, 2004/February 4, 2009

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

Project Cost	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$6,700	$7,600	$4,000	$4,000	$3,500	$25,800
Total Plug-In 2002 ROD Amendment Estimated Direct O&M Costs	$9,501	$9,501	$9,501	$9,501	$9,501	$47,505

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Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G)

I. SITE INFORMATION			
Site Name:	**C-Area Reactor Seepage Basins (904-66G and 904-68G)**	**Date of Inspection:**	**06/13/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #60**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**85°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other In-situ stabilization via grouting

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

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) Post Closure Manager (Title) 6/26/2012 (Date)

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

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) Inspector/Maintenance Coord. (Title) 06/13/2012 (Date)

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

Problems/Suggestions: ☐ Report Attached

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

- **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

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

1. **O&M Documents:**

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

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for C-Reactor Seepage Basin*, ER-IDS-019-013._____

_____

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

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

2. Health and Safety Plans (HASPs):

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

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

3. O&M and OSHA Training Records: ☒

Remarks: Training Records are complete and up to date per 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: ☐

Remarks:

6. Settlement Monument Records: ☐

Remarks:

7. Groundwater Monitoring Records: ☐

Remarks:

8. Leachate Extraction Records: ☐

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: ☐

Remarks:

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

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

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

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: Fencing at this site is in good condition._____

B. Signs

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

Remarks: Signs at this site are in good condition._____

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

V. Access and Institutional Controls *(Continued)*

C. Institutional Controls

A. 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.) *Walk-throughs*

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

B. 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 H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

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

Remarks: Roads at this site are in good condition.

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

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

Areal extent _____ Depth _____

Remarks:

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

Lengths _____ Widths _____ Depths _____

Remarks:

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

Areal extent _____ Depth _____

Remarks:

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

Areal extent _____ Depth _____

Remarks:

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

Areal extent _____ Depth _____

Remarks: Vegetation is mowed routinely.

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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

Remarks:_____

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

Areal extent_____ Depth_____

Remarks:_____

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

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

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

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

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

Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

A. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

B. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

C. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

D. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

E. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

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

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

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

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☒ Deformation not evident
Remarks:

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

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

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

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*
C. Treatment System ☐ Applicable ☒ N/A
1. Treatment Train (Check components that apply)**:** ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters_____ ☐ Additive (e.g., chelation agent, flocculent)_____ ☐ Others_____ ☐ Good Condition ☐ Needs maintenance ☐ Sampling ports properly marked and function ☐ Sampling/maintenance log displayed and up-to-date ☐ Equipment properly identified ☐ Sampling ports properly marked and function ☐ Quantity of groundwater treatment annually_____ ☐ Quantity of surface water treatment annually_____ Remarks:_____
2. Electrical Enclosures and Panels *(properly rated and function)***:** ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Tanks, Vaults, Storage Vessels: ☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance Remarks:_____
4. Discharge Structure Appurtenances: ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
5. Treatment Building(s): ☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks:_____

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☒ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

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

1. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment H-1. Five-Year Review Site Inspection Checklist – C-Area Reactor Seepage Basins (904-66G and 904-68G) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is institutional controls, contaminated soil consolidation and pipeline grouting, and a soil cover system to prevent exposure to contaminated media and prevent the release of COCs to groundwater above MCLs. The remedy seems to be fully established and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. There are no issues. O&M of the low permeability soil cover, current access controls and SRS Site Use and Site Clearance controls are effectively maintaining the long-term protectiveness of the remedy.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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

I. Introduction

This report is the second five-year review for Central Shops Burning/Rubble Pits (631-1G and 631-3G) (CSBRP) Operable Unit (OU). This review was conducted from August 2012 through September 2012. Contaminants have been left in place at the CSBRP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the CSBRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

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

III. Background

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

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

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

Physical Characteristics

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

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

Land and Resource Use

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

History of Contamination

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

metal shavings, and electrical switch gear. Additional investigations within Pit 631-3G identified abundant stainless steel metal shavings, sheet metal, burned wood, and one crushed 208-L (55-gal). Pit 631-3GA received an estimated 10,224 m^3 (13,372 yd^3) of debris consisting of unburned materials including metal, large concrete slabs, and transite. In addition, burned materials identified in the pit included sheet metal, stainless steel shavings, wire, glass and wood. Figures I-3 and I-4 present photographs of the CSBRP OU before remediation and in the current condition (2012).

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

Initial Response

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

Basis for Taking Action

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

water) or the groundwater. PAHs tend to be immiscible in water. The list of specific PAHs is shown in Table I-2.

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

No remedial goals (RGs) were established.

IV. Remedial Actions

Remedy Selection

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

- Maintain restricted (industrial) land use.

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

Remedy Implementation

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

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

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

System Operations/O&M

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

- The water level in Pit 631-3G is measured quarterly with piezometers to determine if the pit surface area improvements are reducing the water level in the pit as designed. The water level measurements are listed in Figure I-5 and the evaluations are reported in the Five-Year Remedy Reviews.
- Annual site inspections and site maintenance.
- Site controls and land use restrictions via the SRS Site Use / Site Clearance Programs, which restrict invasive and permanent installation activities at the CSBRP OU.

The ROD estimated operation and maintenance (O&M) cost associated with the selected remedy has a present worth cost of $94,420 discounted at 7% per year for 30 years (WSRC 2002). The actual O&M cost since the remedial action was completed in FY05 until FY11 is $96,193. The actual O&M costs (Table I-3) are as expected.

V. Progress since Last Review

The previous protectiveness statement concluded that implementation of institutional controls at the CSBRP OU is expected to remain protective of human health and the environment. Institutional controls and enhanced stormwater management have been implemented and are functioning properly. It is recommended that water level measurements continue to be taken at the two piezometers (CSR 14PZ and CSR 17PZ).

VI. Five-Year Review Process

The following tasks were performed as part of the review:

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

Data Review

The improved stormwater management has been moderately effective in reducing the water level in the 631-3G pit. Reduction of water elevation in 631-3G pit since the stormwater management improvements were made indicate that the stormwater management improvements have been working as designed. Data from two piezometers (CSR-14PZ and CSR-17PZ) sampled at CSBRP OU are shown in Figure I-5. Piezometer CSR-14PZ results indicate that water elevation increased temporarily above the bottom of the basin (3 m [10 ft]) due to the 25 cm (9.84 in) of rain that fell during December 2009. The average rainfall for this region from 2007 to 2011 is approximately 12.7 cm (5 in) during the month of December. This increase in rainfall caused the temporary water level increase of perched water in CSBRP (631-3G). The increase in water levels was not of concern for the effectiveness of the remedy since the levels were temporary and PAHs are not miscible in water.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 31, 2012 at the CSBRP, and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The CSBRP OU was inspected by SRNS and DOE SR personnel on May 31, 2012. No issues were identified for the CSBRP OU during this inspection and interviews.

On January 15, 2013, a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

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

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 standards or physical conditions of the CSBRP OU that would affect the protectiveness of the remedy.

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 other issues related to current site conditions or activities that currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

Per the CSBRP OU Land Use Control Implementation Plan, groundwater monitoring will continue until there is a declining water level for three consecutive years.

X. Protectiveness Statement(s)

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

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

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

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

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

WSRC, 2003. *Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP) [with Land Use Control Implementation Plan] for the Central Shops Burning/Rubble Pits (CSBRP) (631-1G and 631-3G) Operable Unit (U)*, WSRC-RP-2003-4018, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

Various – *Inspection Data Sheets - Field Inspection Checklist for Central Shops Burning Rubble Pits Operable Units 631-1G and 631-3G*, ER-IDS-019-031, Inspection Period 2007 through 2011 (semiannually)

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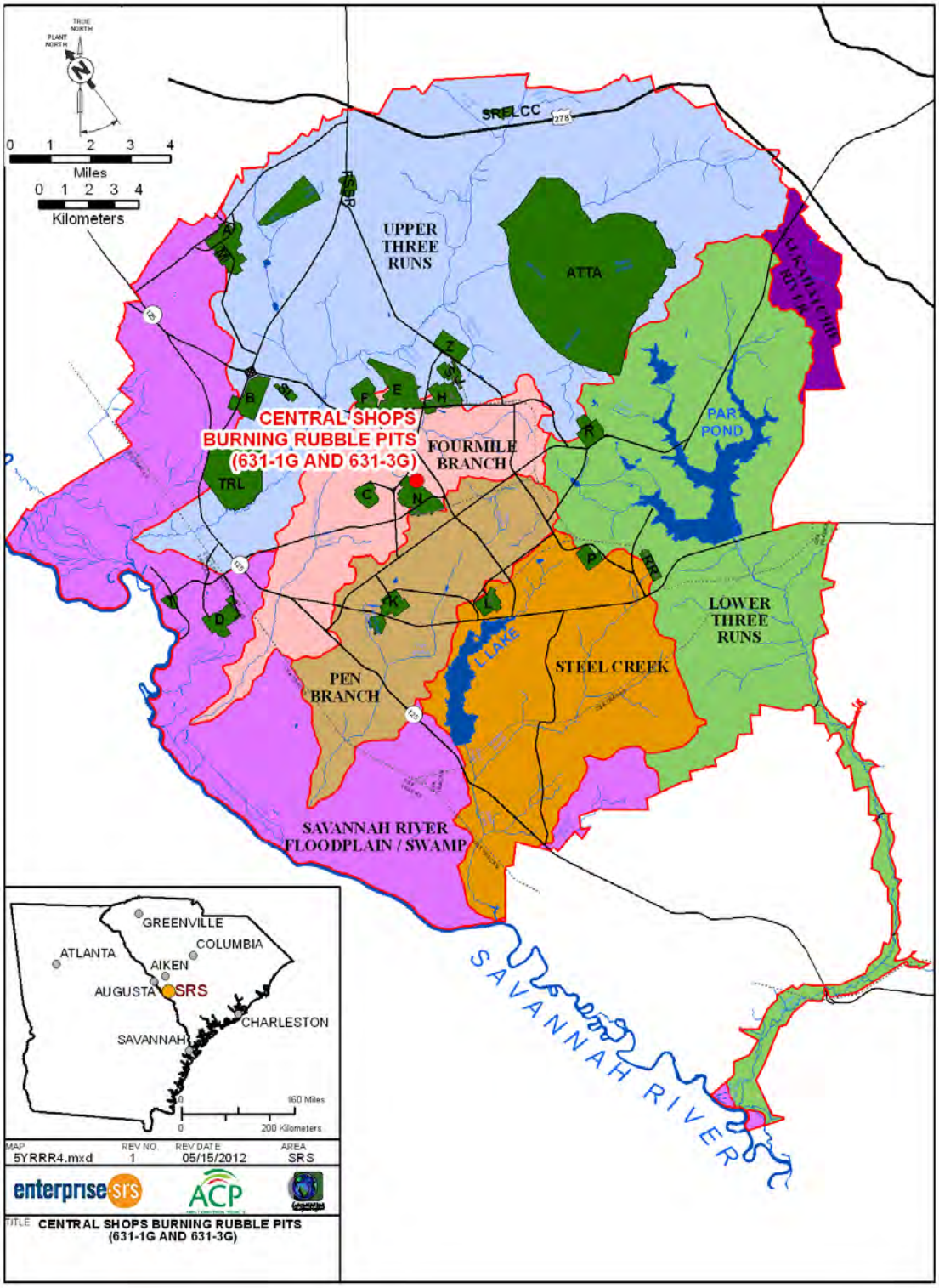


Figure I-1. Location of the Central Shops Burning/Rubble Pits Operable Unit at SRS

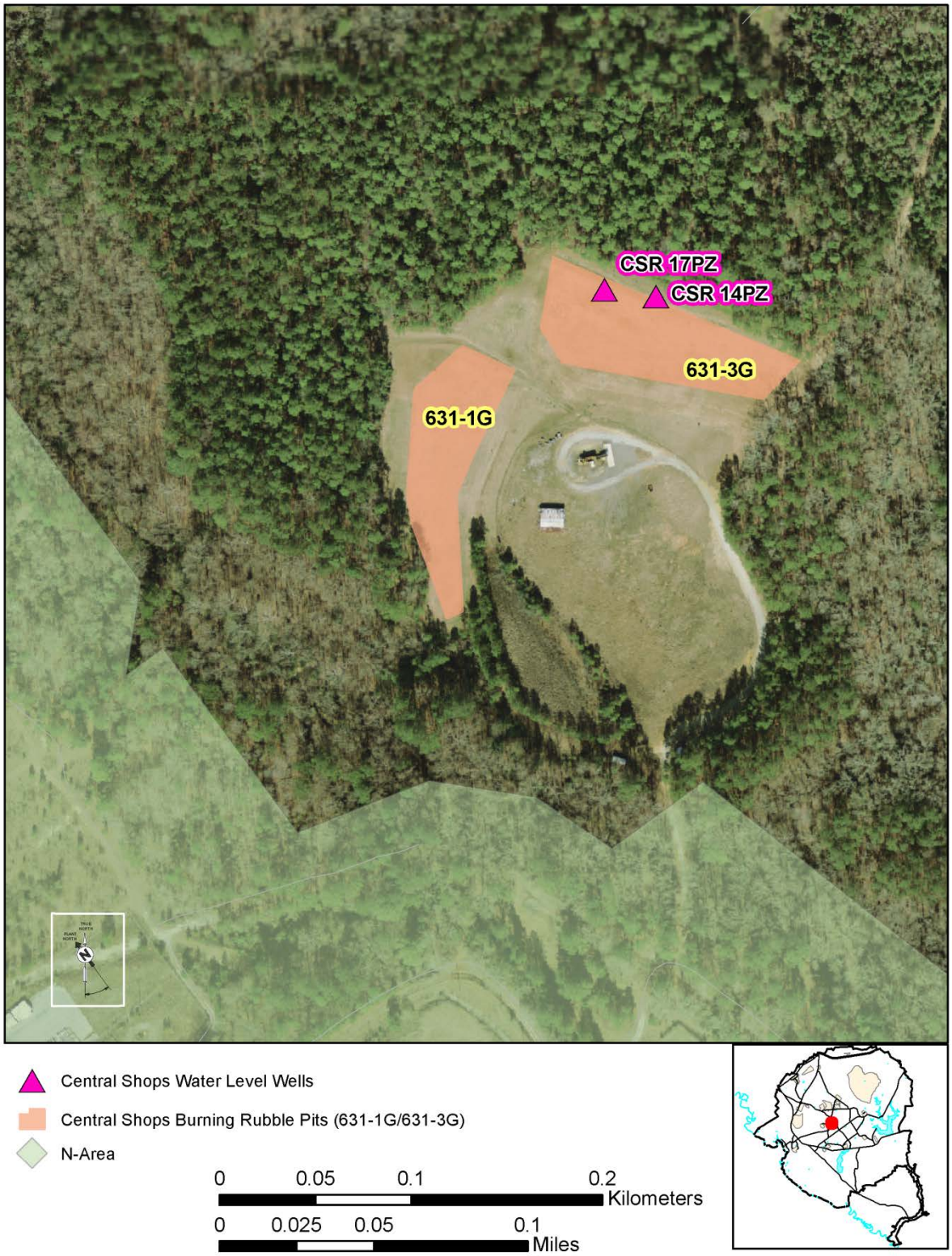


Figure I-2. Layout of the Central Shops Burning/Rubble Pits Operable Unit



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

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Figure I-4. Current Photo of CSBRP OU (2012)

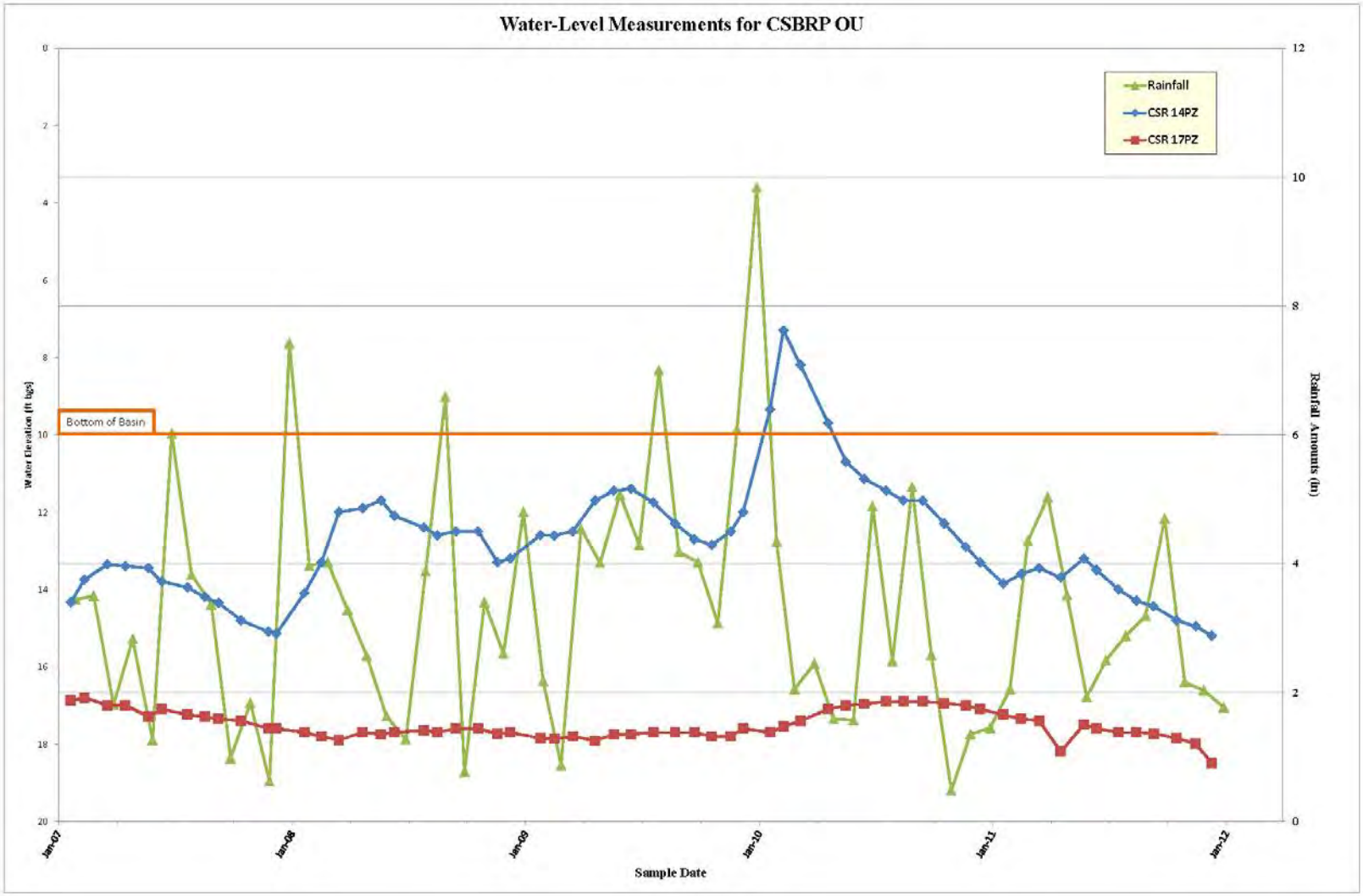


Figure I-5. Water Level Measurements from CSR 14PZ and CSR 17PZ) (2007-2011)

Table I-1. Chronology of OU Events

Event	Date
RFI/RI Field Start/Complete	June 1996/June 4, 2001
Record of Decision (ROD) Issuance	June 30, 2003
Remedial Action Start/Complete	November 17, 2003 / November 3, 2004
Previous Five-Year Review	February 4, 2009

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

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

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

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	10,700	10,000	6,400	6,800	6,300	40,200
Total ROD Estimated Direct O&M Costs	20,000	5,000	5,000	5,000	5,000	40,000

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

I. SITE INFORMATION			
Site Name:	**Central Shops Burning Rubble Pits (631-1G/631-3G) OU**	**Date of Inspection:**	**05/31/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #50**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**83°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

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

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

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) Post Closure Manager (Title) 6/26/2012 (Date)
   Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) 05/31/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

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

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

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

_____

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

III. ONSITE DOCUMENTS & RECORDS VERIFIED ***(Continued)***			
2. Health and Safety Plans (HASPs):			
☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER			
3. O&M and OSHA Training Records:	☒ Readily Available	☒ Up to Date	☐ N/A
Remarks: Training Records are complete and up to date per ACP training matrix.			
4. Permits and Service Agreements:			
☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
5. Gas Generation Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
6. Settlement Monument Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
7. Groundwater Monitoring Records:	☒ Readily Available	☒ Up to Date	☐ N/A
Remarks: Water elevation records only.			
8. Leachate Extraction Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
9. Discharge Compliance Records:			
☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
10. Daily Access/Security Logs:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			

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

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: _____

B. Signs

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

Remarks: Signs at this site are in good condition. _____

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

V. ACCESS AND INSTITUTIONAL CONTROLS ***(Continued)***

C. Institutional Controls

1. Implementation and Enforcement

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

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

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

Frequency: Once every 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Candice Freeman (Name) | Waste Area Group Manager (Title) | 10/16/12 (Date) | 803-952-7085 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks: Survey markers 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 I-1. Five-Year Review Site Inspection Checklist – Central Shops Burning Rubble Pits (631-1G/631-3G) OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

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

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

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

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident
Lengths Widths Depths
Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident
Areal extent Depth
Remarks:

5. Vegetative Cover: ☐ Grass ☒ Cover properly established ☒ No signs of stress
Areal extent Depth
Remarks:

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

VII. COVER SYSTEMS *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*			
D. Cover Penetrations ☒ Applicable ☐ N/A			
1. Gas Vents: ☐ Active	☐ Passive		
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A
Remarks:			
2. Gas Monitoring Probes:			
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A
Remarks:			
3. Monitoring Wells:			
☒ Properly secured/locked	☒ Functioning	☒ Routinely sampled	☒ Good Condition
☐ Evidence of leakage at penetration		☐ Needs maintenance	☐ N/A
4. Leachate Extraction Wells:			
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A
Remarks:			
5. Settlement Monuments: ☐ Located		☐ Routinely Surveyed	☒ N/A
Remarks:			
E. Gas Collection and Treatment ☐ Applicable ☒ N/A			
1. Gas Treatment Facilities:			
☐ Flaring	☐ Thermal destruction	☐ Collection for reuse	
☐ Good condition	☐ Needs maintenance		
Remarks:			
2. Gas Collection Wells, Manifolds, and Piping:			
☐ Good condition	☐ Needs maintenance		
Remarks:			

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

VII. COVER SYSTEMS ***(Continued)***
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:** ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☒ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

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

VII. COVER SYSTEMS ***(Continued)***
2. Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A
1. Siltation: ☐ Location shown on site map ☒ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☒ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☒ N/A Remarks:_____
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
1. Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

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

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

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

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

IX. **GROUNDWATER/SURFACE WATER REMEDIES *(Continued)***
C. Treatment System ☐ Applicable ☒ N/A
1. Treatment Train (Check components that apply)**:** ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters_____ ☐ Additive (e.g., chelation agent, flocculent)_____ ☐ Others_____ ☐ Good Condition ☐ Needs maintenance ☐ Sampling ports properly marked and function ☐ Sampling/maintenance log displayed and up-to-date ☐ Equipment properly identified ☐ Sampling ports properly marked and function ☐ Quantity of groundwater treatment annually_____ ☐ Quantity of surface water treatment annually_____ Remarks:_____
2. Electrical Enclosures and Panels *(properly rated and function)***:** ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Tanks, Vaults, Storage Vessels: ☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance Remarks:_____
4. Discharge Structure Appurtenances: ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
5. Treatment Building(s): ☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks:_____

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

IX. **GROUNDWATER/SURFACE WATER REMEDIES *(Continued)***
6. Monitoring Wells *(pump and treatment remedy)***:** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
D. Monitoring Data ☐ Applicable ☒ N/A
1. Monitoring Data: ☐ Is routinely submitted on time ☐ Is of acceptable quality
2. Monitoring Data: ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining
E. Monitored Natural Attenuation ☐ Applicable ☒ N/A
1. Monitoring Wells *(natural attenuation remedy)***:** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
X. OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Soil Vapor Extraction System ☐ Applicable ☒ N/A
1. Blowers, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances: ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

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

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

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CHEMICALS, METALS, AND PESTICIDES PITS (080-170G, -171G, -180G, -181G, -182G, -183G, AND -190G) (CMP PITS) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the Chemicals, Metals, and Pesticides Pits (CMP Pits) Operable Unit (OU). Contaminants have been left in place at the CMP Pits at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the CMP Pits OU is protective of human health and the environment. The review was conducted from August 2012 through September 2012. This report documents the results of the review.

II. OU Chronology

Table J-1 lists the chronology of site events for the CMP Pits OU.

III. Background

CMP Pits OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for the Savannah River Site (SRS). The media of concern is surface soil, subsurface soil, groundwater, sediment, and surface water.

Physical Characteristics

The CMP Pits OU is located in the central portion of the SRS in Barnwell County more than 11.2 km (7 mi) from the site boundary and is approximately 1,560 m (5,200 ft) north of the L-Area perimeter fence (Figure J-1). The CMP Pits are located within the Pen Branch watershed approximately 375 m (1,250 ft) southeast of Pen Branch. The OU consists of five subunits: the ballast area soils, CMP Pits and associated vadose zone (Field A), vadose zone (Field B), groundwater, and Pen Branch surface water and sediment (Figure J-2). Characteristics of each subunit are described as below:

- The CMP Pits and associated vadose zone (Field A) – An approximately 0.41 hectare (1 acre) area which includes the seven former unlined pits. The seven pits are located

in two rows and occupy an area 3 to 4.5 m (10 to 15 ft) wide, 13.5 x 21 m (45 to 70 ft) long, and 3 to 4.5 m (10 to 15 ft) deep. The pits occupy the top of a knoll at an approximate elevation of 310 ft mean sea level (msl). Field A is the vadose zone area which was contaminated by the CMP Pits operation.

- Vadose zone (Field B) – An area approximately one acre that is located 30 m (100 ft) north of Field A. Field B is another vadose zone area which was contaminated by the CMP Pits operation.

- Ballast Area – An area approximately one-half acre that is located adjacent to and part of Field A. The Ballast Area was used to stockpile excavated pit soils and fluorescent lighting ballasts during the 1984 excavation.

- Groundwater – Previous wastes dumped at the CMP Pits has contaminated the groundwater at and near the CMP Pits with volatile organic compounds (VOCs) (primarily tetrachloroethylene [PCE] and trichloroethylene [TCE]) and the pesticide, Lindane, above maximum contaminant levels (MCLs). The groundwater plume extends from the CMP Pits northward towards Pen Branch.

- Pen Branch Surface Water and Sediment – Groundwater from CMP Pits flows towards and discharges to Pen Branch, however, the stream has never seen contaminant concentrations above MCLs. The sediment at Pen Branch has not been impacted by the CMP Pits operations.

Land and Resource Use

The CMP Pits OU is located in the unrestricted land use zone of SRS, outside of the industrial zone defined by the *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a). According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. Therefore, future land use for the CMP Pits OU is reasonably anticipated to be industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The CMP pits were designed to receive nonradioactive wastes (chemicals, metals, and pesticides) and operated from August 1971 until February 1979. During that time, chemicals, metals, pesticides, and fluorescent lighting ballasts containing polychlorinated biphenyls (PCBs) were disposed of in the pits. In 1984, the buried wastes and surrounding soil was excavated.

PCBs and pesticides were detected in soil at or near the ground surface to the west of the CMP Pits in an area that is now referred to as the "Ballast Area". The presence of the PCB- and pesticide-contaminated soil is attributed to stockpiling material recovered from the pits during the 1984 removal action.

Not all contaminated soils were removed, and the vadose zone remained contaminated with VOCs. Groundwater contamination has occurred as a result of the contamination leaching from soil. Two groundwater plumes exist at the CMP Pits, designated as the main plume and the northeast distal plume. These plumes are moving northward towards Pen Branch. Groundwater modeling indicates that the CMP Pits are the source for the main plume (WSRC 2002). Particle tracking towards and from the northeast plume suggests that this plume is from a different source than that of the main plume. It is possible that the a drainage ditch located approximately 110 m (361 ft) north of the CMP Pits, is a possible source area (Figure J-2). However, additional characterization efforts concluded that if a source was once present, it is now depleted (WSRC 2003a). It is also possible that the distal plume originated from the main plume, but has been separated due to the drop in the water table elevation over time, which has created a dry zone in the upper aquifer zones (Figure J-3).

No contaminants were found at levels that posed a risk to human health or the environment in the Pen Branch surface water or sediment (WSRC 2003a).

Figures J-4 and J-5 presents photographs of the CMP Pits OU before remediation and currently (2012), respectively.

Initial Response

The following pre-Record of Decision (ROD) activities have been performed to support the overall cleanup strategy for the CMP Pits OU:

- Original excavation of the CMP Pits conducted with clean backfill and cover system (1984);
- SVE units installed in CMP Pits Field A (Interim Action in 2001) (WSRC 1999b), however, possible dense non-aqueous phase liquid (DNAPL) was found and unexpected conditions forced additional characterization before SVE startup;
- Ballast Area Soil Excavation / Off-site Incineration (Interim Action) (2000) (WSRC 1999b), however, soil containing Silvex was found that could not be treated or disposed of offsite. The amount of contaminated soil was found to be significantly greater than originally estimated. An evaluation of treatment technologies for bioremediation of Silvex contaminated soils was needed;
- Soil Vapor Extraction (SVE) in CMP Pits Field B (Interim Action) (2001) (WSRC 2001);
- Ballast Area Soil Excavation / Bioremediation (Treatability Study – Phase I) (2001);
- SVE in CMP Pits Field A (Interim Action) (2002) (WSRC 2001);
- SVE units converted to passive system (Baroballs^{TM}) in Field B (Interim Action) (2002) (WSRC 2001);
- Ballast Area Soil Excavation / Bioremediation (Treatability Study – Phase II) (2002);
- Ballast Area Soil Excavation / Bioremediation (Interim Action) (2004) (WSRC 2003b);

DNAPL VOC contamination was found to be trapped in the clay horizon beneath the CMP Pits in Field A, where SVE units alone could not remediate the contamination. Additional remediation techniques were needed to remediate the contaminant source to groundwater.

Basis for Taking Action

Releases of VOCs (predominantly PCE and TCE) and pesticides to groundwater have occurred from contaminated soil at the CMP Pits. Groundwater is contaminated above MCLs with PCE, TCE, Lindane, and carbon tetrachloride. Exposure to these constituents above MCLs through ingestion or prolonged dermal contact increases the risk of cancer. The refined constituents of concern (RCOCs) for the CMP Pits OU are listed in Table J-2.

The CMP Pits OU remedial goals (RGs) in soil have been developed to be protective based upon future industrial land use and in groundwater have been developed to achieve MCLs or residential RGs (Table J-2).

IV. Remedial Actions

Remedy Selection

In 2005, a final ROD was issued to address the source of contamination in the vadose zone and the groundwater plume. As stated in the ROD, the remedial action objectives (RAOs) are as follows:

Ballast Area

- Prevent human and ecological receptors from direct contact with PCB-contaminated surface soil at concentrations > 1 mg/kg; and
- Prevent direct contact with pesticide-contaminated surface soils so that constituents of concern (COCs) do not present an unacceptable risk to human and ecological receptors.

CMP Pits Field A and B Vadose Zone

- Prevent COC migration to groundwater; and
- Prevent residential exposure to surface soil above RGs.

Groundwater

- Prevent human exposure to contaminated groundwater above MCLs or RGs;

- Reduce the COC concentrations in the groundwater plume to MCLs; and
- Prevent discharge of contaminated groundwater to surface water at concentrations above MCLs.

Surface Water and Sediment

There are no remedial action objectives established for the Pen Branch surface water and sediment because no COCs were identified.

Remedy Implementation

The implementation of the final remedial action included the following activities:

Ballast Area

- Established institutional controls (i.e., physical access controls to prevent unauthorized entry to SRS [fences, guards, security patrols, etc.], administrative controls that maintain the CMP Pits OU for industrial use only, warning signs, and use restrictions via the SRS Site Use/Site Clearance Program) after the completion of the interim action. The interim action included a small portion of contaminated soil that was removed for incineration at an offsite facility. The remaining Silvex contaminated soil was treated onsite using enhanced bioremediation.

CMP Pits Field A Vadose Zone

- Operating a combination of electrical resistance heating (ERH) to remove DNAPL, and continued operation of the SVE system throughout the ERH operation.

CMP Pits Field B Vadose Zone

- Continued operation of the interim action passive SVE system via BaroBalls™.

Groundwater

- Established a monitoring natural attenuation (MNA) network by installing additional groundwater monitoring wells. MNA will effectively remediate the low-concentration residual groundwater contamination that remains following completion

of the source control remedial action. The PCE plumes comprised approximately 17.8 hectares (44 acres); the TCE plumes comprised approximately 16.6 hectares (41 acres) in 2011,

- Issued an Effectiveness Monitoring Plan (EMP) which provides the sampling and reporting requirements associated with MNA (WSRC 2006a).
- Established land use controls for 2.9 hectares (7.1 acres) at the CMP Pits OU (Figure J-2).

System Operations/Operation and Maintenance

Operations at the CMP Pits OU are now complete.

- ERH and SVE have been completed in Field A. The ERH equipment and associated SVE wells have been removed or abandoned in accordance with SRS Manual 3Q5 and R.61-71 South Carolina Well Standards. The results of the ERH/SVE operations were reported in the 2009 Effectiveness Monitoring Report (EMR) (SRNS 2009). Confirmation soil sampling was reported in the 2010 EMR (SRNS 2010).
- At Field B, the passive SVE units were abandoned in concurrence with the Field A SVE abandonments.

The following maintenance activities are ongoing:

- Groundwater and surface water monitoring for the MNA network. Sampling will continue until MCLs have been attained. The MNA remedy will be evaluated annually in EMRs based on groundwater monitoring data as defined in the approved EMP (WSRC 2006a). Groundwater monitoring data has been reported in EMRs since June 2009. The MNA remedy is expected to reduce groundwater concentrations to below MCLs within a reasonable time frame (40 years).
- Annual site inspections for evidence of damage to the cover system due to erosion or intrusion by burrowing animals. The inspections also address upkeep of the vegetative cover and access control barriers (e.g., the warning signs),

- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required,

- Institutional controls (i.e., physical access controls to prevent unauthorized entry to SRS [fences, guards, security patrols, etc.], administrative controls that maintain the CMP Pits OU for industrial use only, and warning signs) are being enforced to preclude access through the SRS Site/Use Site Clearance program and SRS site security.

The operation and maintenance (O&M) costs associated with the selected remedy for CMP Pits OU, which include maintenance of the soil cover, groundwater monitoring and institutional controls, has a ROD estimated present worth of $2,102,976 discounted at 3.9% per year for 40 years of maintenance activities. O&M cost estimate was based on five years (2 years ERH-SVE plus 3 years passive SVE) of operation. The actual (O&M) cost since construction of the remedial action operating equipment in FY08 until FY11 is $1,583,000. The actual O&M costs (Table J-3) were higher than expected, because a larger volume of contaminated soil (254.7 vs. 2,295 m^3 [333 vs. 3,000 yd^3]) was treated with ERH, which required a second SVE, more sampling, a larger electrolyte distribution system, and a condensate treatment system. Groundwater monitoring and reporting costs were also higher than expected.

V. Progress since Last Review

The previous protectiveness statement concluded that the remedial actions at CMP Pits OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks have been controlled by the operation of ERH/SVE and passive SVE and are currently being controlled with MNA and institutional controls that have been functioning properly.

The ERH and/or SVE systems were effective at removing VOC contamination from the vadose zone created when the water table level dropped in elevation in Field B and from the porous horizons in the source area in Field A. The source term has been depleted;

therefore, the ERH and SVE systems have been shut down and abandoned. Groundwater and surface water monitoring per the EMP has been ongoing since 2007. These results have been documented in annual EMRs (SRNS 2009; SRNS 2010; SRNS 2011; SRNS 2012)

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;
- Reviewed all process and performance monitoring data provided by the annual EMRs and provided a technical assessment of whether the ERH/SVE and passive SVE functioned as intended by the ROD and whether the shutdown criteria has been achieved;
- Reviewed the groundwater and surface water monitoring data provided in the EMRs (SRNS 2009; SRNS 2010; SRNS 2011; SRNS 2012) as summarized in Table J-4;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment J-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***

- Four annual EMRs have been submitted to date and were reviewed (2009 [SRNS 2009]; 2010 [SRNS 2010]; 2011 [SRNS 2011]; 2012 [SRNS 2012]). These reports include all sample results for PCE, TCE, carbon tetrachloride, associated VOC degradation products, and Lindane collected from monitoring wells and surface water

stations between 2008 and 2011. These reports include time-series plots at each monitoring station for PCE, TCE, and Lindane since 2001, plume maps for the three main constituents, and cross-sections of the stratigraphy with the PCE plume."

- ***Summary of Inspections and Interviews***

Interviews were conducted with Richard Feagin, O&M staff member, on June 7, 2012 by phone and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The CMP Pits OU was inspected by SRNS and USDOE personnel on September 17, 2012. No issues were identified for the CMP Pits OU during this inspection and interviews.

- On January 22, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- Soil treatment via enhanced bioremediation is effective in preventing exposure to human and ecological receptors with PCB-contaminated surface soils at the Ballast Area. Monitoring and sampling data verified that the RGs were achieved as shown in Table J-5. Further information on the enhanced bioremediation can be found in the Interim Post-Construction Report (WSRC 2006b).

- The ERH/SVE and passive SVE was effective in preventing RCOC migration to groundwater. As reported in the 2010 EMR (SRNS 2010), concentrations of VOC contamination in the vadose zone soils were greatly reduced to levels below RGs. Pre-ERH/SVE concentrations of PCE were as high as 8,800 mg/kg. After the ERH/SVE shutdown, 59 confirmation soil samples were collected. The maximum PCE result was 1.8 mg/kg, well below the RG of 30.7 mg/kg. Confirmation

dichloromethane (DCM) soil sample results were at a maximum of 0.0111 mg/kg, well below the RG of 0.2 mg/kg.

- Groundwater results around the actual CMP Pits source area have been decreasing with time and were at a maximum PCE concentration of 643 µg/L in 2011 (Table J-4). DCM groundwater results have been below the MCL (5 µg/L) since the ERH/SVE shutdown. 2011 DCM maximum results were 1.94 µg/L. Table J-4 compares the Pre-ERH/SVE groundwater concentrations with current (2011) concentrations. Based on recent groundwater data, minor sampling optimizations have been made reducing some wells to annual sampling (SRNS 2012).

- The Field A cover system is effective in preventing residential exposure to surface soils above RGs. The cover system maintenance program and land use controls have been effective in maintaining the integrity of the cover system. The annual inspection reports indicate no significant deficiencies.

- The MNA and institutional controls are effective in preventing human exposure to contaminated groundwater. Overall RCOC concentrations have been reduced in the groundwater.

- The MNA is effective in preventing discharge of contaminated groundwater to surface water. RCOC concentrations of surface water have always been below MCLs. Results are mainly non-detect.

The above remedial activities are meeting the RGs established for the CMP Pits OU, as discussed in Section IV, 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 remedy selection are still valid. The MCLs for the currently monitored RCOCs, PCE, TCE, Lindane, carbon tetrachloride, and DCM, have remained the same since the remedies were implemented. The MCL for total trihalomethanes (i.e., bromodichloromethane, and

chloroform) has changed from 100 µg/L to 80 µg/L. Although this change did not impact the effectiveness of the remedy, future reports (starting with the 2013 EMR) will reflect this change.

More stringent 2012 PRGs/RSLs do not impact the protectiveness of the remedy because soil treatment is effective in reducing the concentration of contaminants and exposure to human and ecological receptors at the Ballast Area, and the Field A cover system prevents exposure of human and ecological receptors to remaining soil contaminants left in place. In addition, more stringent PRGs/RSLs would not impact the LUCs that are in place to prevent exposure to or ingestion of contaminated groundwater or soil media at the CMP Pits OU.

Due to the presence of chlorinated solvents at the site, there is a potential that 1,4-dioxane may also exist because it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. The presence of 1,4-dioxane is not likely to change the protectiveness of the remedial action that includes LUCs (at a minimum) which consequently renders the exposure pathway to human receptors incomplete. An evaluation of the effectiveness of the remedy is premature until such time that a formal MCL is established.

SRS has performed a historical review of groundwater data and it was determined that 1,4-dioxane was analyzed for at CMP Pits from 2001 to 2006 with a total of 590 analyses. There were 84 detections with a maximum concentration of 140 µg/L. As a result of this review, and in anticipation of the establishment of an MCL for this contaminant, 1,4-dioxane will be added to the groundwater monitoring program at CMP Pits. Results will be included in subsequent monitoring reports and summarized in the next Five-Year Remedy Review.

There have been no changes in standards or physical conditions of the CMP Pits OU that would affect the protectiveness of the remedy.

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

Issues related to the CMP Pits OU are presented in Table J-6.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions for the CMP Pits OU are listed in Table J-7.

X. Protectiveness Statement(s)

The remedy at the CMP Pits 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 the ingestion of, contaminated soil and groundwater. All threats to contaminated soil at the CMP Pits OU have been addressed through implementation of the soil cover, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the CMP Pits OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

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

SRNS, 2009. *Effectiveness Monitoring Report for the Electrical Resistance Heating / Soil Vapor Extraction System and Monitored Natural Attenuation at the Chemicals, Metals, and Pesticides Pits Operable Unit (U) March 2008 through March 2009*, SRNS-

RP-2009-00573, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Effectiveness Monitoring Report for the Monitored Natural Attenuation at the Chemicals, Metals, and Pesticides Pits Operable Unit (U) March 2009 through March 2010*, SRNS-RP-2010-00896, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Effectiveness Monitoring Report for the Monitored Natural Attenuation at the Chemicals, Metals, and Pesticides Pits Operable Unit (U) March 2010 through March 2011*, SRNS-RP-2011-01136, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Effectiveness Monitoring Report for the Monitored Natural Attenuation at the Chemicals, Metals, and Pesticides Pits Operable Unit (U) March 2011 through March 2012*, SRNS-RP-2012-00158, 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, 1999b. *Interim Record of Decision for the Chemicals, Metals, and Pesticides Pits (080-17G, 080-17.1G, 080-18G, 080-18.1G, 080-18.2G, 080-18.3G, 080-19G) (U)*, WSRC-RP-98-4198, Revision 1.1, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2001. *Interim Record of Decision Amendment for the Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G) (U)*, WSRC-RP-2000-4158, Revision 1.2, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken, SC

WSRC, 2002. *Groundwater Modeling for the Chemical, Metals, and Pesticides (CMP) Pits (U)*, WSRC-RP-2002-4195, Revision 0, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken, SC

WSRC, 2003a. *RCRA Facility Investigation/Remedial Investigation Addendum with Baseline Risk Assessment for the CMP Pits (U)*, WSRC-RP-2002-4049, Revision 1.1, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken, SC

WSRC, 2003b. *Interim Record of Decision Amendment for the Chemicals, Metals, and Pesticides Pits-Ballast Area (U)*, WSRC-RP-2001-4232, Revision 1.1, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken, SC

WSRC, 2004. *Record of Decision Remedial Alternative Selection for the Chemicals, Metals, and Pesticides Pits Operable Unit (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) (U)*, WSRC-RP-2004-4090, Revision 1, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken, SC

WSRC, 2006a. *Effectiveness Monitoring Plan for the Electrical Resistance Heating (ERH)/Soil Vapor Extraction (SVE) System and Monitored Natural Attenuation at the Chemicals, Metals, and Pesticides Pits Operable Unit (U)*, WSRC-RP-2005-4077, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006b. *Interim Post-Construction Report (IPCR) for the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit – Ballast Area (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G) (U)*, WSRC-RP-2005-4065, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist Chemical, Metal, and Pesticides Pits (U)*, ER-IDS-019-062, Inspection period 2007 through 2011 (annually)

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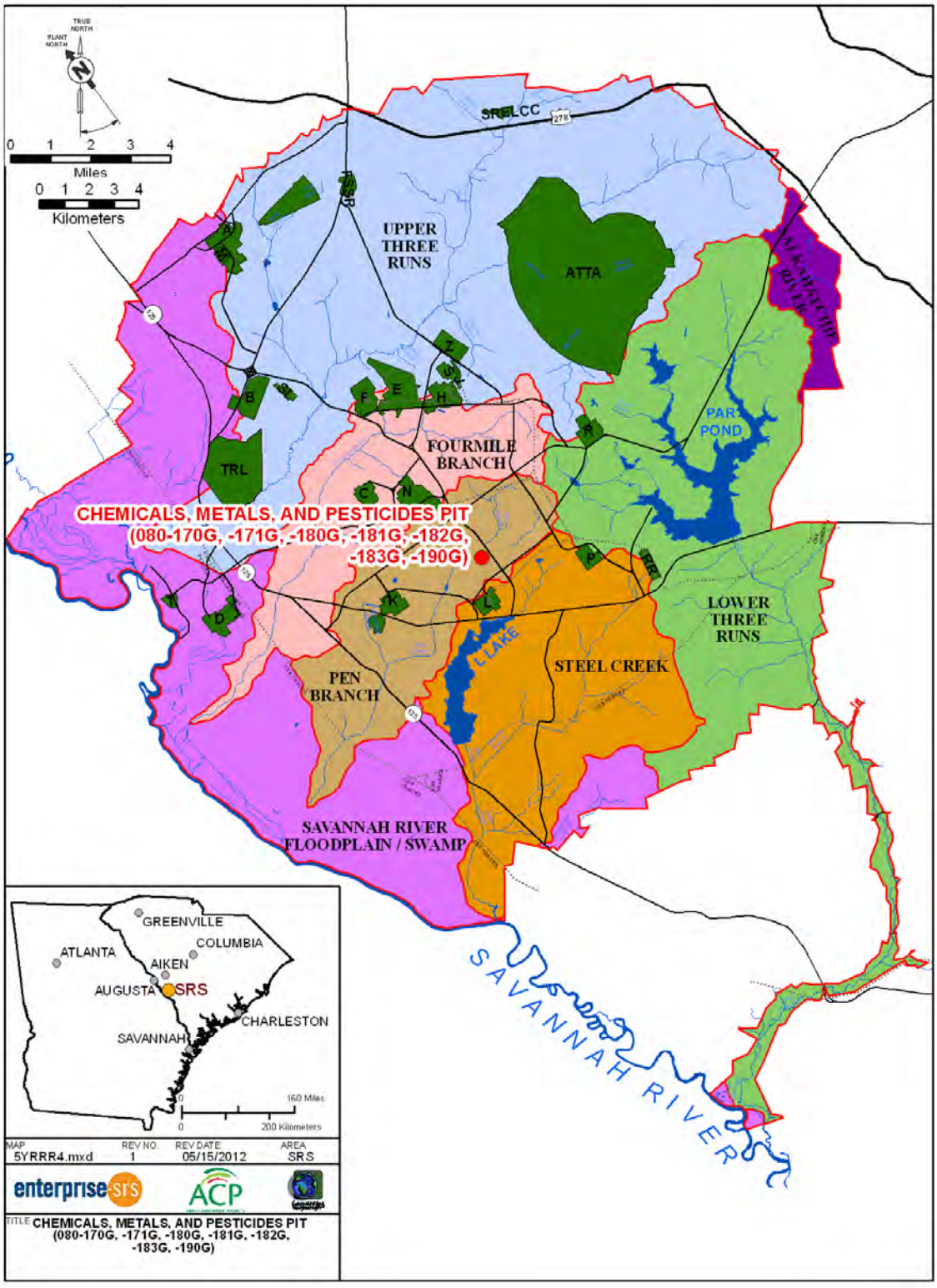


Figure J-1. Location of the CMP Pits OU at SRS

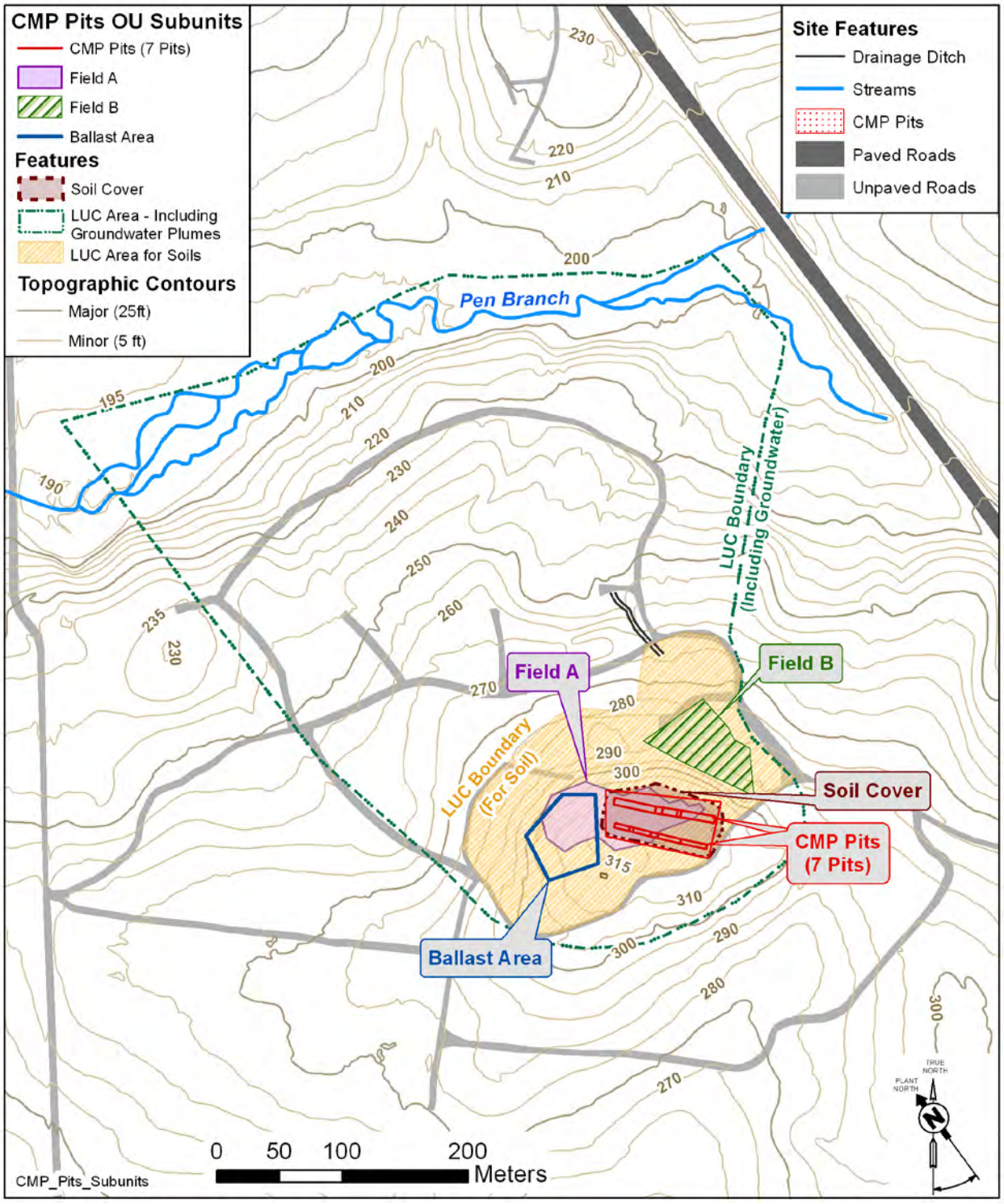


Figure J-2. Layout of the CMP Pits OU

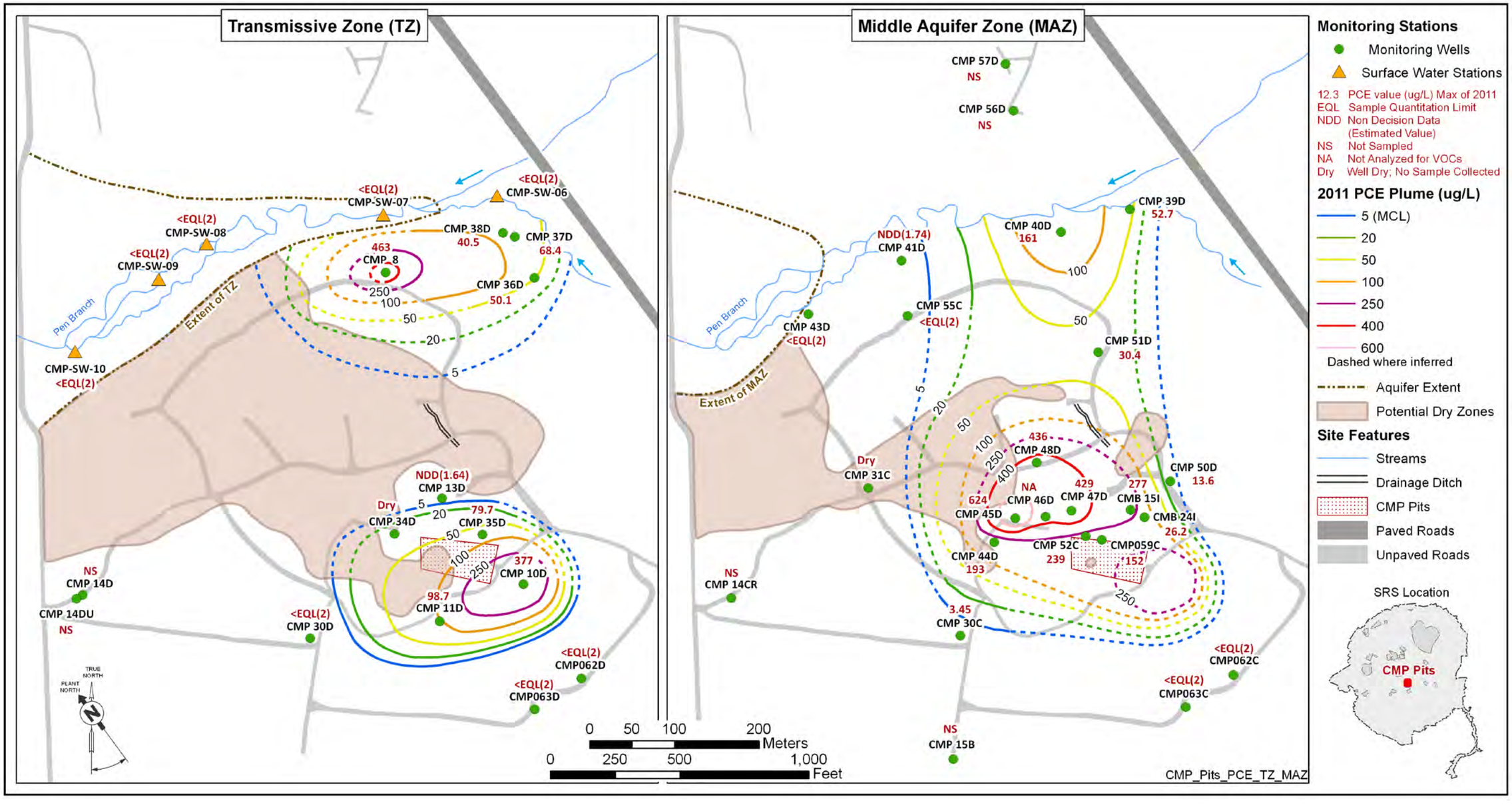


Figure J-3. 2011 PCE Plume in the TZ and MAZ

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Figure J-4. Photo of CMP Pits Before Remediation Activities (During Disposal Operation)



Figure J-5. Photo of CMP Pits Currently (2012)

Table J-1. Chronology of OU Events

Event	Date
Removal Action (Soil Excavation)	1984
Remedial Investigation Complete	October 1, 1997
Interim ROD Issuance	January 19, 2000
Interim Remedial Action Construction Start / Completion	December 10, 1999 / December 5, 2001
Interim Remedial Action Operations Start / Completion	April 23, 2001 / October 12, 2005
First Interim ROD Amendment Issuance	April 8, 2002
Second Interim ROD Amendment Issuance	October 21, 2003
ROD Issuance	May 10, 2005
Remedial Action Construction Start / Completion	April 6, 2006 / November 7, 2007
Remedial Action Operations Start / Completion	November 2007 / June 28, 2009
Previous Five-Year Reviews	February 12, 2004 / February 4, 2009

Table J-2. CMP Pits RCOCs by Medium and Subunit with Final Remedial Goals

		Type of RCOC					
Area/Media of Concern	**Refined COCs**	**ARAR**	**CM/ PTSM**	**HH**	**ECO**	**RGs (mg/kg or mg/L)**	**Final Remedial Goal Basis**
Ballast Area	PCB	✓			✓	1.00E+00	ARAR
	Dieldrin			✓	✓	6.84E-02	Ecological
	Endrin				✓	3.97E-02	Ecological
	Heptachlor Epoxide				✓	2.10E-02	Ecological
	p,p'-DDD				✓	2.87E-01	Ecological
	p,p'-DDE				✓	5.54E-01	Ecological
	p,p'-DDT			✓	✓	1.62E+00	Ecological
CMP Pits and Associated Field A Vadose Zone [2]	Dichloromethane		✓			2.48E-02	Contaminant migration
	Tetrachloroethylene		✓			3.07E+01	Contaminant migration
Groundwater	Alpha-benzene hexachloride			✓		5.33E-06	Future Resident
	Beta-benzene hexachloride			✓		1.84E-05	Future Resident
	Delta-benzene hexachloride			✓		1.84E-05	Future Resident
	Dieldrin			✓		2.09E-06	Future Resident
	Lindane	✓		✓		2.00E-04	ARAR
	Bis(2-ethylhexyl) phthalate	✓		✓		6.00E-03	ARAR
	Total Trihalomethanes[1]	✓		✓		0.80E-01[3]	ARAR
	Carbon Tetrachloride	✓		✓		5.00E-03	ARAR
	Dichloromethane	✓		✓		5.00E-03	ARAR
	Tetrachloroethylene (PCE)	✓		✓		5.00E-03	ARAR
	Trichloroethylene (TCE)	✓		✓		5.00E-03	ARAR

1. Total Trihalomethanes includes chloroform and bromodichloromethane. Although these constituents are not ARAR COCs (Site concentrations pose a risk but do not exceed the MCL), they do have an MCL that is an ARAR and; as such, is the appropriate final RG.
2. Vadose zone RGs apply anywhere in the vadose zone. The RGs are target values based on available data. During remedial action implementation, vadose zone and groundwater monitoring may indicate that different values may be protective and meet the remedial action objective of preventing migration to groundwater.
3. The MCL for Total Trihalomethanes includes chloroform and bromodichloromethane has been updated with the EPA 2012 RSL Table value of 0.08 mg/L, from the former 1.00E+01 mg/L value.

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

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	19,500	758,000	496,000	147,000	162,000	1,583,000
Annual Estimated Costs (Active SVE Operations)	0	230,642	230,642	0	0	
Annual Estimated Costs (Passive SVE Operations)	94,713	94,713	94,713	0	0	
Annual Estimated Costs (Monitored Natural Attenuation)	36,897	36,897	36,897	36,897	36,897	
Annual Estimated FYR Costs (1 each for SVE & MNA)	26,616	0	0	0	0	
Total ROD Estimated Direct O&M Costs	158,226	362,252	362,252	36,897	36,897	956,524

Table J-4. Comparison of RGs and Groundwater and Surface Water Monitoring Data from 2011

	RGs	Groundwater		Surface Water
RCOC	MCL (µg/L)*	2007 (Pre-ERH/SVE) Maximum Concentration (µg/L)	2011 Maximum Concentration (µg/L)	2011 Maximum Concentration (µg/L)
PCE	5.0	1,350	643	Non Detect
TCE	5.0	851	707	Non Detect
Lindane	0.2	3.05	1.98	Not Analyzed
Carbon Tetrachloride	5.0	24.6	17.1	Non Detect
Dichloromethane	5.0	2.09	1.94	Non Detect
Bromodichloromethane	80	16	11.4	Non Detect
Chloroform	80	30.4	24.1	Non Detect

* MCL values are based on US EPA values available May 2012.

Table J-5. Ballast Area Enhanced Bioremediation Soil Sample Confirmation Results

RCOC	Remedial Goal (µg/kg)	Maximum Result of Confirmation Samples (µg/kg)
PCB	1,000	192
Dieldrin	68.4	40.9
Endrin	40	9.06
Heptachlor Epoxide	21	8.55
p,p'-DDD	287	194
p,p'-DDE	554	49.6
p,p'-DDT	1620	322

Table J-6. Issues Identified for CMP Pits OU

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1,4-Dioxane has been identified as being a potential contaminant at CMP Pits OU based on its possible association with other solvents that are present at CMP Pits OU and previous 1,4-dioxane groundwater data results from 2001 through 2006. However, there is a lack of recent groundwater data to dismiss 1,4-dioxane as being present at levels which would be harmful to human health or the environment.	N	N

Table J-7. CMP Pits OU Recommendations and Follow-up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date*	Affects Protectiveness? (Y/N)	
					Current	Future
1,4-Dioxane has not been monitored recently at the CMP Pits OU wells and surface water stations	• 1,4-Dioxane will be monitored in all of the CMP Pits OU wells and surface water stations that are normally analyzed for VOCs during the 4Q13 sampling event. The data results will be presented in the subsequent annual EMR that will be submitted in June 2014, as well as in the next Five-Year Remedy Review. Based on previous results from 2001 through 2006 it is anticipated that 1.4-dioxane will be added to the monitoring network. However, based on the new results, the USEPA, SCDHEC and USDOE will decide whether or not 1,4-dioxane will need to be permanently added to the list of monitored constituents.	USDOE	SCDHEC/ USEPA	June 2014	N	N

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Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit

I. SITE INFORMATION			
Site Name:	**Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit**	**Date of Inspection:**	**06/07/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #24**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**85°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Operation and combination of Electrical Resistance Heating (ERH) and continued operation of the Soil Vapor Extraction (SVE) system (Field A); passive SVE via BaroBalls™ for (Field B) have been concluded. MNA continuing.

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

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

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

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 06/07/2012 (Date)

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

Problems/Suggestions: ☐ Report Attached

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for Chemical Metal and Pesticides Pits*, ER-IDS-019-062.

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

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

2. Health and Safety Plans (HASPs):

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

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

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks: Water elevation records only.

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

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

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

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks:_____

B. Signs

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

Remarks: Signs at this site are in good condition._____

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) 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.) Walk-throughs

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks: Survey monuments were located and in good condition

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) 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:

VII. COVER SYSTEMS ☒ 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.

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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

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

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

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

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

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

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

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

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

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

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

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

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

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

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

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:
☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks:

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:
☐ Good Condition ☐ Needs Maintenance
Remarks:

3. Spare Parts and Equipment:
☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided
Remarks:

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:
☐ Good Condition ☐ Needs Maintenance
Remarks:

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:
☐ Good Condition ☐ Needs Maintenance
Remarks:

3. Spare Parts and Equipment:
☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided
Remarks:

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

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

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: SVE units have concluded operations_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment J-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The selected remedial action for groundwater is Monitored Natural Attenuation (MNA) and Institutional Controls to control human exposure to contaminated groundwater above MCLs; the selected remedy for the Ballast Area of institutional controls is to prevent direct contact to PCB-contaminated soils above concentrations of 1 mg/kg. A combination of ERH to remove DNAPL and continued operation of the SVE system for Source Area (Field A) and of the passive soil vapor extraction system via Baroballs™ for Source Area (Field B) have concluded their operation. MNA effectively remediates the low-concentration residual groundwater contamination that remains following implementation of the source control remedial action. Institutional controls are in place and being implemented to provide access control and prevent exposure as designed. In conclusion, the selected remedies for the CMP Pits are functioning as intended.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the integrity of the MNA. There are no issues requiring corrective actions,
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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C-, K-, L-, and R-REACTOR COMPLEXES

I. Introduction

This report is the first five-year review for the C-, K-, L-, and R-Reactor Complexes. The four Reactor Complexes were first evaluated together to obtain regulatory approval for in situ decommissioning (ISD) as an early remedial action (SRNS 2009a). In 2009, the USDOE decided to proceed with removal actions to support accelerated remediation of several subunits of the R-Area Operable Unit under the American Recovery and Reinvestment Act of 2009. These removal actions included the ISD for R-Reactor Building (105-R) Complex as described in the Non-Time Critical Removal Action (SRNS 2009c). This strategy resulted in an acceleration of the completed remedial actions of about three years.

Therefore, the R-Reactor Complex will not be discussed as part of this report. Discussions pertaining to the R-Reactor Complex will be included in Appendix WW (RAOU).

Contaminants have been left in place at the C-, K-, and L-Reactor Complexes at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at C-, K-, and L-Reactor Complexes is protective of human health and the environment. The review for C-, K-, and L-Reactor Complexes was conducted from July 2012 through August 2012. This report documents the results of the review.

II. OU Chronology

Table K-1 lists the chronology of events for the C-, K-, and L-Reactor Complexes.

III. Background

The C-, K-, and L-Reactor Complexes are listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media of concern are metal components, concrete, and sediment. Groundwater was not included as part of the scope for the EAROD.

Physical Characteristics

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

Each of the Reactor Complexes includes:

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

Land and Resource Use

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

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

materials; the K-Reactor Complex is being used for nuclear materials disposition activities; and the L-Reactor Complex is being used for nuclear materials storage. These missions will cease prior to implementation of the ISD end-state.

History of Contamination

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

Initial Response

No initial response actions have been taken at the C-, K-, L-, and R-Reactor Complexes.

Basis for Taking Action

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

Reactor Vessel Subunit

In each reactor vessel subunit, embedded in the floor of the process room, is a low-pressure and low-temperature reactor with deuterium oxide (D_2O [moderator]) cooling of the core. The nuclear fission process took place within the reactor tank, a cylinder composed of stainless steel containing a lattice of fuel and target assemblies, control rods, and instrumentation submerged in the primary heavy water moderator/coolant.

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

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

Disassembly Basin Subunit

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

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

Reactor Building and Attached Structures Subunit

Each building subunit is a reinforced-concrete structure with walls and floors several feet thick in some areas for blast resistance. The buildings extend from -15.2 m (-50 ft) to +45.4 m (+149 ft). Most of the processing equipment and components are located below grade.

The building is subdivided into areas based on activities performed in support of operations. These areas are 1) Assembly Area; 2) Process Area; and 3) Purification Area (Figure K-3). The Assembly Area received and prepared fuel and target rods from another area of SRS (M Area). The fuel and target rods were then sent to the Process Area. The Process Area houses the reactor vessel subunit, which is embedded in the floor of the process room. The Process Area also contains the shield water system, control and safety rod-actuating mechanisms, heat exchangers, primary coolant circuit pumps, helium blanket gas system, and the main control room. The Purification Area was used to remove fission and activation products from moderator water and blanket gas. In the Purification Area, moderator water passed through filters, ion exchange resin, and then through distillation columns before being returned to the primary cooling water circuit. This process resulted in the accumulation of radionuclides in process vessels contained within shielded cells.

Attached structures are outside of the main building, but physically connected to the main building. These attached structures include the Engine Houses (108-1 and 108-2) and the Standby Pumphouse (191), with the exception of the R-Reactor Complex, where no Standby Pumphouse was constructed. The Engine Houses are two-level facilities that provided emergency backup power for operations. These facilities contained diesel generators, direct current generators, and air compressors. The exhaust pipes for these facilities used asbestos insulation. The basement for these facilities contained support equipment including diesel tanks, coolant tanks, and pumps.

As a result of activities conducted in the building and attached structures subunits, structural concrete and components may be impacted with fixed contamination at concentrations exceeding the 1E-06 industrial worker risk threshold and 1E-03 PTSM thresholds in portions of the building (i.e., sumps, Purification Area). The building

concrete and components could also be impacted with contaminants at concentrations that may have the potential to migrate to groundwater at levels exceeding regulatory standards (i.e., MCLs).

IV. Remedial Actions

Remedy Selection

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

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

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

Under the ISD scenario for the C-, K-, and L-Reactor Complexes, the specific end-state configuration will be determined at the time the particular Reactor Complex is addressed. It is likely that a majority of the Reactor Building would remain, with the below-grade equipment and spaces grouted, as well as the Reactor Vessel. The Reactor Vessel would be stabilized in place using a grout with appropriate physical and chemical characteristics. The existing water would be removed from the Disassembly Basin. It is also likely that the stack and the above-grade structure of the Disassembly Basin would

be removed due to safety and structural integrity concerns. In addition, the below-grade structure of the Disassembly Basin would be grouted and capped.

LUCs would also be implemented to prevent direct human/animal exposure and to preclude uses other than industrial while operational activities occur at these facilities between signature of the EAROD and the completion of the USDOE's mission involving these facilities. The LUC objectives defined in the EAROD for the Reactor Building Complexes include: 1) restricting unauthorized worker access and preventing unauthorized contact, removal, or excavation of contaminated media; 2) prohibiting the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playgrounds; 3) maintaining the integrity of any current or future remedial or monitoring systems; 4) preventing access or use of contaminated groundwater until cleanup levels are met; and 5) preventing construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion. Final LUC objectives would be determined in the final RODs for the specific Area OUs.

The Selected Remedies for C-, K-, and L-Reactor Complexes will meet the remedial action objectives (RAOs) (SRNS 2009a), which are presented below:

Reactor Vessel Subunits

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

Disassembly Basin Subunits

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

Building and Attached Structures Subunits

- Prevent migration of radioactive or hazardous contaminants from the building to groundwater in concentrations that exceed regulatory standards (i.e., MCLs) to the extent practicable.
- Prevent industrial worker exposure to radioactive or hazardous contamination that exceeds 1E-06 industrial worker risk and 1E-03 PTSM risk thresholds.
- Prevent animal intruder exposure to radioactive and hazardous contamination.

The remedial actions selected to meet the RAOs and the threshold criteria to provide overall protection of human health and the environment and comply with Applicable or Relevant and Appropriate Requirements (ARARs) for the C-, K-, and L-Reactor Complexes is as follows:

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

Remedy Implementation

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

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

- Entrance requirements, warning signs/and or notices posted around the perimeter and at the entrances to building designated as a Property Protection Area;

- Locations within the Reactor Building Complexes that contain hazardous or radiological materials/contaminants are identified by posting (existing signs) for those individuals granted access through entrance requirements;

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

- SRS access controls to prevent exposure to trespassers, as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary; and

- In the long term, if the property, or any portion thereof, is ever transferred from DOE, notice of the type and quantity of any hazardous substances that were known to have been stored (for more than one year), released, or disposed of on the property will be provided. In addition, if the property, or any portion thereof, is ever transferred by deed, the U.S. Government will also satisfy the requirements of CERCLA 120(h)(3) to include a description of the remedial action taken, a covenant, and an access clause.

System Operations/Operation and Maintenance

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

The operation and maintenance (O&M) costs associated with the selected remedy for C-, K-, L-, and R-Reactor Complexes, which include maintenance for the annual inspections, have a ROD estimated present worth of $21,497,385 - $94,147,875 discounted at 3.9% for 200 years of maintenance activities. There are no O&M costs to report since implementation of the LUC component of the remedy began after FY11.

V. Progress since Last Review

Since this is the first five-year review for the C-, K-, and L-Reactor Complexes, there is no progress to report.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, References; and
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment K-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls.

Data Review

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

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on June 26, 2012 at the C-, K-, and L-Reactor Complexes and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The C-, K-, and L-Reactor Complexes was inspected by SRNS and USDOE personnel on September 17, 2012. No issues were identified for the C-, K-, and L-Reactor Complexes during this inspection and interviews.

Site inspections were conducted by USEPA and SCDHEC personnel, accompanied by DOE SR and SRNS personnel on January 16, 2013 (K- and L-Reactor Complexes) and January 29, 2013 (C-Reactor Complex). No significant problems regarding these OUs were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The selected remedy component currently being implemented is LUCs, which are preventing the exposure of industrial receptors to contaminated media or structures. The remainder of the remedy selected in the EAROD to implement ISD will be completed upon closure of the Reactor Building Complexes to address all threats associated with the Reactor Building Complexes. The Early Action Land Use Control Implementation Plan for C, K, and L-Reactors governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (SRNS 2010).

The annual site inspection confirmed LUCs are preventing human health exposure.

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

The exposure assumptions and remedial action objectives used at the time of remedy selection are still valid. There have been no changes in standards or physical conditions of C-, K-, or L-Reactor Complexes that would affect the protectiveness of the remedy. Since the C-, K-, and L-Reactor Complexes have not begun characterization activities, a final list of COCs and RGs have not been determined. More stringent 2012 PRGs/RSLs are not expected to impact the protectiveness of the remedy for the C-, K-, and L-Reactor Complexes when compared to similar analysis for the P- and R-Reactor Complexes. LUCs are in place to prevent exposure to contaminated media or structures.

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

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

VIII. Issues

There are no issues related to current site conditions or activities that would prevent the remedy from being protective once it is implemented.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for C-, K-, and L-Reactor Complexes.

X. Protectiveness Statement(s)

The selected remedies for C-, K-, and L-Reactor Complexes are currently protective of human health and the environment because LUCs including physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that limit site use to industrial, and warning signs and groundwater use restrictions via the Site Use/Site Clearance Program are in place to prevent human exposure to contaminated media. However, in order for the remedy to be protective in the long-term, the remainder of the remedy in the EAROD to implement ISD for the Reactor Building Complexes must be completed. .

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

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

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

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

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

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

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

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

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist C-Reactor Complex (U)*, ER-IDS-019-060, Inspection period 2007 through 2011 (annually)

Various - Inspection Data Sheets – *Field Inspection Checklist K-Reactor Complex (U)*, ER-IDS-019-059, Inspection period 2007 through 2011 (annually)

Various - Inspection Data Sheets – *Field Inspection Checklist L-Reactor Complex (U)*, ER-IDS-019-058, Inspection period 2007 through 2011 (annually)

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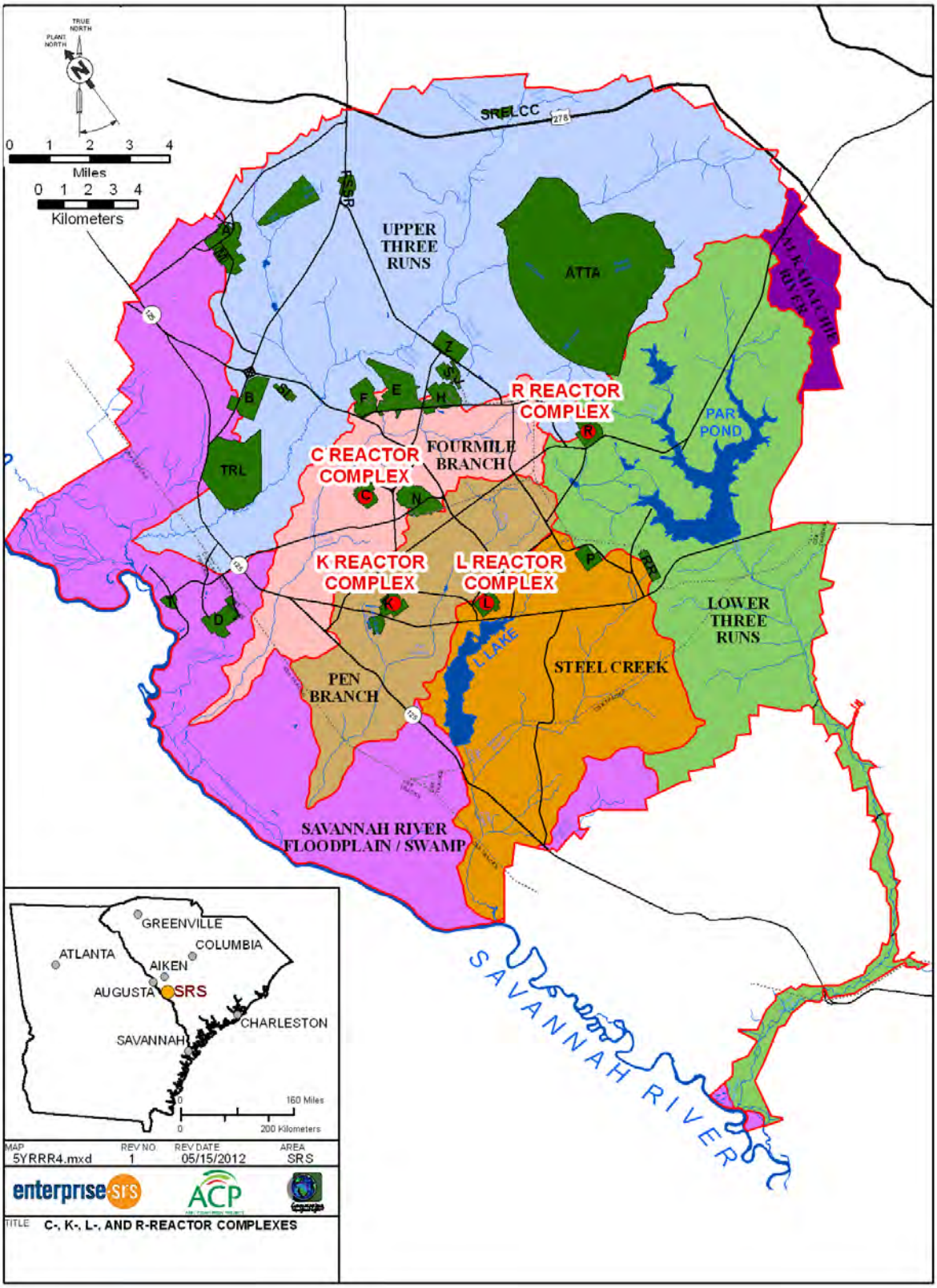


Figure K-1. Location of C-, K-, L-, and R-Reactor Complexes at Savannah River Site

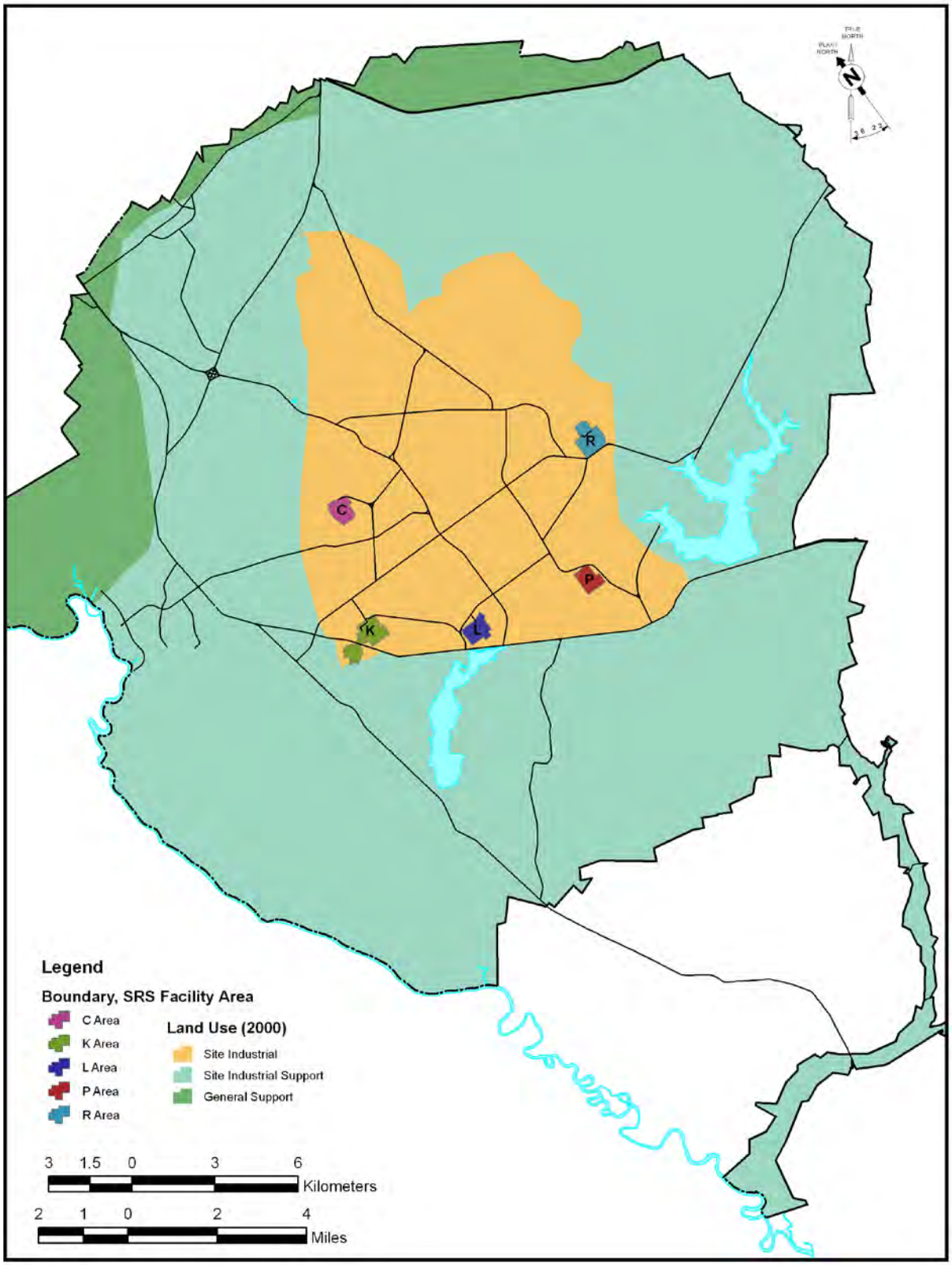


Figure K-2. Location of C-, K-, and L-Reactor Complexes within the SRS Site Industrial Land Use Boundary

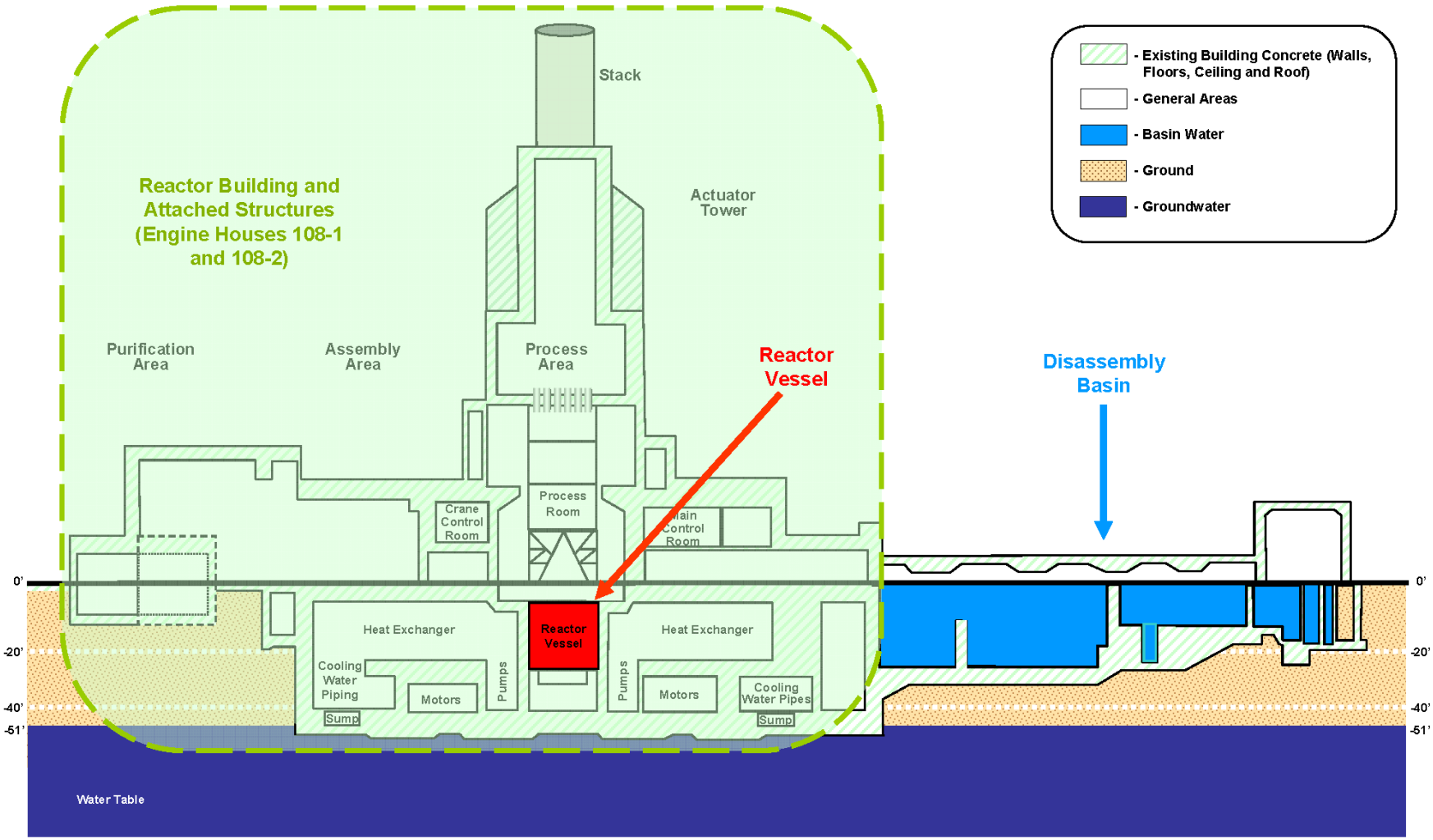


Figure K-3. Generic Layout of the Reactor Complexes Subunits

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



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



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

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Table K-1. Chronology of OU Events

Event	Date
EAROD Issuance	December 3, 2009
Remedial Action Start/Finish	October 4, 2010 / March 28, 2011
Previous Five-Year Reviews	None

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

I. SITE INFORMATION			
Site Name:	**C-, K-, and L-Reactor Complexes**	**Date of Inspection:**	**06/13/2012 for C** **8/1/2012 for K and L**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #70,90,91**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Partly cloudy/85F for 6/13/2012** **Foggy/85F for 8/1/2012**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other *In situ* decommissioning

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

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

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

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 06/26/2012 (Date)

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

Problems/Suggestions: ☐ Report Attached

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

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

Remarks: *See Field Inspection Checklists: ER-IDS-019-060; ER-IDS-019-058; ER-IDS-019-059*

_____

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

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

2. Health and Safety Plans (HASPs):

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

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

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

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

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: _____

B. Signs

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

Remarks: Signs are in good condition

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

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams/Phil Prater (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

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

VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☐ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☐ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☐ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:_____
E. Gas Collection and Treatment ☐ Applicable ☐ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:_____
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

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

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

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

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

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

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

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

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

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

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

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

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

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

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

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

The selected remedy for the Reactor Complexes is an *in situ* decommissioning end state with LUCs to maintain industrial land use. Warning signs have been posted around the reactor complexes and administrative controls have been put in place to prevent unauthorized invasive activities at the reactors. The remedy, institutional controls, is functioning as designed as indicated by no evidence of invasive activities.

B. Adequacy of O&M

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

The O&M procedures consisting of annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintain the CKL Reactor Complexes and the condition of its warning signs are good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

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

N/A

D. Opportunities for Optimization

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

N/A

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

I. Introduction

This report is the fourth five-year review for the D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the DBRP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the DBRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

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

III. Background

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

Physical Characteristics

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

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

77.1 x 13.8 x 3 m (257 x 46 x 10 ft); the dimensions of 431-1D are 68.7 x 68.7 x 3 m (229 x 36 x 10 ft). The two pits are separated by a 45-m (150-ft) wide berm of undisturbed soil. The pits have been backfilled with soil, and vegetation has been established on the resulting surface. The pit cover is raised above the surrounding terrain to enhance drainage.

Land and Resource Use

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

History of Contamination

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

Initial Response

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

Basis for Taking Action

Soils and groundwater were investigated in two phases of sampling between 1989 and 1993. A RCRA Facility Investigation (RFI) / Remedial Investigation (RI) Report (WSRC 1995b) and Baseline Risk Assessment (BRA) (WSRC 1995a) were completed in 1995. The soils analytical data indicate that little or no contamination of soil has occurred outside of the OU. The analytical data from the 1993 soil samples identified the following constituents of concern (COCs): arsenic, benzo(a)pyrene, chromium, manganese, octachlorodibenzo-p-dioxin, Aroclor-1260 (polychlorinated biphenyl [PCB]), and total alpha-emitting radium. Aroclor-1260 is the primary risk driver, contributing to a carcinogenic risk of $1x10^{-5}$ to a future resident for ingestion of soil. The maximum concentration of 3.39 mg/kg is also greater than the toxic substance control value of 1 mg/kg established for PCBs in high occupancy areas. The RFI/RI (WSRC 199b) and BRA (WSRC 1995a) indicated the DBRP OU posed minimal risk to the environment. The risk to future on-unit works is 1.0E-6. Ingestion of soil in the top two-foot layer by future residents poses a risk of 1.0E-5, primarily from Aroclor-1260.

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

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

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

Future Land Use – Arsenic and manganese are identified as posing a non-carcinogenic hazard to future resident adults and children and future on-unit workers through

groundwater ingestion and inhalation pathways. Arsenic is identified as posing a carcinogenic risk to future on-unit workers and future on-unit residents through the groundwater ingestion pathway. In addition, polyaromatic hydrocarbons and 1,2-dichloroethane are identified as posing a carcinogenic risk to the future on-unit worker through the groundwater ingestion pathway. It should be noted that the arsenic risk was based on a single measured arsenic value in the groundwater that was less than the MCL for drinking water.

No ecological risks were identified for the DBRP OU.

None of the risks associated with the soil in the DBRP was found to be greater than $1.0x10^{-4}$. Aroclor-1260 (max value 3.39 mg/kg) from the 0-2 foot soil interval in Pit 431-D was the predominant risk driver for future residents contributing 79% of the $1.0x10^{-5}$ risk. The HI for this exposure scenario was 0.7. The to-be-considered guidance for PCBs is a recommended soil action level of 1.0 mg/kg for residential use and 10-25 mg/kg for industrial use. The Aroclor-1260 concentration in Pit 431-D is well below the range for industrial land use (WSRC 1997).

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

IV. Remedial Actions

Remedy Selection

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

Prevent hypothetical future industrial workers from exposure to PCBs (3.39 mg/kg) in surface and subsurface soils at concentrations that exceed target risk levels. In Pit 431-D, the PCB recommended soil action levels are 1.0 mg/kg for residential use and 10-25 mg/kg for industrial use.

No RAOs were identified for groundwater, but verify that no significant groundwater contamination is originating from the DBRP and that no remedial action for groundwater is required. However as mentioned above, the approved addendum to the FRR (WSRC 2006) terminated groundwater monitoring.

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

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

However as mentioned above, the approved addendum to the FRR (WSRC 2006) terminated groundwater monitoring.

Remedy Implementation

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

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

Systems Operations/O&M

There are no system operational requirements.

The following maintenance activities are ongoing:

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

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

The operation and maintenance (O&M) cost associated with the selected remedy has a ROD estimated present worth cost of $368,000 discounted at 7% per year for 30 years of maintenance activities. The total actual O&M cost from completion of the remedial action in FY98 to FY11 is $238,087. The O&M costs during the last five years (i.e., FY07-FY11) have been lower than estimated because groundwater monitoring has been discontinued.

V. Progress since Last Review

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

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

VI. Five-Year Review Process

The following tasks were performed as part of the review:

Reviewed documents listed in Section XII, Documents Reviewed;

Confirmed implementation of the remedial action;

Inspected the OU, interviewed maintenance personnel; and documented the results on the Inspection Checklist provided in Attachment L-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and

Reviewed changes in standards and to-be-considered guidance.

Data Review

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

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

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the DBRP OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The DBRP OU was inspected by SRNS and USDOE personnel on July 24, 2012 and September 27, 2012. No issues were identified for the DBRP OU during this inspection and interviews.

On January 22, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended?

The remedy is functioning as intended as demonstrated below:

The native soil cover and institutional controls are effective in preventing exposure to PCBs to future industrial workers. The cover maintenance program and LUCs have been effective in maintaining the integrity of the soil cover.

The confirmatory groundwater monitoring program was effective in verifying "no action" is appropriate for groundwater.

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

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid except for the MCL for arsenic. At the time of the ROD issuance, the MCL for arsenic was 50 µg/L. In 2001, the MCL for arsenic was changed to 10 µg/L. However, arsenic was not detected in the DBRP OU groundwater during the five-year monitoring period and therefore, had no impact on the effectiveness of the remedy. More stringent 2012 preliminary remediation goals/regional screening levels do not impact the protectiveness of the remedy because the native soil cover and establishment of LUCs prevent exposure to any remaining soil contaminants left in place.

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

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

VIII. Issues

There are no issues for this OU.

IX. Recommendations and Follow-up Actions

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

X. Protectiveness Statement(s)

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

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

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

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

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

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

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

WSRC, 1996. *D-Area Burning/Rubble Pits (431-D and 431-1D) Corrective Measures Study/Feasibility Study (U)*, WSRC-RP-95-904, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

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

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2005. *Technical Evaluation for Groundwater Monitoring at the D-Area Burning/Rubble Pits (431-D and 431-1D) OU (U)*, WSRC-RP-2004-4056, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

Various – *Inspection Data Sheets - Field Inspection Checklist – D-Area Burning/Rubble Pits (431-D and 431-1D) Operable Unit (U)*, ER-IDS-019-003, Inspection period 2007 through 2011 (annually)

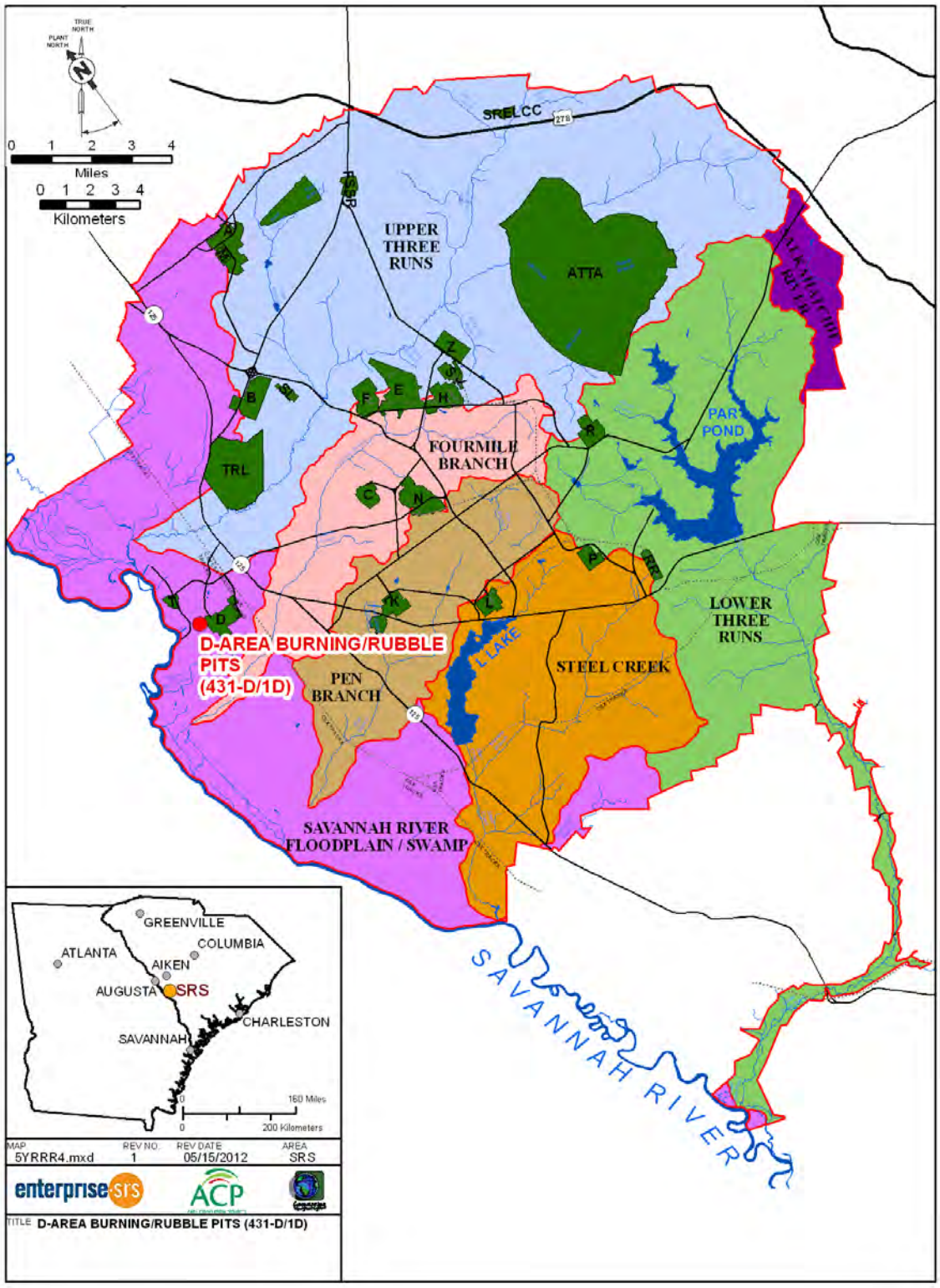


Figure L-1. Location of the D-Area Burning/Rubble Pits (431-D and 431-1D) OU

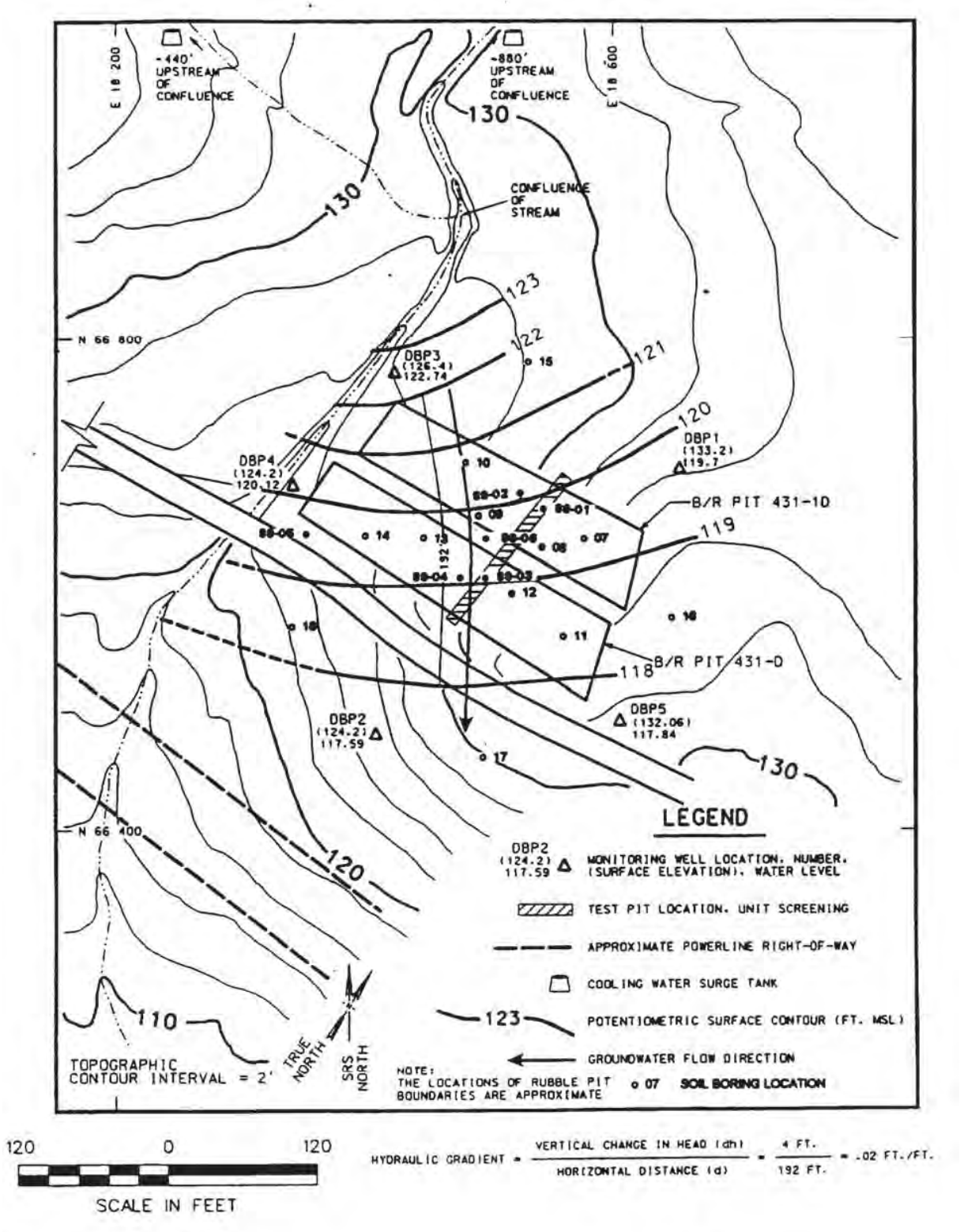


Figure L-2. Site Layout for the D-Area Burning/Rubble Pits (431-D and 431-1D) OU



Figure L-3. Photograph of DBRP during active operation, circa 1973.



Figure L-4. Current Photo of DBRP OU (2012)

Table L-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	1989/November 6, 1996
Record of Decision (ROD) Issuance	April 22, 1997
Remedial Action Start / Complete	May 12, 1998/May 12, 1998
Previous Five-Year Reviews	June 30, 1997, February 12, 2004, February 4, 2009

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

Project Cost	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$7,200	$8,200	$4,500	$4,800	$4,100	$28,800
Institutional Controls	$0	$0	$0	$0	$0	
Groundwater Monitoring and Reporting (Note - not included since it was discontinued in 2004)	n/a	n/a	n/a	n/a	n/a	
Five Year Reviews	$3700	$0	$0	$0	$0	
Total ROD Estimated Direct O&M Costs	$ $3,700	$ $0	$0	$0	$0 $12,333	$6 $3,700

*Source of estimate: The ROD (WSRC 1997) provides a present worth for 6 five-year ROD reviews of $8,000. A present worth analysis was used to convert this estimated total present worth cost into six unit costs of $3,700 for each of the five-year ROD reviews.

Table L-3. Results of DBRP OU Groundwater Sampling (1998-2003)

Analyte Name	# of Samples	# of Detects	Concentration		Units	Detection Limit[1]	Sample Quantitation Limit[1]	MCL (2005)[2]	MCL (2012)
			Minimum	Maximum					
1,1,2-Trichloroethane	28	0			µg/L	0.39	5	5	5
1,2-Dichloroethane (DCE)	28	0			µg/L	0.53	5	5	5
Aroclor-1260	28	0			µg/L	0.808	1.09		
Arsenic	32	0			µg/L	7	70	50	10
Benzene	28	0			µg/L	0.28	5	5	5
Benzo(a)anthracene	28	0			µg/L	1.83	10.6		
Benzo(a)pyrene	28	0			µg/L	2.74	10.6	0.2	0.2
Benzo(b)fluoranthene	28	0			µg/L	1.95	10.6		
Benzo(k)fluoranthene	28	0			µg/L	2.28	10.6		
Chromium	30	10	1.1	27.4	µg/L	3	11	100	100
Chrysene	28	0			µg/L	1.9	10.6		
Dichloromethane (methylene chloride)	28	6	0.49	4.75	µg/L	4	10	5	5
Endrin	28	0			µg/L	0.0161	0.109		2
Manganese	29	26	3	905	µg/L	8.6	15	50[3]	50[3]
Octachlorodibenzo-p-dioxin	26	0			ng/L	4.8	10.1		
Radium, total	21	14	0.649	4.3	pCi/L	1.43	3.79	5	5
Tritium	30	23	0.32	7.69	pCi/mL	0.926	2.132	20	20

1 - Maximum detection limit and sample quantitation limit reported to bound the non-detect values.
2 - The MCL (2005) column values are those reported in WSRC-RP-2005-4084, Rev. 1
3- Manganese has a secondary MCL promulgated to protect the aesthetics of public water supplies and not based on toxicity.

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

I. SITE INFORMATION			
Site Name:	**D-Area Burning/Rubble Pits (431-D and 431-1D) (DBRP) Operable Unit**	**Date of Inspection:**	**07/24/2012**
Location and Region	**SRS, USEPA Region 4**	**USEPA ID:**	**CERCLIS #31**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 95°F**

Remedy Includes: *(Click all that apply)*

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

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

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

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

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

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

_____

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

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

2. Health and Safety Plans (HASPs):

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

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

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

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

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: _____

B. Signs

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

Remarks: Signs were in good condition. _____

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

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

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

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

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

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/27/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

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

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:_____
B. Other Site Conditions
Remarks:_____

VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*

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

Remarks:_____

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

Areal extent_____ Depth_____

Remarks:_____

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

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

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

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

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

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

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

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

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

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

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

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

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

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

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

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

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

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

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

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

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

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

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

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

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is institutional controls with a period of groundwater monitoring (terminated in 2004). A summary report, including the data and interpretation was submitted to SCDHEC, DOE, and USEPA following each monitoring event. During five consecutive monitoring and reporting cycles over five years, none of the constituents of concern exceeded the MCL; therefore, in 2004, SCDHEC, DOE, and USEPA concurred with terminating the groundwater monitoring at DBRP.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Institutional controls require annual site inspections and maintenance (repair of erosion damage, cover maintenance, and warning signs). Site inspections indicated no issues therefore the long-term protectiveness of the remedy is intact. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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D-AREA EXPANDED OPERABLE UNIT (U)

I. Introduction

This report is the second five-year review for the D-Area Expanded Operable Unit (DEXOU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the DEXOU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the DEXOU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table M-1 lists the chronology of site events for the DEXOU.

III. Background

The DEXOU is a Resource Conservation Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS).

The scope of the DEXOU remedial action includes two surface units: D-Area Rubble Pit (431-2D) (DRP) and 488-D Ash Basin (488-DAB). The 488-DAB is divided into several subunits: 488-DAB Interior, the 488-D Pooled Basin, the 488-DAB (Exterior), the 488-D Drainage, and the Dead and Stressed Vegetation Area (DSVA). The contaminated media associated with the DEXOU are soils at DRP; and soils, sediment, and surface water at 488-DAB. The layout of the DEXOU within D-Area is shown on Figure M-1. The D-Area groundwater is addressed as a separate OU.

Physical Characteristics

The DEXOU covers approximately 15.3 hectares (37.7 acres) within D Area at SRS in Barnwell County, South Carolina (Figure M-2). D Area is situated on a broad and generally flat erosional terrace of low relief adjacent to the floodplain of the Savannah River. The water table is about 7.5 m (25 ft) below groundwater surface (bgs) throughout D Area. DEXOU lies approximately 900 m (3,000 ft) east of the nearest SRS boundary, the Savannah River.

D-Area Rubble Pit (431-2D)

The DRP is located approximately 300 m (1,000 ft) northwest of the 488-DAB and covers about 4.3 hectares (10.5 acres) (WSRC 1998). The topography is relatively flat with an elevation range of approximately 37.5 to 39.3 m (125 to 131 ft) above mean sea level (msl). The area is heavily vegetated and bounded by a natural drainage (DRP Stream Boundary) both to the east and south of the unit. The DRP Stream Boundary is fed by the D-006 Outfall, which receives stormwater runoff from the northwestern portion of D Area, including storage facilities, parking lots, the northwest side of the D-Area Powerhouse (484-D), and other active and inactive facilities. Surface water runoff from the DRP occurs only during heavy rainfall events. The DRP Stream Boundary flows west into the flood plain of the Savannah River.

488-D Ash Basin

The 488-DAB is an unlined, earthen containment basin located approximately 270 m (900 ft) south of the D-Area Powerhouse (484-D). The 488-DAB is situated adjacent to the floodplain of the Savannah River on a terrace deposit with low relief. The 488-DAB interior subunit is approximately 540 m (1,800 ft) long, 180 m (600 ft) wide and covers 9.3 hectares (22.8 acres) (WSRC 1998). The 488-DAB exterior subunit covers an area of approximately 1.79 hectares (4.4 acres) (WSRC 1998). The basin was constructed above grade and the berms that form the walls of the basin are 5.4 m (18 ft) high. The berms are constructed of man-made fill consisting primarily of sand, silt, and clay. Elevations across the basin range from approximately 36 m (120 ft) msl in the western end to 39 m (130 ft) msl in the eastern end while the bottom is near original grade, approximately 33

to 34.5 m (110 to 115 ft) msl, which is about 6 m (20 ft) above the elevation of the Savannah River (27.6 m [92 ft] msl).

The bottom of the 488-DAB sits atop a dense, locally continuous, low permeability clay layer, which runs beneath both the 488-DAB and the DSVA. The vertical hydraulic conductivity of the clay layer averages about $1.0x10^{-7}$ cm/s, which has restricted vertical percolation across the clay layer. As a result, the perched water above the clay layer is elevated with respect to the "regional" water table. The regional water table potentiometric surface is within the clay layer under the basins; consequently, there is little to no unsaturated zone under the water that is mounded above the clay layer.

Land and Resource Use

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

History of Contamination

D-Area Rubble Pit (431-2D)

The DRP received waste from 1951 through 1989. About 1.8 hectares (4.4 acres) on the eastern side of the DRP received waste consisting of soil mixed with asphalt, coal, paper, metal, plastic, glass fragments, foam insulation, fiberboard, asbestos, roofing materials, wire, road gravel, and other miscellaneous debris. The estimated volume, assuming an average thickness of 1.8 m (6 ft), is about 38, 250 m^3 (50,000 yd^3). The remaining 2.5 hectares (6.1 acres) to the west were covered with ash and coal rejects. Figure M-3 provides a photograph of the DRP prior to remediation activities.

488-D Ash Basin

The 488-DAB was constructed in the early 1950s and used to intercept, stabilize, and provide passive treatment of ash-sluice water before it was discharged to local surface streams. In 1978, ash-sluice water was diverted to the newly constructed 488-1D and

488-2D ash basins. From 1978 until the mid-1990s, the 488-D received dry ash and coal rejects. In addition to the basin, some areas outside the basin were contaminated by the processes related to the 488-DAB. These areas cover 1.8 hectares (4.4 acres) and include the DSVA, 488-D perimeter soils, and drainage ditch areas. Figure M-3 provides photographs of the 488-DAB and its subunits prior to remediation activities.

Initial Response

A RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan for the 488-DAB and the D-Area Coal Pile Runoff Basin (DCPRB) was issued in 1998 to characterize the waste units (WSRC 1998). Due to the continued operation of the D-Area Powerhouse (484-D), several units that were once part of the DEXOU were removed from the scope. The DCPRB and D-Area Waste Oil Facility associated with the planned continued use of the D-Area Powerhouse (484-D) facilities were removed from the original scope in 2001 (WSRC 2001). In addition, the Borrow Pit was also removed from the DEXOU scope, as it will be used as part of the closure of other ash basins operated by South Carolina Electric and Gas Company. Two additional units were removed from the DEXOU and placed into other regulatory programs: the D-Area Gas State Area was placed in the Underground Storage Tank Program, and the D-Area Cinders Disposal Pit was listed as a Site Evaluation Area (WSRC 2004a).

An RFI/RI/Baseline Risk Assessment (BRA) was performed to assess the risks posed by the DEXOU to human health and the environment (WSRC 2003). The assessment included quantitative calculations of human health risks, ecological risks, and the threat posed by future leaching to groundwater.

Basis for Taking Action

The following lists the principal sources of contamination for the DEXOU:

- Elevated metals and polychlorinated biphenyls (PCBs) in DRP soil;
- Coal-related metals and radionuclides associated with coal rejects and ash in and near the 488-DAB; coal rejects containing arsenic and beryllium were identified as principal threat source material (PTSM) based on contaminant mobility;

- Low pH pooled surface water in the 488-D Pooled Basin; and
- Low pH surface water and sediments at the DSVA to the north of the 488-DAB.

The highest metals and PCBs (i.e., Aroclor 1254) contaminant concentrations at the DRP were found in the upper 2.1 m (7 ft) of the pile where debris was present. Approximately 57 m^3 (74 yd^3) of surface soil contained elevated levels of PCBs and 60 m^3 (78 yd^3) of surface soil contained elevated levels of zinc (WSRC 2008). Table M-2 identifies the refined constituents of concern (RCOCs) for DRP soils.

The 488-DAB Interior, consisting mainly of ash and a mixture of ash and coal rejects in the top 1.2 m (4 ft), had elevated levels of arsenic and some coal-related radionuclides. Table M-3 summarizes the RCOCs for soils at 488-DAB. Arsenic, selenium, and vanadium were identified as ecological concerns in the surface and subsurface soils. Low pH surface water at the west end of the basin contained metals that posed an unacceptable risk to the ecological receptors and contributed to groundwater contamination.

IV. Remedial Actions

Remedy Selection

Tables M-4, M-5, and M-6 present the remedial goals (RGs) for the DRP soils, 488-DAB (interior) and 488-DBA (exterior) soils, and the 488-D Pooled Basin/488-D Drainage/Dead and Stressed Vegetation Area Surface Water and Sediment, respectively. As stated in the Record of Decision (ROD) (WSRC 2004a), the remedial action objectives (RAOs) for DEXOU are as follows:

D-Area Rubble Pit (431-2D)

- Prevent exposure of industrial workers to surface soils containing unacceptable levels of arsenic and PCBs (i.e., Aroclor 1254);
- Prevent exposure of ecological receptors to elevated levels of metals and PCBs (i.e., Aroclor 1254) in soils; and
- Prevent generation of low pH leachate and beryllium from leaching to groundwater above MCL.

488-D Ash Basin

- Prevent or minimize contaminants leaching to groundwater above maximum contaminant levels (MCLs)/ remedial goals (RGs);
- Prevent exposure of industrial workers to waste materials, surface soils, and sediments containing unacceptable levels of arsenic and coal-related radionuclides;
- Prevent exposure of ecological receptors to arsenic, selenium, and vanadium present in the basin;
- Prevent or minimize the acidic runoff that results in pooled water at the west end of the basin;
- Prevent exposure of ecological receptors to metals in surface water in the 488-D Pooled basin, the 488-D Drainage, and the DSVA above ambient water quality criteria;
- Protect ecological receptors from elevated arsenic in sediment in the 488-D Drainage ditch; and
- Prevent exposure of ecological receptors to unacceptable risk due to low pH (due to the presence of coal fines) in the sediment in the DSVA.

As stated in the ROD (WSRC 2004a), the selected remedies for the DEXOU are as follows:

- A removal remedy was selected for DRP to address the low-level threat source material with elevated metals and Aroclor 1254, which consisted of the following activities:
  - Excavating waste materials and soils containing coal rejects to visual extent and verification laterally by arsenic and zinc RGs;
  - Excavating a PCB hot spot followed by verifying that soil concentrations were below the PCB RG;
  - Consolidating excavated soils and waste material from DRP to the 488-DAB;

  - Backfilling with clean fill, grading and vegetating excavated area to minimize erosion;
  - Implementing institutional controls; and
  - Groundwater monitoring to evaluate long-term effectiveness of the remedy in preventing exposure to potential future residents to elevated levels of arsenic.

- A containment remedy was selected for 488-DAB to address the PTSM in the ash and coal within the basin, which consisted of the following activities:
  - Consolidating the coal rejects and impacted soils and sediment from the 488-DAB exterior subunit within the 488-DAB basin interior;
  - Installing a low permeability geosynthetic cover system at 488-DAB interior subunit;
  - Placing 0.3 m (1 ft) of clean fill over excavated areas with the 488-DAB exterior subunit;
  - Implementing institutional controls; and
  - Groundwater monitoring to evaluate long-term effectiveness of the remedy.
- Institutional controls and monitoring will be performed per the SRS Land Use Control Assurance Plan (LUCAP) (WSRC 1999) and site-specific Land Use Control Implementation Plan (LUCIP).

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

- Prevent contact, removal or excavation of waste left in place [debris, coal, and coal rejects]; and
- Preclude residential use of the property.

Remedy Implementation

The following actions were conducted for the DRP and 488-DAB source units as final actions (WSRC 2008). Figures M-4 and M-5 present current photographs of the DEXOU.

- The remedial activities for the DRP included:
  - Removing approximately 56.6 m^3 (2,000 ft^3) of PCB-contaminated soil at a concentration greater than 1 mg/kg by excavating, packing and shipping to an approved off-SRS disposal facility. The area was sampled for confirmation that PCBs were removed to meet the RG.
  - Consolidated approximately 45,900 m^3 (60,000 yd^3) of soil and coal reject materials containing unacceptable levels of arsenic to visual extent of coal within the DRP and along the adjacent road by excavating and transporting to 488-DAB.
  - Backfilled the DRP to a minimum of 0.09 m (0.3 ft), graded and vegetated to minimize erosion.
- The remedial activities for the 488-DAB included:
  - Consolidating approximately 38,250 m^3 (50,000 yd^3) of material containing coal rejects at the 488-DAB Exterior Subunit by excavating to a minimum depth of 0.3 m (1 ft) and transporting to 488-DAB. Backfilling, regrading, and seeding all excavated areas. The portion of the DSVA delineated as a wetland (approximately 0.4 hectares [1 acre]) was replaced either through the site wetland bank or reconstruction of a wetland at another location. After excavating and removing waste from 488-D exterior, a permanent berm was installed for the new sedimentation basin, and the overflow detention basin was constructed to the north of the sedimentation basin with a 90-cm (36-inch) corrugated drainage pipe leading to the detention basin to drain the stormwater collected in the sedimentation basin from the engineered cover system.
  - Consolidating approximately 84.2 m^3 (110 yd^3) of soil from the bottom and sides of the drainage ditch at the west end of the 488-DAB by excavating to a depth of

approximately one foot and transporting to 488-DAB. Removed the section of the overflow drain pipe, which ran between the 488-DAB and the drainage ditch. The remaining section of the pipe, which was within the basin, was sealed with low strength concrete. Backfilled, regraded, and seeded all excavated areas.

- Managing pooled water on the west side of the basin through evaporation or discharge to the land surface based on pH level. Installed erosion/sediment control measures and temporary berms during construction to minimize soil erosion and direct water away from the pooled water area.
- Installing a 10-hectare (25-acre) engineered cover system over the entire 488-DAB and consolidated areas. The cover system includes an erosion layer, a protection layer, a drainage layer, and an infiltration layer (geosynthetics). The cover system has a maximum hydraulic conductivity of 4.8×10^{-9} cm/s (WSRC 2008), an expected minimum life of 100 years, and was designed for a 25-year, 24-hour storm event.
- Establishing a groundwater monitoring network per the requirements of the *Monitoring Work Plan for the D-Area Groundwater Operable Unit* (WSRC 2004c) and abandoning 17 monitoring wells that were no longer needed in the well monitoring network.

- Establishing land use controls (LUCs) for 17.6 hectares (43.27 acres) for the DEXOU to include the following:
  - Warning signs will be posted to alert on-site workers to the presence of hazardous substances and to prevent unauthorized entry and unrestricted uses;
  - Institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements;
  - SRS access controls to prevent exposure to trespassers, as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which

describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary; and

- In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner in compliance with Section 120(h) of CERCLA that includes notification disclosing former waste management and disposal activities, results from groundwater monitoring, and remedial actions taken on the site. The deed would also include deed restrictions precluding residential use of the property.

Contamination present in groundwater and the wetland will be addressed as part of the D-Area Groundwater and D-Area Wetland OU investigations. The RCRA permit was revised on November 4, 2004 to reflect selection of the final remedy in accordance with the procedures under 40 CFR Part 270 and South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.264.101, 270 (SCDHEC 2003).

Systems Operations/Operation and Maintenance

There are no system operational requirements. Groundwater monitoring is being performed to collect groundwater data for evaluating the long-term effectiveness of the remedial action.

The following maintenance activities have been implemented:

- Site inspections will be performed annually to ensure access control barriers (e.g., warning signs) are in place and that the 488-DAB is developing a self-sustaining vegetative cover and/or has not been subject to erosion, subsidence, or intrusion of burrowing animals. Inspections to ensure DRP is developing self-sustaining vegetation; and
- Necessary repairs for erosion control damage will be performed for the geosynthetic cover system, including vegetation, the drainage system and cover slopes. Maintenance (including site inspections, mowing, general housekeeping) and upkeep of access control signs.

•

The estimated operation and maintenance (O&M) costs associated with the selected remedy include O&M costs of the cover, groundwater monitoring, and institutional controls and have a present worth cost of $399,946 discounted at 3.9% per year for 500 years (WSRC 2004b). The actual O&M cost since the remedial action was completed in FY07 until FY11 is $49,700. The actual O&M costs (Table M-7) are as expected.

V. Progress since Last Review

The previous protectiveness statement concluded that the remedial actions at DEXOU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The final remedial actions were not evaluated in the previous five-year review because the remedial action had just been completed. The final remedial actions of excavation, removal, and the backfilling of excavated areas along with institutional controls and contaminated soil consolidation under a low permeability geosynthetic cover system have now been installed and have been functioning properly.

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

VI. Five-Year Review Process

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

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Reviewed the groundwater monitoring data presented in the D-Area Groundwater OU annual reports (WSRC 2005, WSRC 2007, SRNS 2009, and SRNS 2011) to evaluate long-term effectiveness of the remedy;
- Confirmed implementation of the remedial action;

- Inspected the OU, 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 the functionality of the access controls; and

- Reviewed changes in standards and to-be-considered guidance.

Data Review

- Review of the annual field inspections for the DRP and the 488-DAB indicate the cover system and LUCs have been effective in maintaining the integrity of the cover systems. Field inspections of the engineered geosynthetic cover system are being performed and indicate the integrity of the cover system is intact and no problems have occurred. The most prevalent findings have been sediment buildup that blocks drainage grates and impedes runoff and vegetation along the access road and surrounding the basin and pit that needs cutting and clearing. Each finding was corrected in a timely manner (i.e., days to several months).

- 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 and at concentrations well below the RG of 1 mg/kg (0.081 and 0.045 mg/kg).

- Review of the groundwater reports indicates a widespread area of low pH, as well as, sulfate and beryllium plumes above RGs within the D-Area Groundwater OU (Figure M-6). The low pH and sulfate is mostly due to the degradation of pyrite associated with the coal storage yard and the D Area Coal Pile Runoff Basin, which is up-gradient of the capped DEXOU. It is not possible to completely rule out that past releases from the DRP and DEXOU, and the current capped DEXOU sediments as contributing to the plumes. However, the consolidation of pyrite bearing coal rejects into the 488-DAB (from DRP and elsewhere), and placement of the low permeability cap system over the 488-DAB is thought to be effective in minimizing contaminants leaching from the source (basin) to groundwater. While rainwater can infiltrate the area identified as the DRP and the 488-DAB exterior, the removal action reduced the leachable contaminant mass resulting in a decreased loading to the groundwater. The

principal source of low pH (and associated metal impacts) to the groundwater (under, up-gradient and down-gradient) of the 488-DAB has been historically recognized as the D Area Coal Pile Runoff Basin which manages the coal storage yard runoff.

- Review of the plume maps for 2004, 2006, 2008 and 2010 indicates the beryllium, sulfate and depressed pH plumes are relatively stable (WSRC 2005, WSRC 2007, SRNS 2009, and SRNS 2011) (Figures M-6 and M-7). This situation is consistent with the historical and continued releases from the D Area Coal Pile Runoff Basin. During this review cycle, adjacent ash basins (located to the right of the 488-DAB [Figure M-4]) were active. These open ash basins are not thought to contribute to groundwater contamination because the water is not low in pH, the ash is not significantly leachable, and the active basins appear to only contribute a large volume of recharge to the groundwater. The remedial activities associated by the DEXOU (removals and capping of 488D) appear to be performing according to design.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the DEXOU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The DEXOU was inspected by SRNS and USDOE personnel on July 24, 2012 and September 27, 2012. No issues were identified for the DEXOU during this inspection and interviews.

On January 22, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

The removal actions for the DRP and 488-DAB exterior subunit, as well as the cover system 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.

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

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

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

The next five-year review is scheduled for no later than January 2019.

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, 2003. *South Carolina Hazardous and Mixed Waste Permit, Permit Number SC1 890 008 989, 2003 RCRA Permit Renewal for the Savannah River Site, issued September 30, 2003, Module VIII – Corrective Action for Solid Waste Management Units & Areas of Concern, Appendix VIII-A, Solid Waste Management Unit Remedy Selection*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC.

SRNS, 2009. *2008 Annual Groundwater Monitoring Report for the D-Area Groundwater Operable Unit (U)*, SRNS-RP-2009-00596, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *2010 Annual Groundwater Monitoring Report for the D-Area Groundwater Operable Unit (U)*, SRNS-RP-2011-01154, 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, 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, March 2013, 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. *Corrective Measures Study/Feasibility Study Report for the D-Area Expanded Operable Unit (U)*, WSRC-RP-2003-4143, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004c. *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. *2005 Annual Groundwater Monitoring Report for the D-Area Groundwater Operable Unit (U)*, WSRC-RP-2005-4059, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

WSRC, 2007. *2006 Annual Groundwater Monitoring Report for the D-Area Groundwater Operable Unit (U)*, WSRC-RP-2007-4025, Washington 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 2007 through 2011 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, D-Area Ash Basin (488-D) (U)*, ER-IDS-019-041, Inspection period 2007 through 2011 (annually)

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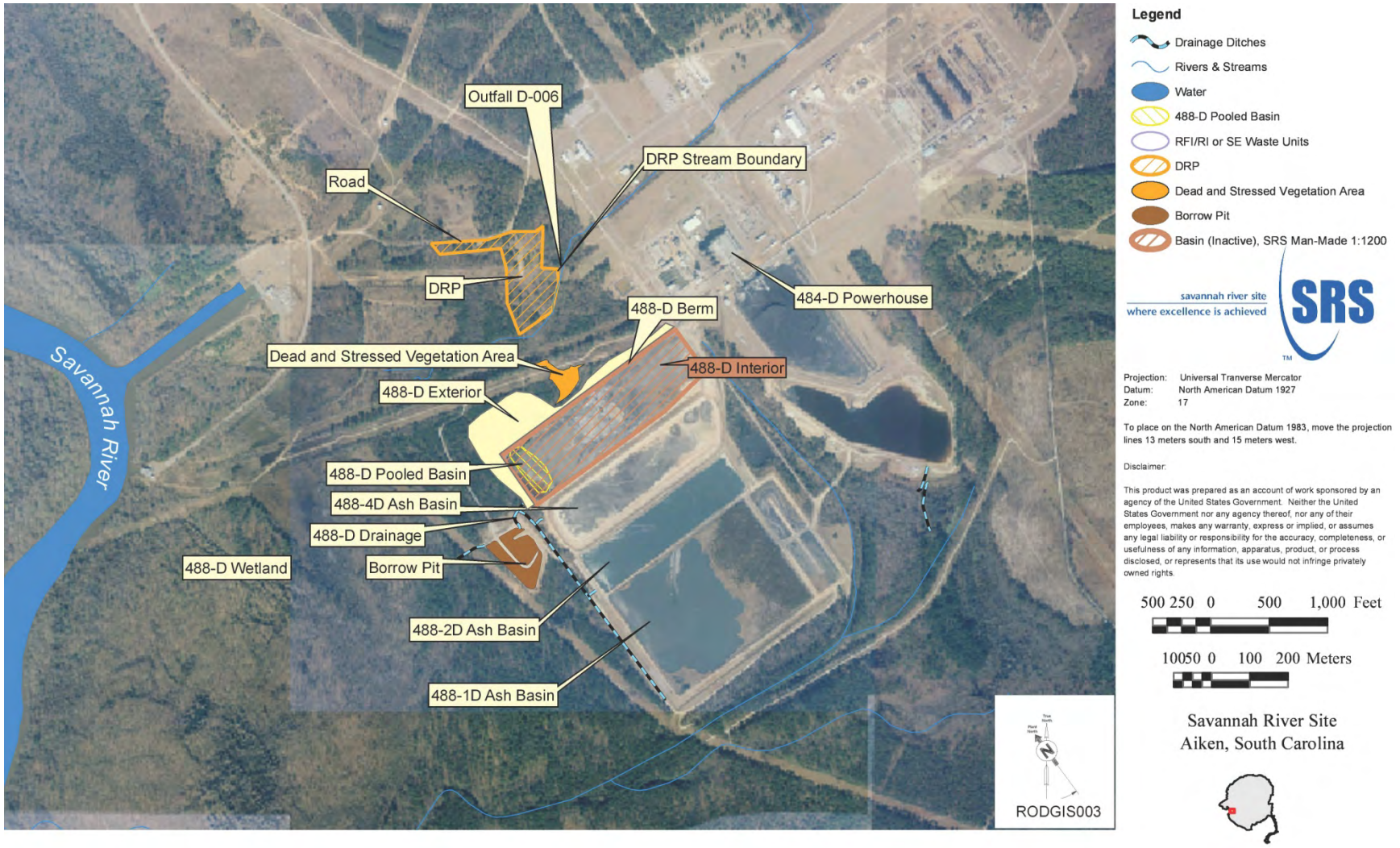


Figure M-1. Layout of D Area and the DEXOU

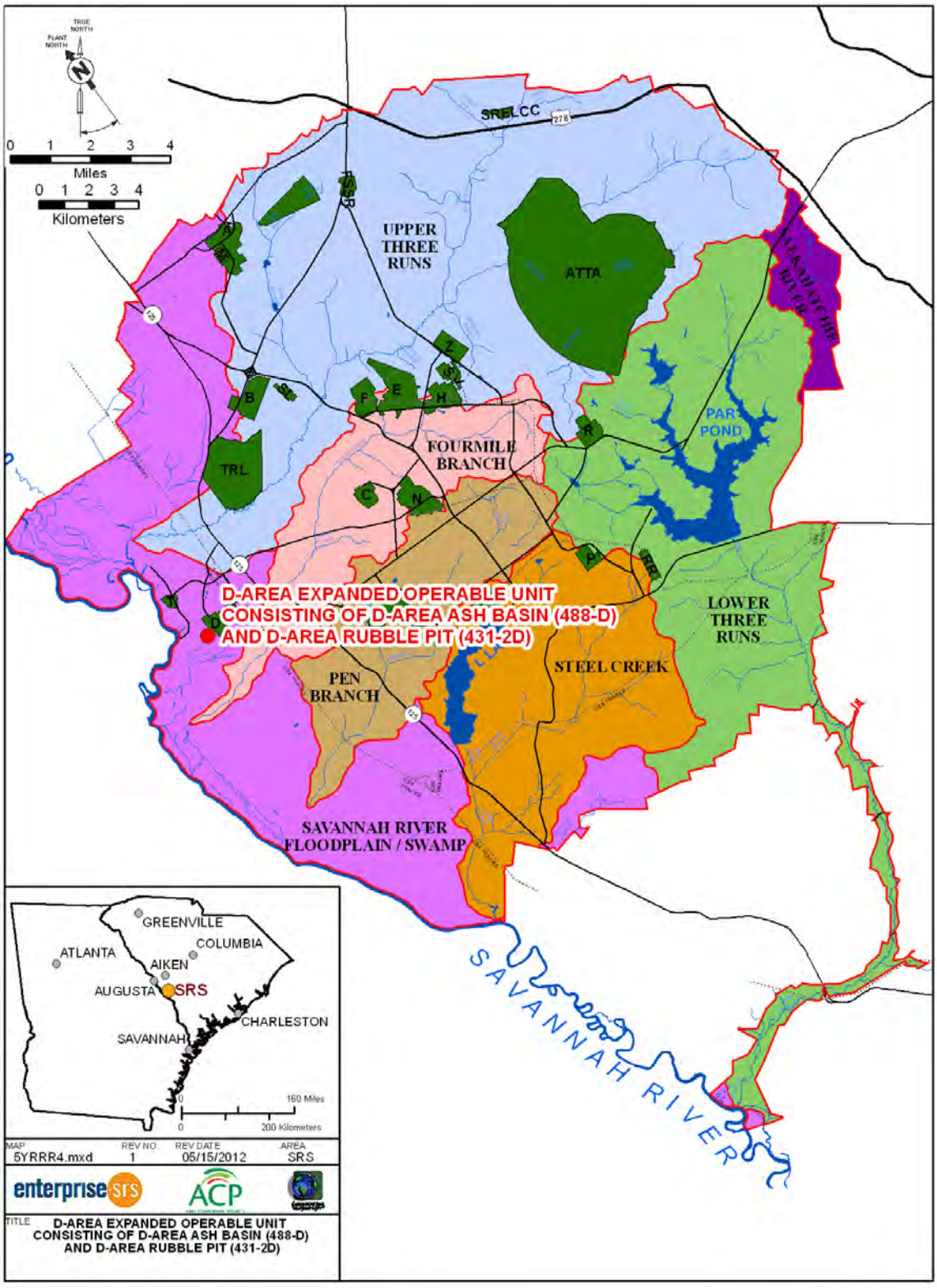


Figure M-2. Location of the DEXOU within the Savannah River Site



DRP



Interior of 488-DAB



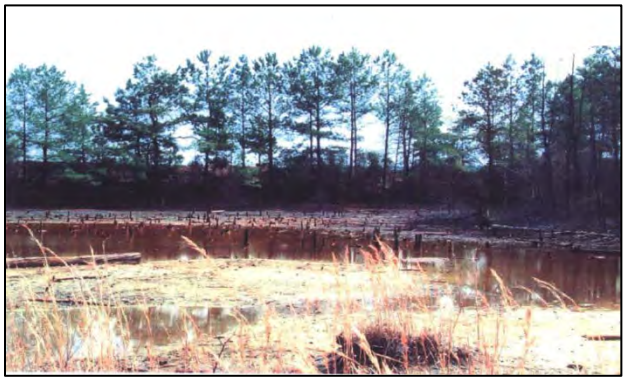
Exterior of 488-DAB (north side)



488-D Pooled Basin and Standpipe



488-DAB Drainage



DSVA (488-DAB berm in background)

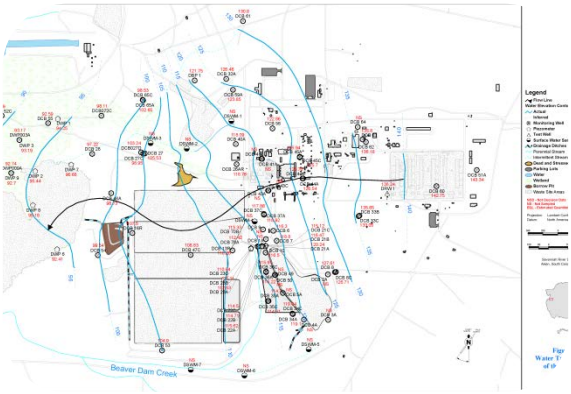
Figure M-3. Before Photo of the DEXOU



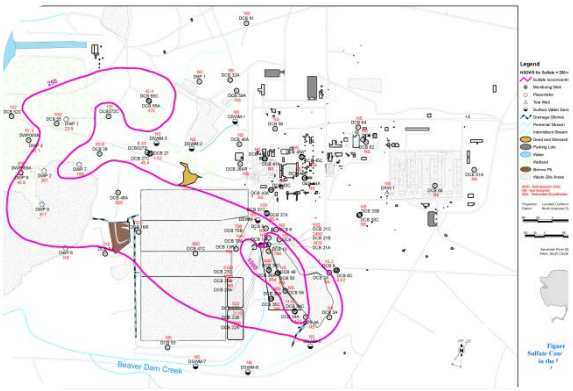
Figure M-4. **Current Photo of the D-Area Rubble Pit (431-2D)(within upper box) and the 488-D Ash Basin (within box in center of photo) (2010)**



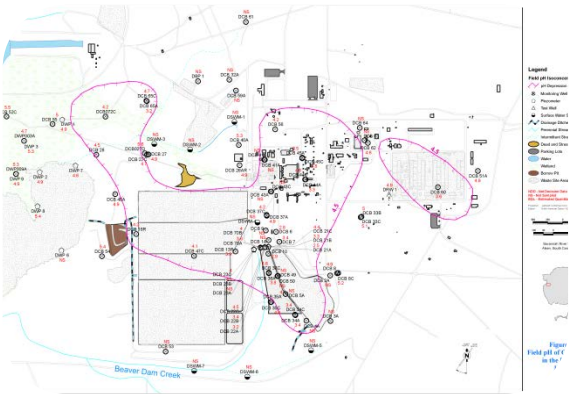
Figure M-5. Current Photographs of the DEXOU Subunits



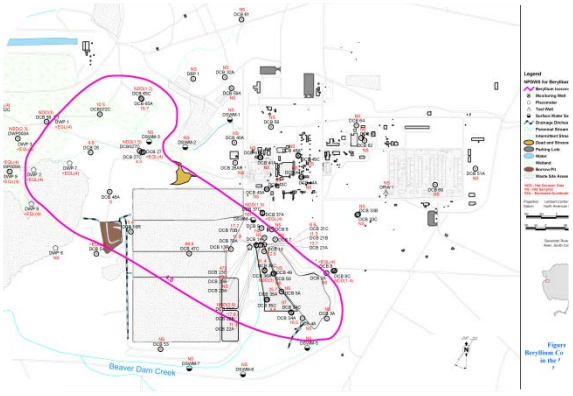
Groundwater Flow Direction



Sulfate Plume



Depressed pH Plume

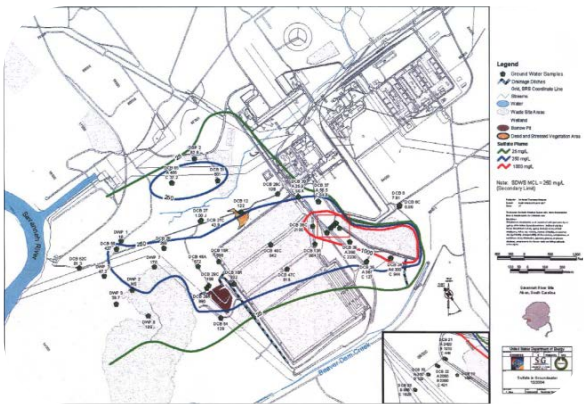


Beryllium Plume

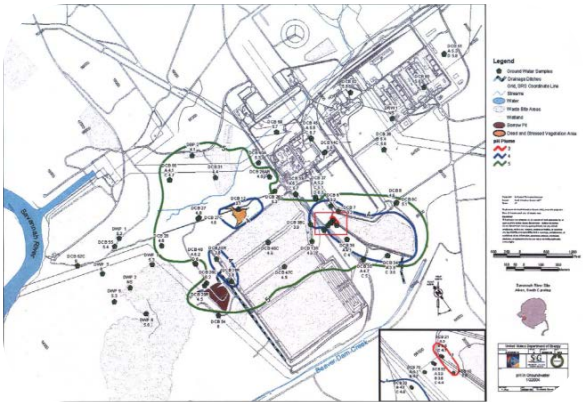
Figure M-6. 2010 Plume Maps and Groundwater Flow Direction for the D-Area Groundwater Operable Unit (SRNS 2011)



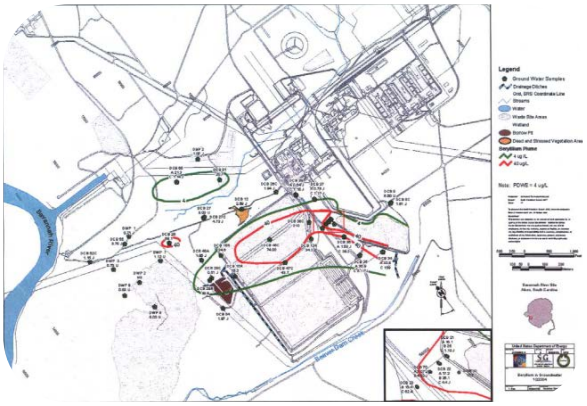
Groundwater Flow Direction



Sulfate Plume



Depressed pH Plume



Beryllium Plume

Figure M-7. 2004 Plume Maps and Groundwater Flow Direction for the D-Area Groundwater Operable Unit (WSRC 2005)

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Table M-1. Chronology of OU Events

Event	Date
RFI/RI Field Start/Complete [D-Area Ash Basin (DAB)/ D-Area Coal Pile Runoff Basin (DCPRB)]	September 29, 1998/ March 2, 1999
RFI/RI Field Start / Complete [DEXOU]	February 23, 2001 / December 18, 2003
DEXOU Record of Decision (ROD) Issuance	December 17, 2004
DEXOU Remedial Action Start / Complete	August 5, 2005 / July 10, 2007
Previous Five-Year Review	February 4, 2009

Table M-2. Constituents of Concern for the D-Area Rubble Pit (431-2D)

Refined COC	Refined COC Type
Antimony	ECO
Arsenic	HH, ECO
Beryllium	CM
Selenium	ECO
Zinc	ECO
Benzo[a]pyrene	HH-res
Aroclor-1254	ARAR, HH-res, ECO
Aroclor-1260	ARAR, ECO

RCOC Designation:

- PTSM = Principal Threat Source Material
- ARAR = Applicable or Relevant and Appropriate Requirement
- CM = Contaminant Migration RCOC
- HH = Human Health RCOC
- HH-res = Human Health RCOC for the future resident only
- ECO = Ecological RCOC

Table M-3. Constituents of Concern for 488-DAB

Refined COC	488-DAB Refined COC Type (Interior)	488-DAB Refined COC Type (Exterior)
Soil		
Arsenic	PTSM, CM, HH, ECO	HH
Barium	CM	
Beryllium	PTSM, CM	
Iron	CM, HH-res	
Mercury	CM	
Selenium	CM, ECO	
Thallium	CM, HH-res	
Vanadium	ECO	
Actinium-228	HH	
Lead-212	HH	
Potassium-40	HH	
Radium-226	CM, HH	
Radium-228	CM, HH	
Thorium-228	HH	
Thorium-234	HH-res	
Uranium-234	CM	
Uranium-235	CM, HH-res	
Uranium-238	CM, HH	

Refined COC	Refined COC Type 488-D Pooled Basin	488-D Drainage	DSVA
Surface Water			
Aluminum	ARAR, ECO	ARAR, ECO	ARAR, ECO
Arsenic	ARAR, HH-res	ARAR, HH-res	
Beryllium	ARAR, ECO	ARAR, ECO	ECO
Cobalt		ECO	
Copper	ARAR, ECO	ARAR	
Iron	ARAR, ECO	ARAR, ECO	
Thallium	ARAR	ARAR	
pH	ECO	ECO	ECO
Sediment			
Arsenic		HH-res, ECO	HH-res
Actinium-228		HH-res	
Potassium-40		HH-res	HH-res
Radium-226		HH-res	
Radium-228			HH-res
pH			ECO

Table M-4. Remedial Goals for Soils at DRP (WSRC 2004a)

Refined COC	Refined COC Type	RG	Units
Antimony Beryllium Selenium Benzo[a]pyrene	ECO CM ECO HH-res	Visual Extent[1]	NA
Arsenic	HH, ECO	3.3[2]	mg/kg
Zinc	ECO	59.6[3]	mg/kg
Aroclor-1254	ARAR, HH_res, ECO	1.0[4]	mg/kg
Aroclor-1260	ARAR, ECO	1.0[4]	mg/kg

1 - "Visual Extent" as determined by the presence of coal rejects or waste material and verified in the 0-1 foot interval by the arsenic and zinc RGs.
2 - RG based on human health – future industrial worker risk (1.0E-06)
3 - RG based on ecological risk (LOAEL-based HQ=1)
4 - RG based on total PCBs, rather than individual Aroclors. RG based on the high occupancy use ARAR established under TSCA.
HH – Human Health; HH-res – Human Health residential only
ECO Ecological
CM – Contaminant Migration
ARAR – Applicable or Relevant and Appropriate Requirements
NA – not applicable

Table M-5. Remedial Goals for Soils at 488-DAB (Interior) and 488-DAB (Exterior) (WSRC 2004a)

Refined COC	488-DAB (Interior) Refined COC Type	488-DAB (Exterior) Refined COC Type	RG	Units
Arsenic	PTSM, CM, HH, ECO	HH	3.30[1]	mg/kg
Barium	CM		41.8[2]	mg/kg
Beryllium	PTSM, CM		0.332[2]	mg/kg
Iron	CM, HH-res		8,340[2]	mg/kg
Mercury	CM		0.54[2]	mg/kg
Selenium	CM,ECO		0.70[3]	mg/kg
Thallium	CM, HH-res		0.159[2]	mg/kg
Vanadium	ECO		18.8[2]	mg/kg
Actinium-228 Lead-212 Potasisium-40 Radium-226 Radium-228 Thorium-228 Thorium-234 Uranium-234 Uranium-235 Uranium-238	HH HH HH CM, HH CM, HH HH HH-res CM CM, HH-res CM, HH		Visual Extent	NA

RG based on human health- future industrial worker risk (1.0E-06)
RG based on two times unit-specific background average
RG based on ecological risk (LOAEL – based HQ=1)
Coal-related radionuclides will be addressed through removal of coal rejects (Visual Extent) and verified in the 0-1 foot interval by the arsenic RG.
HH – Human Health; HH-res – Human Health resident only
ECO – Ecological
CM – Contaminant Migration
PTSM – Principal Threat Source Material
NA – not applicable

Table M-6 Remedial Goals for Surface Water and Sediment at 488-D Pooled Basin, 488-D Drainage, and Dead and Stressed Vegetation Area (WSRC 2004a)

Refined COC	Refined COC Type			RG	Units
	488-D Pooled Basin	488-D Drainage	Dead and Stress Vegetation Area (DSVA)		
Surface Water					
Aluminum	ARAR, ECO	ARAR, ECO	ARAR, ECO	0.0872[1]	mg/L
Arsenic	ARAR, HH-res	ARAR, HH-res		0.15[1]	mg/L
Beryllium	ARAR, ECO	ARAR, ECO	ECO	0.00053[1]	mg/L
Cobalt		ECO			
Copper	ARAR, ECO	ARAR		0.0169[1]	mg/L
Iron	ARAR, ECO	ARAR, ECO		0.980[1]	mg/L
Thallium	ARAR	ARAR		0.002[2]	mg/L
pH	ECO	ECO	ECO	5.8[3]	Units
Sediment					
Arsenic		HH-res, ECO	HH-res	3.30[4]	mg/kg
Actinium-228 Potassium-40 Radium-226 Radium-228		HH-res HH-res HH-res	 HH-res HH-res	Visual Extent[5]	NA
pH			ECO	NA[6]	Units

1 - RG based on Ambient Water Quality Criteria
2 - RG based on MCL
3 - RG based on the unit-specific average
4 - RG based on the HH-future industrial worker soil (1.3E-06), as the end-state of the DWVA will be soil, not sediment
5 - Coal-related radionuclides will be addressed through removal of coal rejects (Visual Extent) and verified in the 0-1 foot interval by the arsenic RG
6 - The DSVA will not be restored as a wetland; therefore, the pH RG is not applicable (NA).
HH-res - Human Health residential only
ECO – Ecological
ARAR – Applicable or Relevant and Appropriate Requirements
NA – not applicable

Table M-7. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	10,600	12,300	8,000	10,200	8,800	49,700
Total ROD Estimated Direct O&M Costs	23,000	9,000	9,000	9,000	9,000	59,000

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D])

I. SITE INFORMATION			
Site Name:	**D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D])**	**Date of Inspection:**	**07/24/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #63**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**sunny 95°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Groundwater Monitoring, Excavation and Consolidation of Contaminated Soil

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

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

Remarks: See Waste Unit Inspection and Maintenance, ER-SOP-019, ER-IDS-019-038 (DRP) and ER-IDS-019-41 (488-D).

_____

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

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

2. Health and Safety Plans (HASPs):

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

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

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

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

4. Permits and Service Agreements:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

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

Remarks:

9. Discharge Compliance Records:

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

Remarks:

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

Remarks:

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: _____

B. Signs

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

Remarks: Signs are in good condition

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(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.) Walk-through

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/27/12 (Date) | 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☐ Roads adequate ☐ N/A Remarks: The roads for this OU are in good condition.
B. Other Site Conditions
Remarks: Vegetation is mowed routinely.

VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent _____ Depth _____ Remarks:
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent _____ Depth _____ Remarks:
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent _____ Depth _____ Remarks:
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☒ No signs of stress Areal extent _____ Depth _____ Remarks:

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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

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

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

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

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

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

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

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☒ Applicable ☐ N/A
1. Outlet Pipes Inspected: ☒ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☒ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☒ Applicable ☐ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☒ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☒ Erosion not evident Remarks:_____
3. Outlet Works: ☒ Functioning ☐ N/A Remarks:_____
4. Dam: ☒ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

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

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

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

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks: In good condition

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*
C. Treatment System ☐ Applicable ☐ N/A
1. Treatment Train (Check components that apply)**:** ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters_____ ☐ Additive (e.g., chelation agent, flocculent)_____ ☐ Others_____ ☐ Good Condition ☐ Needs maintenance ☐ Sampling ports properly marked and function ☐ Sampling/maintenance log displayed and up-to-date ☐ Equipment properly identified ☐ Sampling ports properly marked and function ☐ Quantity of groundwater treatment annually_____ ☐ Quantity of surface water treatment annually_____ Remarks:_____
2. Electrical Enclosures and Panels *(properly rated and function)***:** ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Tanks, Vaults, Storage Vessels: ☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance Remarks:_____
4. Discharge Structure Appurtenances: ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
5. Treatment Building(s): ☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks:_____

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*
6. Monitoring Wells *(pump and treatment remedy)***:** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
D. Monitoring Data
1. Monitoring Data: ☐ Is routinely submitted on time ☐ Is of acceptable quality
2. Monitoring Data: ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining
E. Monitored Natural Attenuation
1. Monitoring Wells *(natural attenuation remedy)***:** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
X. OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Soil Vapor Extraction System ☐ Applicable ☒ N/A
1. Blowers, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances: ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment M-1. Five-Year Review Site Inspection Checklist – D-Area Expanded Operable Unit (D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D]) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The selected remedy for the DEXOU is excavation of waste material from DRP and consolidation with the 488-DAB in conjunction with consolidation of the 488-DAB exposure areas (DSVA, basin exterior, DAB drainage), and application of a low permeability geosynthetic cover system, institutional controls, and monitoring. Institutional controls are in place and being implemented to provide access control and prevent exposure as designed. Selected remedies for the D-Area Rubble Pile and the 488-D Ash Basin are functioning as intended. There are no issues requiring corrective actions
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the integrity of the engineered cover, which in turn will maintain the effectiveness of the cover to mitigate leaching. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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D-AREA OIL SEEPAGE BASIN (631-G) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the D-Area Oil Seepage Basin (631-G) (DOSB) Operable Unit (OU). The review was conducted from September 2012 through October 2012. Contaminants have been left in place at the DOSB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the DOSB OU is protective of human health and the environment. This report documents the results of the review.

II. Operable Unit Chronology

Table N-1 lists the chronology of site events for the DOSB OU.

III. Background

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

Physical Characteristics

The DOSB OU is located within SRS in a clearing, approximately 1.6 km (1 mi) north of the coal-fired D-Area Powerhouse (484-D) and approximately 3 km (1.9 mi) from the nearest SRS boundary (Figure N-1). The DOSB was constructed in 1952 as a series of unlined trenches to dispose of waste oil products. The DOSB is approximately 114.9 m (383 ft) long by 32.4 m (108 ft) wide and 2.4 m (8 ft) deep (Figure N-2). During an interim remedial action (IRA) conducted at the unit, the trenches were found to be continuous, without noticeable berms, and were constructed as a series of adjacent trenches along the back half of the clearing.

The groundwater beneath the DOSB is included in the OU. The DOSB is on the Ellenton Plain along the Savannah River at an elevation of 45 m (150 ft) above mean sea level (msl). The terrain is flat, with no discernible slope or relief, and is surrounded by a

mature forest of hardwoods and softwoods. The water table ranges from approximately 1.2 to 4.8 m (4 to 16 ft) below ground surface (bgs) in the area of the DOSB. The water table aquifer system in this area is the Upper Three Runs. Surface drainage is to the southwest, toward the Savannah River, which is at an elevation of 25.5 m (85 ft) msl. The closest surface water feature is a Carolina bay, a natural wetland located adjacent to the unit to the west (Figure N-2). The Carolina bay appears to be dry during the summer months or periods of little to no precipitation, but it may contain surface water during wet seasons. Other wetlands exist approximately 75 m (250 ft) south of the unit (Figure N-2). The major local surface water drainage system is the Savannah River and associated swamps, located approximately 2.6 km (1.6 mi) west of the unit (Figure N-1). Upper Three Runs Creek, a tributary to the Savannah River, is located 2.7 km (1.7 mi) to the north-northwest, and Fourmile Branch, another tributary, is located 2.7 km (1.7 mi) to the south-southeast (Figure N-1).

Land and Resource Use

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

History of Contamination

Prior to SRS ownership, the DOSB area was primarily used for agriculture. In 1952, the DOSB trenches began receiving waste oils and fluids from A-Area and other areas at SRS, which were unacceptable for incineration in the 400-D powerhouse boilers. The waste was periodically burned along with general office and cafeteria waste. There is no evidence that the DOSB received radioactive waste. Figure N-3 is a photograph of one of the trenches during its operational period. In 1975, the basin was removed from service and backfilled with soil. The basin remained inactive and covered with natural vegetation, including bushes and grasses. During a limited scope characterization in

1993, 58 buried 55-gallon drums suspected to contain hazardous substances were discovered.

Initial Response

A preliminary unit evaluation and a unit reconnaissance were performed in August 1988. Since the preliminary unit evaluation concluded that the unit had received hazardous substances, a unit screening investigation was implemented and field investigations conducted between 1988 and 1994. The field investigations involved soil borings, surface geophysics, well and piezometer installation, and groundwater sampling.

Groundwater and soil sampling were performed in 1996 as part of the RCRA Facility Investigation/Remedial Investigation (RFI/RI). The investigation revealed soils contamination in the trenches and a plume of volatile organic compounds (VOCs) in the groundwater. The RFI/RI Report and the Baseline Risk Assessment (BRA) Report for the DOSB (WSRC 1997a) identified eight VOCs as final constituents of concern (COCs): benzene, 1,1-dichloroethylene, total 1,2-dichloroethylene (DCE), cis-1,2-DCE, dichloromethane, tetrachloroethylene (PCE), trichloroethylene (TCE), and vinyl chloride (VC). An IRA (WSRC 1995) was implemented in 1996 and included:

- Removing drums, debris, and principal threat source material (PTSM), transferring drum contents into new drums and properly disposing of all hazardous and non-hazardous materials.
- Backfilling, grading, and seeding the basin in accordance with the Remedial Design/Remedial Action Work Plan (WSRC 1996). The DOSB was graded and seeded to ensure stormwater would runoff to minimize water infiltration and to minimize erosion.
- Installing and testing a biological treatment system (i.e., bioventing system) to volatilize the constituents in the soil and enhance the aerobic degradation of the contaminants in the soil.

Basis for Taking Action

The potential exposure to or ingestion of groundwater contaminated above maximum contaminant levels (MCLs) poses a potential increased risk of cancer to human receptors and is the basis for taking action at the DOSB OU. Although shallow groundwater aquifers at SRS are not used as a drinking water source, the potential for unacceptable human exposure to contaminated groundwater exists as long as contaminants remaining at levels above MCLs.

IV. Remedial Actions

Remedy Selection

The Record of Decision (ROD) (WSRC 1998) identifies COCs for groundwater only, because the remedial action objectives (RAOs) for deep soil was achieved by the IRA. Methylene chloride was initially identified as a soil COC but concentrations were reduced to levels that would not leach to groundwater above the MCLs through the IRA. For this reason, methylene chloride was not identified as a final COC for deep soils in the ROD. Also, no COCs were identified for shallow soil, surface water, and sediment during the RFI/RI and BRA (WSRC 1997a). Remedial goals (RGs) for groundwater COCs were determined to be equivalent to their respective maximum contaminant level (MCL) values. The groundwater contaminants at the DOSB OU and their corresponding RGs are provided in Table N-2. The RAOs for the groundwater are:

- Reduce risk to human health associated with dermal contact and ingestion of groundwater and inhalation of groundwater vapor; and
- Restore groundwater to achieve Applicable or Relevant and Appropriate Requirements (ARARs) and RGs.

As stated in the ROD (WSRC 1998), the selected remedial action is as follows:

- DOSB deep soils - No Further Action since RAOs were achieved by the IRA of bioventing testing;

- DOSB shallow soil, surface water and sediment – No Action because no COCs in those media were identified in the RFI/RI Report and BRA; and
- DOSB groundwater - monitored natural attenuation (MNA)/groundwater mixing zone (GWMZ) with institutional controls.

Natural attenuation mechanisms such as biodegradation, flushing, volatilization, adsorption, and hydrolysis would continue to reduce contaminant concentrations in the groundwater to acceptable levels. The source of groundwater contamination (i.e., DOSB soil) no longer contributes to groundwater contamination as a result of the interim action and bioventing test.

Remedy Implementation

The final remedial action consisted of the following activities:

- Accepting the interim actions of removing 612 m^3 (800 yd^3) of 58 drums and debris and treating 9,371 m^3 (12,250 yd^3) of deep basin soils as final actions;
- Establishing an MNA/GWMZ by implementing a compliance groundwater monitoring program in accordance with the Corrective Measures Implementation/ Remedial Design/Remedial Action Work Plan (WSRC 1999b);
- Establishing institutional controls to control unauthorized access to DOSB groundwater including site control of groundwater well installations through existing SRS procedures, the existing SRS security controls and perimeter fences and use restrictions via the SRS Site Use/Site Clearance Program; and
- Establishing land use controls (LUCs) for 9.35 hectares (23.04 acres) (WSRC 1997b).

Figure N-4 is a current photograph of the OU.

Systems Operations/Operation and Maintenance

There are no system operational requirements at the DOSB OU. DOSB currently meets unrestricted land use criteria for soils, sediment, and surface water. Therefore, annual site inspections and maintenance (e.g., repair of erosion damage, cover maintenance,

removal of trees and warning signs) are not required for soils, sediment, and surface water. Site inspections performed are for the monitoring wells and the 5-Year Remedy Review Reports.

For DOSB groundwater, a compliance groundwater-monitoring program has been established to demonstrate compliance with MCLs at the compliance boundary and compliance with the mixing zone contaminant levels (MZCLs) at the plume wells as required by the GWMZ application and the ROD. All monitoring and reporting is in accordance with the GWMZ application (SRNS 2009).

The ROD estimated operations and maintenance (O&M) costs associated with the selected remedy for DOSB has a present worth of $299,000, which was discounted at 5% per year for 30 years of maintenance activities (WSRC 1998). The actual O&M cost since the remedial action was completed in FY03 until FY11 is $1,121,904. The actual O&M costs (Table N-3) are higher than expected because groundwater monitoring and reporting costs are higher than estimated.

V. Progress since Last Review

The previous protectiveness statement concluded that because the remedial actions at DOSB OU are protective, the site is protective of human health and the environment. Updated transport modeling conducted as part of the Revision 1.5 to the GWMZ Application revised the projection for completing the groundwater clean from the year 2010 to within 20 years (i.e. 2029) (SRNS 2009a). Once remediation is complete and groundwater RGs are achieved, institutional controls (i.e., LUCs) will no longer be needed. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls and use restrictions via the SRS Site Use/Site Clearance Program.

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

The only change for this OU is to the GWMZ. Revision 1.5 of the DOSB GWMZ application (SRNS 2009a), approved by the South Carolina Department of Health and Environmental Services (SCDHEC) and the U.S. Environmental Protection Agency

(USEPA), which identifies the following changes to the monitoring program which were implemented in 2010:

- MZCL constituent concentrations were changed to be consistent with observed degradation (Table N-4);
- Wells DOB 19, DOB19A, DOB15D, DOB 15PZ, and DOB 23 were reclassified as DOSB plume compliance wells. DOB 16 was added to the list of plume compliance wells in 2008. DOB 21 PZ was changed to a boundary compliance well;
- "Total 1,2-DCE' and "trans-1,2-DCE" were removed from the list of GWMZ constituents;
- Natural attenuation laboratory indicator parameters were eliminated. Field indicator parameters continue to be monitored;
- Sampling frequency for background wells were reduced from annual to every other year. Plume and compliances wells were reduced from biannual (2Q and 4Q) to annual sampling; and
- The reporting frequency was modified such that there is a formal report in odd-numbered years and a letter summary report in even-numbered years.

Data indicates that the remedy is still effective.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed documents listed in Section XII, Documents Reviewed;
- Confirmed effective operation of the implemented Remedial Actions;
- Reviewed the groundwater data to determine the suitability of the mixing zone in evaluating whether MNA will foster reaching MCLs for the COCs in the DOSB groundwater;

- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment N-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 interim actions of removing drums, debris and PTSM and conducting a bioventing test were effective in achieving RGs for the DOSB deep soils and removing the source of contamination to the groundwater. The bioventing optimization test, performed during Fall 1996 to Spring 1997, was effective in achieving the soil RG. Thus, no additional injections were needed to maintain the contaminant migration (CM) COC levels below the RG. The last IRA Semiannual Groundwater Monitoring Report (WSRC 1999c), documented the results of the removal action and bioventing test in accordance with the Interim Action Record of Decision (IROD) (WSRC 1995). The bioventing test data verified that "no further action" was appropriate for DOSB deep soils. Post-test soil sampling found that in 26 of 27 samples, the methylene chloride concentration was less than 7 µg/kg. The concentration in the one remaining sample was 28.1 µg/kg, which is below the 41µg/kg RG (WSRC 1997c) and well below the pre-interim action maximum soil concentration of 2,140 µg/kg (WSRC 1997a).

For evaluating the MNA/GWMZ effectiveness, groundwater data from 2003 through 2011, the Revision 1.5 to the groundwater mixing zone application (SRNS 2009a), the RFI/RI with BRA report (WSRC 1997a) and the annual mixing zone reports (SRNS 2009b, SRNS 2010, SRNS 2012) were reviewed. During the period 2007 through 2011, benzene and methylene chloride each had 162 records that were below detection limits. For benzene, there were 13 detects and 24 estimated values. For methylene chloride, there were 0 detects and 1 estimated value. All detects and estimated values were below the MCLs.

In order to evaluate the remainder of the contaminants and the effectiveness of the MNA remedy, the data were reviewed from several perspectives. First, PCE, TCE and VC plumes, which were evaluated during the RFI/RI, were compared with the 2011 plume

maps (Figures N-5, N-6, N-7, N-8, N-9 and N-10). The following were determined from this review:

- The PCE plume in the AQ1/2 and AQ3 aquifers appears to be shrinking;
- The 0.5 µg/L TCE contour appears to be shrinking, while the 5 µg/L contour (MCL) appears to be expanding in the AQ1/2 aquifer, and remaining stable in the AQ3 aquifer;
- Consistent with the revision 1.5 to the GWMZ application (SRNS 2010), the vinyl chloride 2 µg/L contour (MCL) in the AQ1/2 aquifer appears stable, and the 2 µg/L contour in the AQ3 aquifer and the 0.5 µg/L contour in the AQ1/2 and AQ3 aquifers are expanding.

Review of dissolved oxygen data indicates the plume is aerobic. The methane data indicates there are "pockets" of methane, thus there is the potential for aerobic co-metabolism as a mechanism for degradation of TCE. The wells with measureable methane concentrations are several of the plume and near source wells. The presence of aerobic co-metabolic process may be evidenced by the apparent shrinking of the 0.5 µg/L TCE contour.

Additionally, concentration versus distance plots were created for PCE, TCE, 1,2-DCE, cis-1,2-DCE, and vinyl chloride down the centerline of the plume in the AQ2 aquifer (Figure N-11). For the near source wells, concentrations of all contaminants have decreased over time, except for PCE which appears relatively stable but at low concentrations (10 to 15 µg/L range). The ongoing presence of these low concentrations of PCE may be a result of matrix diffusion (ITRC 2011). The impact of matrix diffusion can be extending the remediation time frame as a result of contaminant diffusion from low permeability zones into the higher permeability (sand) zones. The concentrations of contaminants in the plume and boundary compliance wells are showing a decreasing trend with time, some peaking in 2003 and others in 2007. The cis-1,2-DCE and vinyl chloride curves indicate that between 2003 and 2007 these two plumes moved downgradient in the plume compliance well zone with accumulation of mass. Between 2007 and 2011, concentrations of these contaminants decreased. Near the compliance

boundary, located approximately 495 m (1,650 ft) downgradient from the basins, the concentrations of all COCs are below the detection levels.

Based on field data, attenuation rates were estimated by plotting the natural logarithm of the concentration versus time, where time was determined by dividing the distance of the well from the source by the flow rate and calculating the slope (Figure N-12) for TCE. The flow rate used for the calculations was the 70 ft/yr used in the Revision 1.5 to the GWMZ application (SRNS 2009a). Table N-5 presents the calculated degradation rates and associated half-lives for the COCs, other than benzene and methylene chloride which the data indicates are no longer present at this site. These rates represent all attenuation mechanisms. Due to the short length of this plume, approximately 0.4 km (0.25 mi), diffusion will have little effect on this plume (WSRC 2006). Thus, these rates are indicative of degradation, either biotic or abiotic.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 8, 2013 by phone and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The DOSB OU was inspected by SRNS and USDOE personnel on July 24, 2012 and September 27, 2012, respectively, as part of the Five-Year Remedy Review process. No issues were identified for the DOSB OU during this inspection.

On January 22, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

Review of documents, ARARs, risk assumptions, and results of the site inspection indicate that the remedy is functioning as intended by the ROD. The low concentration of contaminants, shrinking plumes and relatively short half-lives indicate the MNA/GWMZ will be effective in restoring groundwater to ARARs and RGs. The timeframe for reaching RGs may be optimistic due to the effect of matrix diffusion.

Institutional controls (i.e., LUCs) are effective in preventing exposure to groundwater and its vapor. Site Inspections are not required by the ROD or LUCIP because the DOSB currently meets unrestricted land use criteria for soils, sediment, and surface water. The only site inspections performed are for the Five-Year Remedy Review Report. The results of the inspection for this five-year review indicate the controls are effective and no problems have occurred. Gate and fencing around the DOSB perimeter, although still being used, is not required.

Are the 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 except for the arsenic MCL. At the time of the ROD issuance, the MCL for arsenic was 50 µg/L. This value was changed in 2001 to 10 µg/L. However, arsenic was not detected in the groundwater during the monitoring period at the DOSB OU. There have been no changes in the MCL values for the eight groundwater COCs identified at the DOSB OU. Therefore, there have been no changes that would impact the effectiveness of the MNA/GWMZ remedy for groundwater. The ARARs, which focus on meeting MCLs, GWMZ compliance limits, and protection of the nearby wetlands, will be met upon meeting the groundwater RGs.

Due to the presence of chlorinated solvents at the site, there is a potential that 1,4-dioxane may also exist because it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. The presence of 1,4-dioxane is not likely to change the protectiveness of the remedial action that includes LUCs (at a minimum) which consequently renders the exposure pathway to human receptors incomplete. An evaluation of the effectiveness of the remedy is premature until such time that a formal MCL is established. SRS has performed a historical review of groundwater data for the DOSB OU resulting in a single sampling event of 5 individual DOB wells in 1991 (2 wells) and 2006 (3 wells). The results indicated 1,4-dioxane was not detected. Before the next Five-Year Remedy Review, groundwater samples at the DOSB OU will include the analysis of 1,4-dioxane. The 1,4-dioxane results will be reported in the subsequent

groundwater monitoring reports, as well as summarized in the next Five-Year Remedy Review.

More stringent 2012 preliminary remediation goals/regional screening levels (PRGs/RSLs) do not impact the protectiveness of the remedy because excavation of highly contaminated media and establishment of a clean soil cover eliminates the human health exposure pathway to remaining soil contaminants left in place. There have been no changes in the MCLs for TCE and PCE that would impact the effectiveness of the MNA/GWMZ remedy for groundwater. In addition, more stringent PRGs/RSLs would not impact the LUCs that are in place to prevent exposure to or ingestion of contaminated soil or groundwater media at the DOSB OU.

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

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

VIII. Issues

There are no issues 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 DOSB OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled through institutional controls (i.e., LUCs) such as physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls, and use restrictions via the SRS Site Use/Site Clearance Program to prevent exposure to or ingestion of contaminated groundwater. Protectiveness of the remedial action will be verified by continued groundwater monitoring.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

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

ITRC, 2011. *Integrated DNAPL Site Strategy*, IDSS-1, Interstate Technology & Regulatory Council, Integrated DNAPL Site Strategy Team, Washington, D.C. www.itrcweb.org.

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SRNS, 2009b. *2008 Annual Mixing Zone Monitoring Report for the D-Area Oil Seepage Basin (631-G0 (U)*, SRNS-RP-2009-00598, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

WSRC, 1995. *Interim Action Record of Decision/ Remedial Alternative Selection (U) D-Area Oil Seepage Basin*, WSRC-RP-93-1550, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996. *Remedial Design/Remedial Action Work Plan for the D-Area Oil Seepage Basin (U),* WSRC-RP-94-1287, Revision 1.3, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997a. *RCRA Facility Investigation/Remedial Investigation Report and the Baseline Risk Assessment Report for the D-Area Oil Seepage Basin (631-G) (U)*, WSRC-RP-96-154, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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WSRC, 1997c. *Evaluation of D-Area Oil Seepage Basin Bioventing Optimization Test Sediment Samples Data*, WSRC-TR-97-00399, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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WSRC, 2006. *Mass Balance: A Key to Advancing Monitored and Enhanced Attenuation for Chlorinated Solvents*, WSRC-STI-2006-00082, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC.

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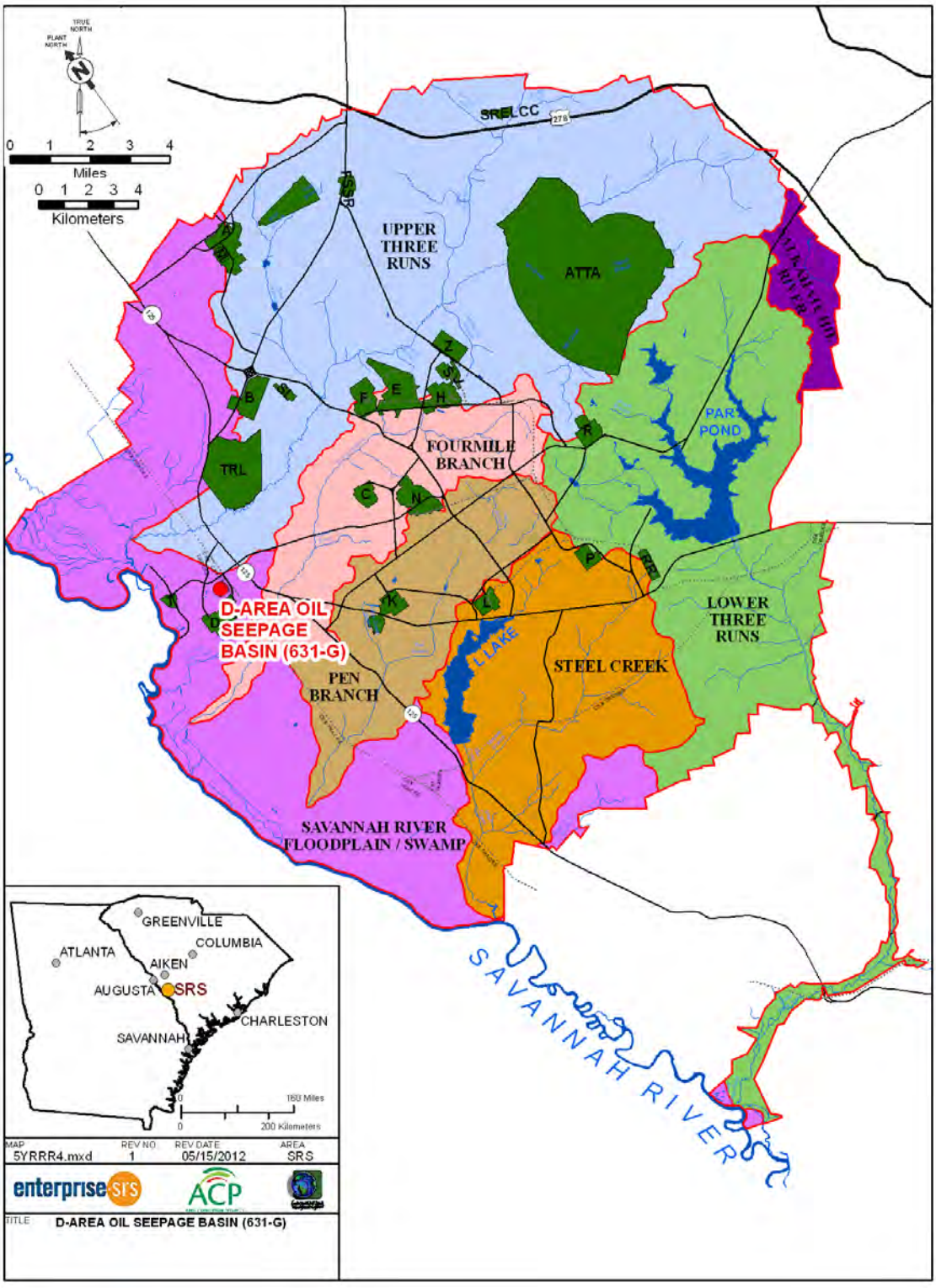


Figure N-1. Location of the D-Area Oil Seepage Basin Operable Unit within SRS

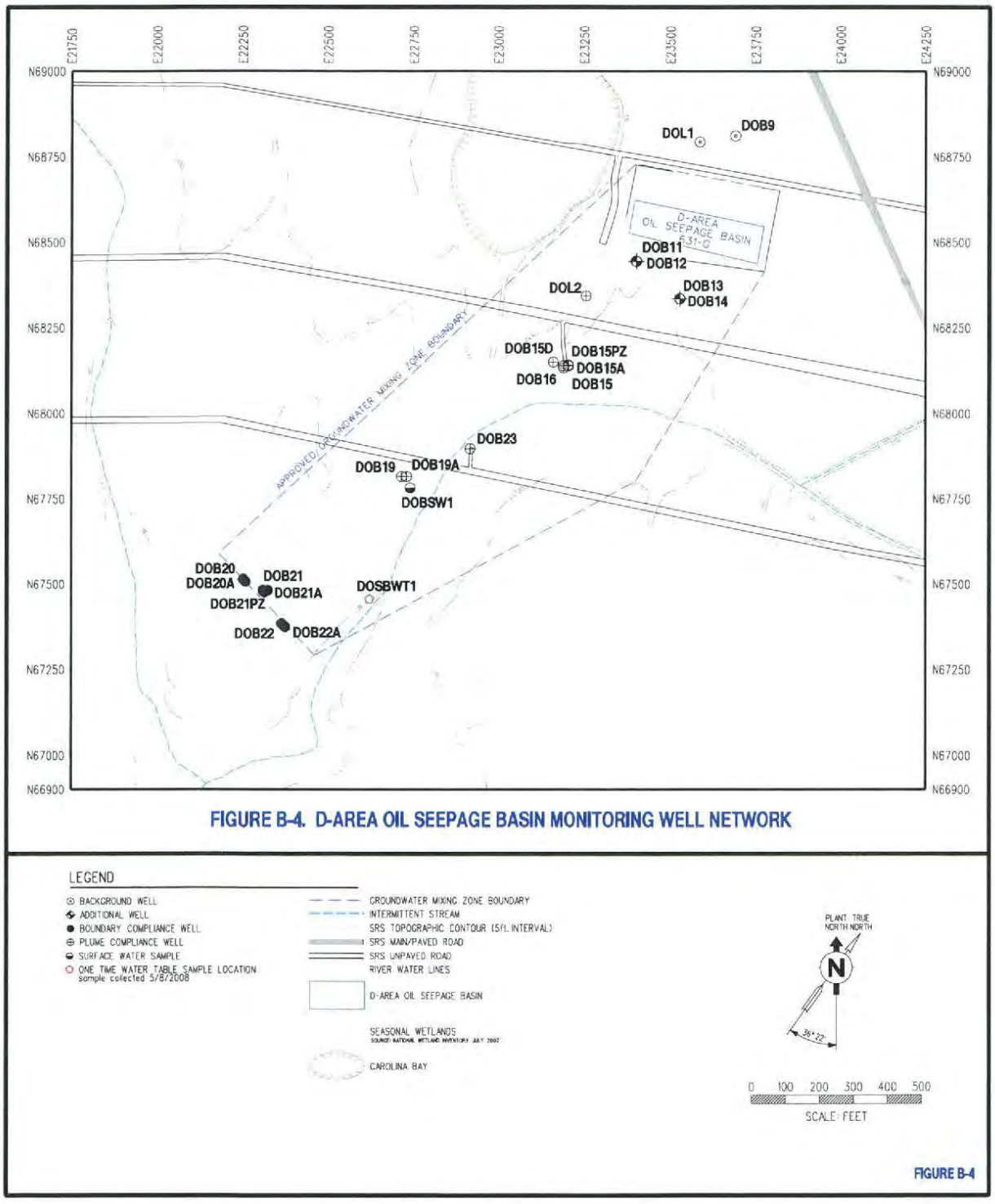


FIGURE B-4. D-AREA OIL SEEPAGE BASIN MONITORING WELL NETWORK

Figure N-2. D-Area Oil Seepage Basin Monitoring Well Location Map



Figure N-3. Photo of the D-Area Oil Seepage Basins Prior to 1975 Backfill Operations



Figure N-4. Current Photographs of the DOSB. (Rectangle represents approximate boundaries of the D-Area Oil Seepage Basin OU)

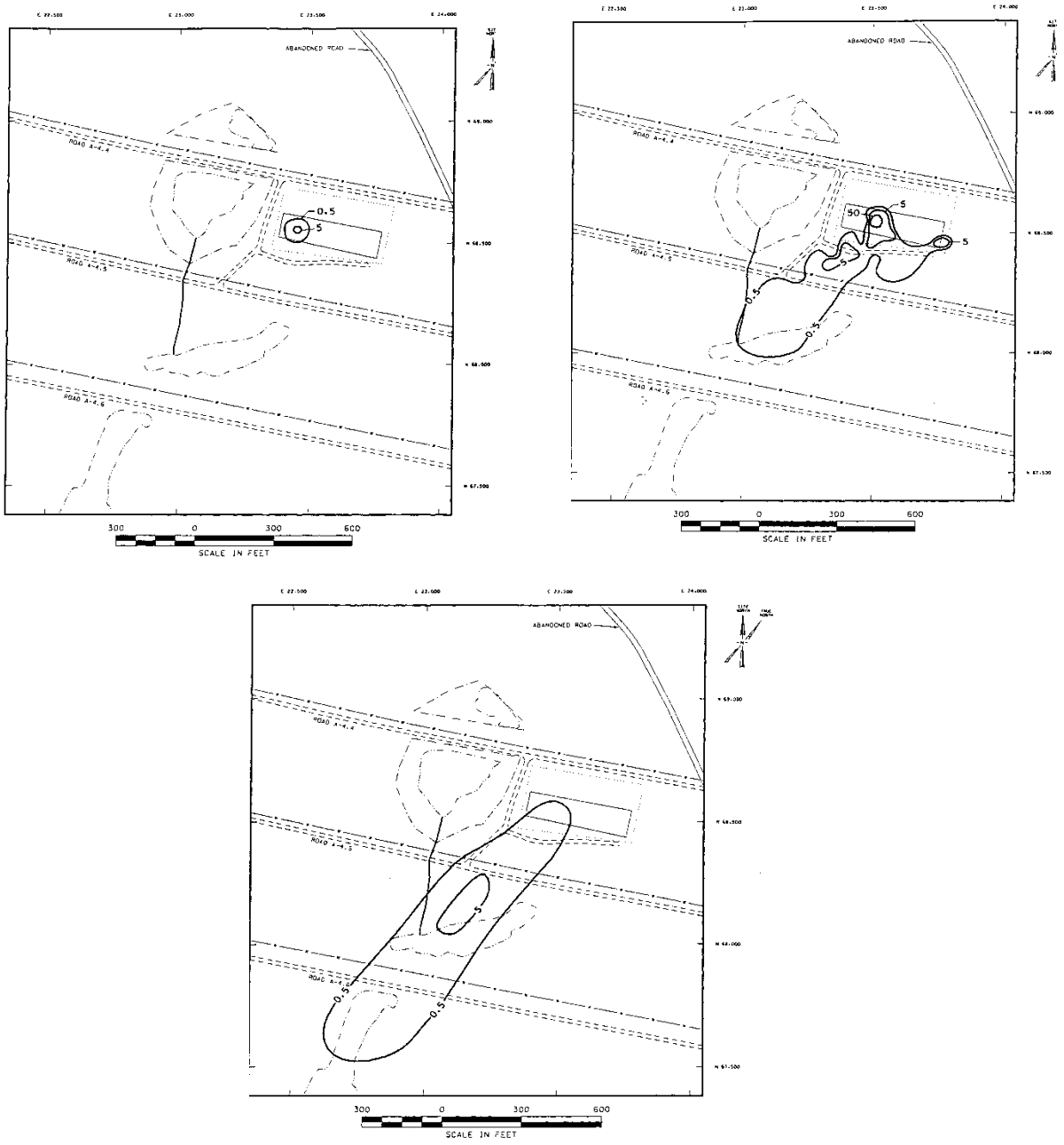


Figure N-5. **DOSB PCE plume maps (1996 data) for Aquifers AQ1, AQ2 and AQ3 (clockwise beginning in upper left corner) (WSRC 1997a)**

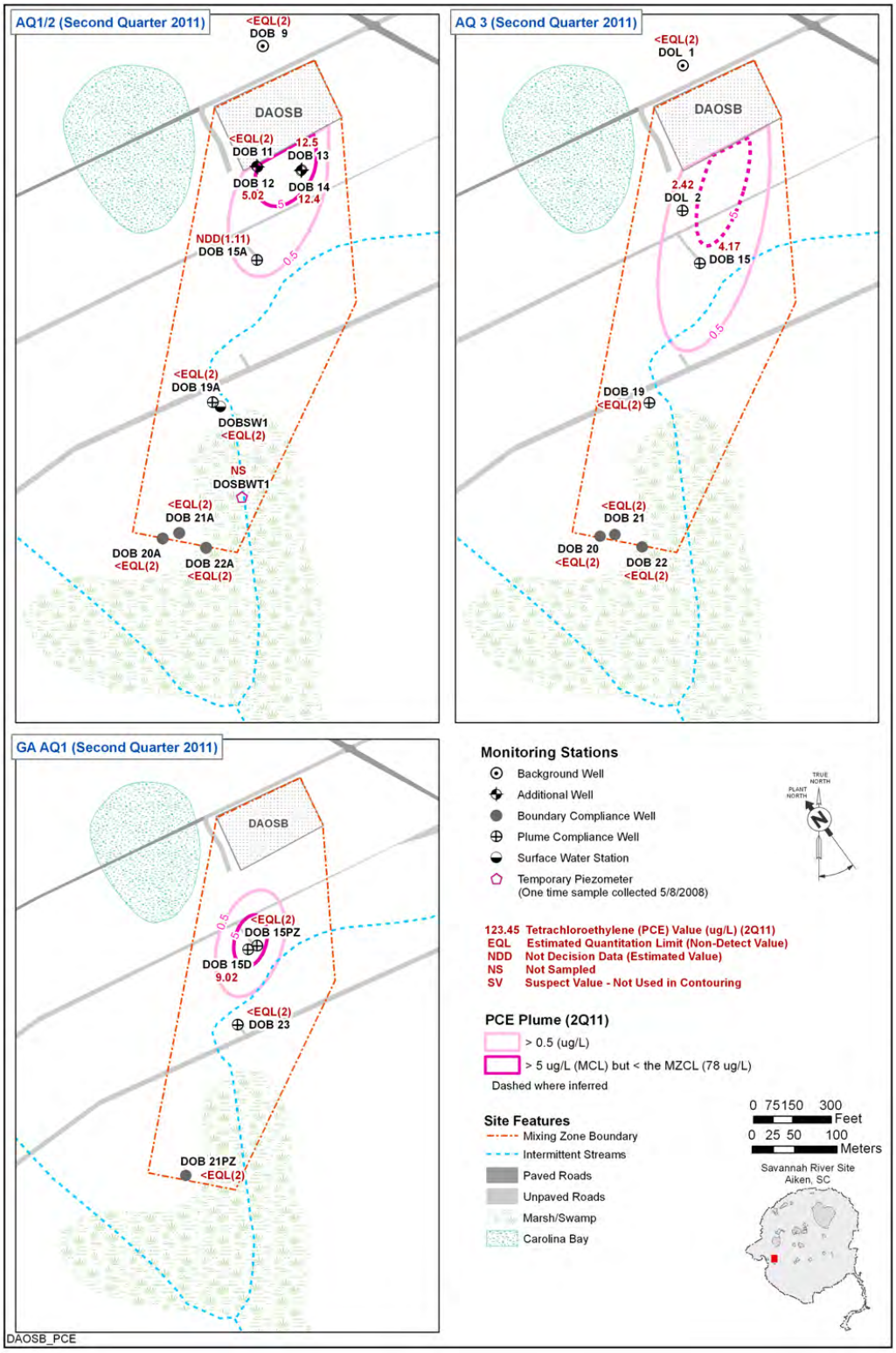


Figure N-6. **DOSB PCE plume maps (2011 data) for Aquifers AQ1/2, AQ3 and GA-AQ1 (clockwise beginning in upper left corner) (SRNS 2012)**

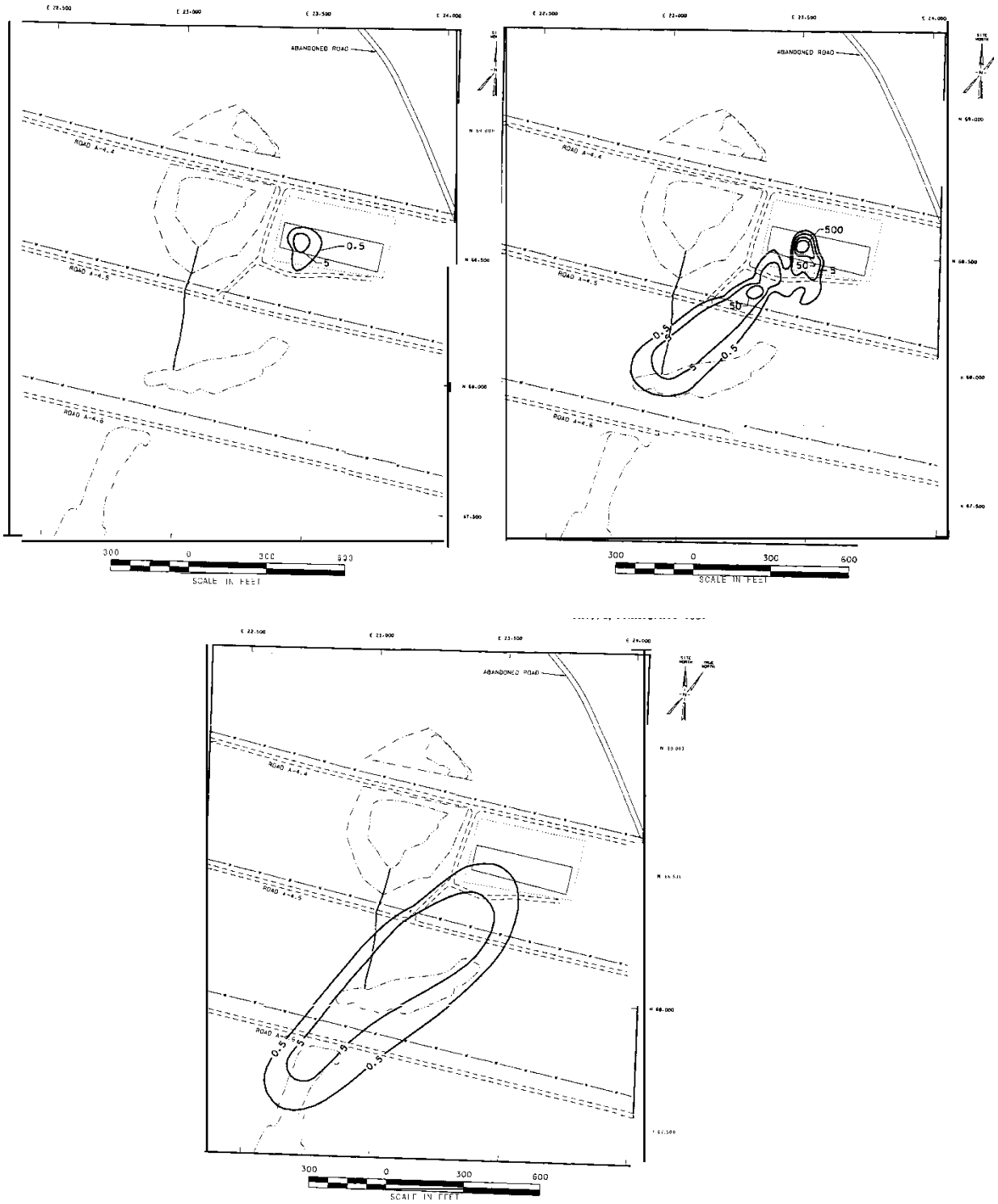


Figure N-7. **DOSB TCE plume maps (1996 data) for Aquifers AQ1, AQ2 and AQ3 (clockwise beginning in upper left corner) (WSRC 1997a)**

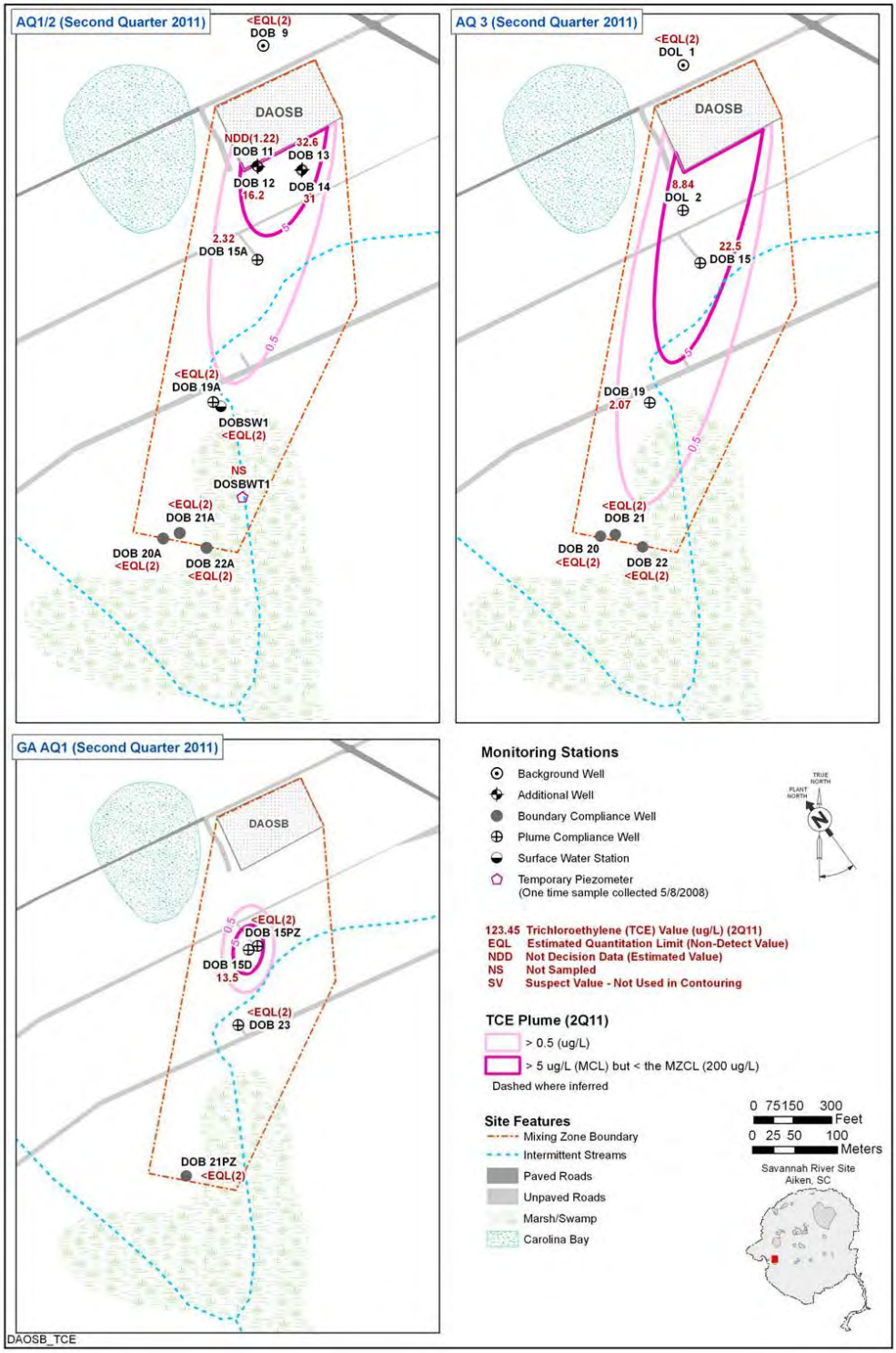


Figure N-8. **DOSB TCE plume maps (2011 data) for Aquifers AQ1/2, AQ3 and GA-AQ1 (clockwise beginning in upper left corner) (SRNS 2012)**

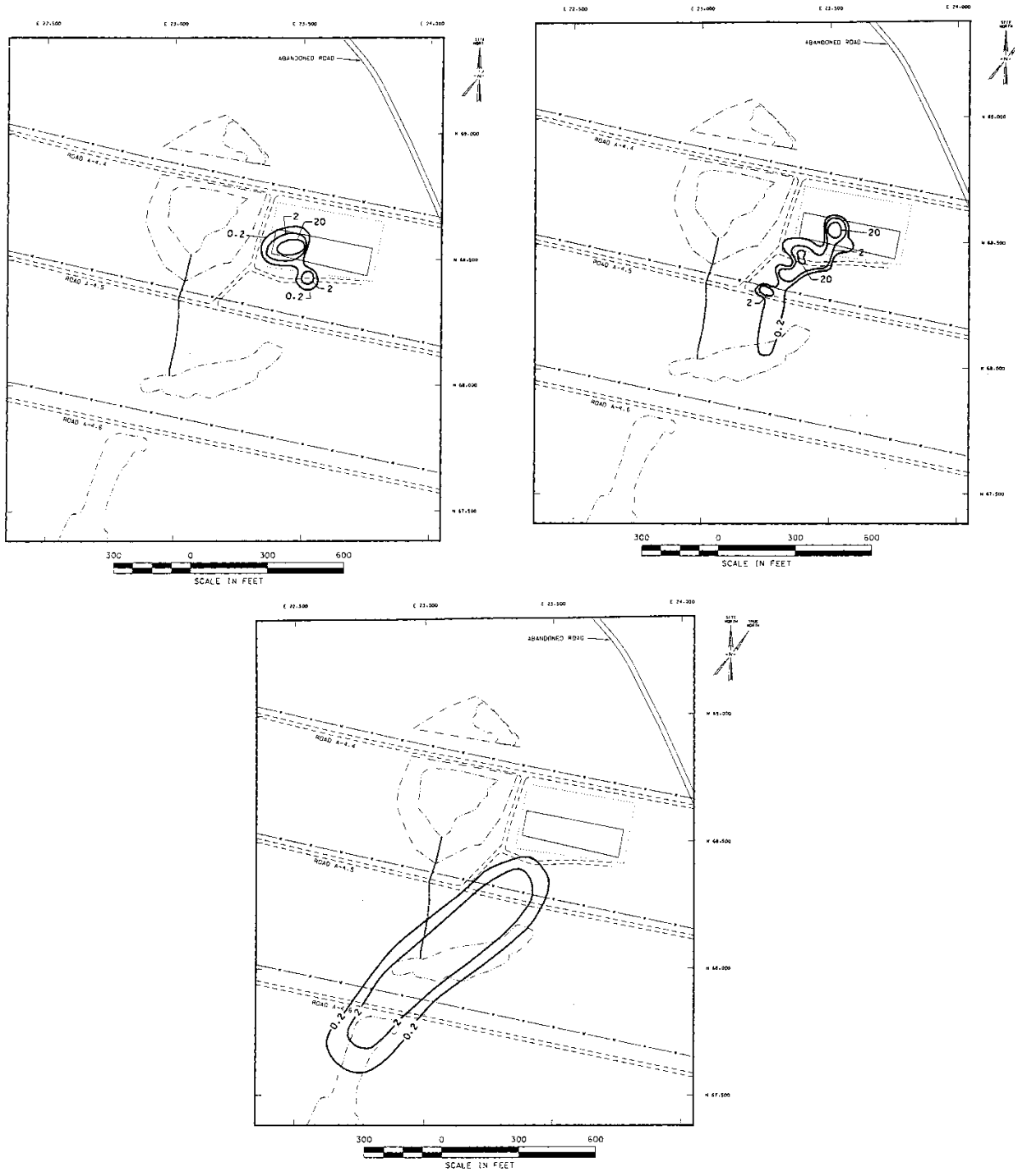


Figure N-9. DOSB vinyl chloride plume maps (1996 data) for Aquifers AQ1, AQ2 and AQ3 (clockwise beginning in upper left corner) (WSRC 1997a)

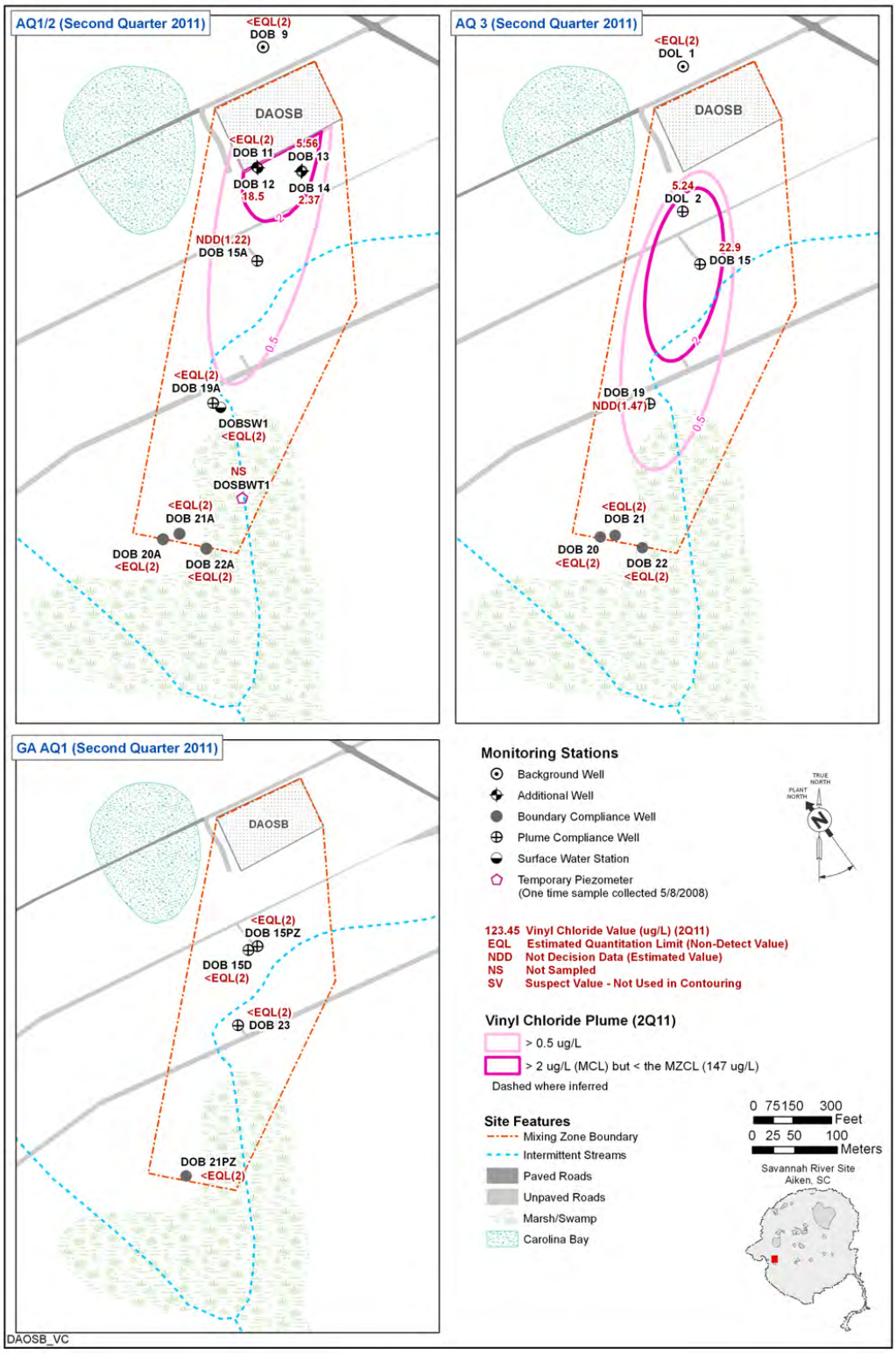


Figure N-10. DOSB vinyl chloride plume maps (2011 data) for Aquifers AQ1/2, AQ3 and GA-AQ1 (clockwise beginning in upper left corner) (SRNS 2012)

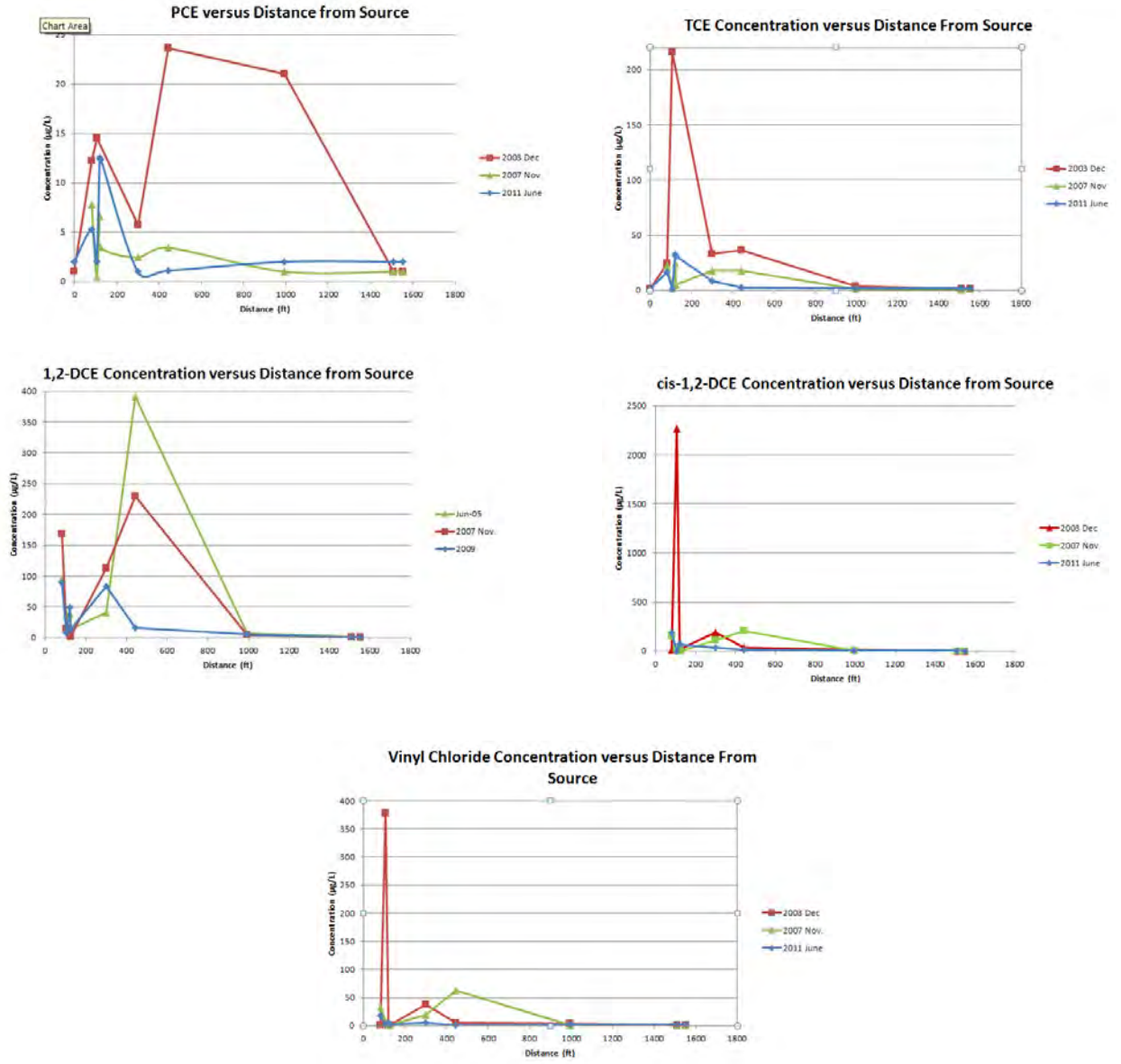


Figure N-11. Concentration versus Distance Plots for PCE, TCE, DCE (1,2 and cis-1,2) and Vinyl Chloride

Vertical axes maximums vary per contaminant based on maximum detected values.
1,2-DCE has a shorter time span of data than the other contaminants.

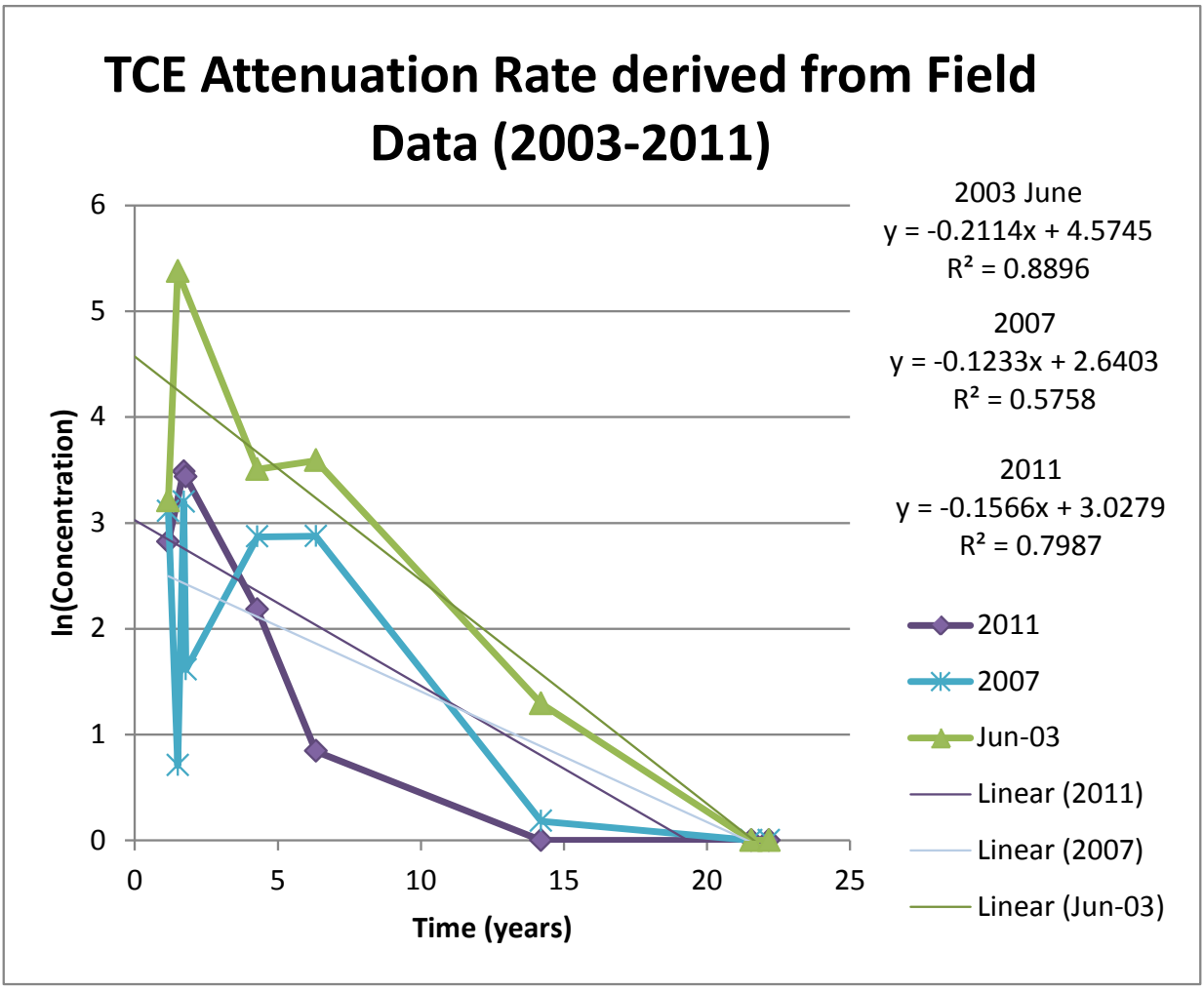


Figure N-12. Evaluation of the Degradation Rate of TCE based on DOSB Field Data

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Table N-1. Chronology of OU Events

Event	Date
RFI/RI Field Start/Complete	1995 / April 24, 1998
Interim Record of Decision (ROD) Issuance	March 6, 1995
Interim Remedial Action Start/Complete	August 13, 1996 / December 31, 1999
Final ROD Signature	March 4, 1999
Remedial Action Start/Complete	September 3, 1999/ January 13, 2000
Previous Five-Year Reviews	June 30, 1997, February 12, 2004, February 4, 2009

Table N-2. Final COCs with Selected RGs

Final COCs	Maximum Concentration Detected (µg/L)	Average Concentration in Groundwater (µg/L)	Selected RG (µg/L)
Tetrachloroethene	85	2.1	5.0
Trichloroethene	1151	8.0	5.0
cis-1,2-Dichloroethene	457	4.88	70.0
total-1,2-Dichloroethene	68.6	21.24	70.0
1,1-Dichloroethene	0.84	0.399	7.0
Vinyl Chloride	52	1.1	2.0
Benzene	6.2	0.22	5.0
Dichloromethane	9.5	0.16	5.0

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

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	85,300	69,100	47,900	53,100	71,700	327,100
Total ROD Estimated Direct O&M Costs	23,000	9,000	9,000	9,000	9,000	59,000

Table N-4. Revised Monitoring Limits for the DOSB Mixing Zone

COC	Units	MZCL (Rev. 1.1)	MZCL (Rev. 1.5)	MCL
Tetrachloroethylene	µg/L	85	78	5
Trichloroethylene	µg/L	1,150	200	5
Cis-1,2-Dichloroethene	µg/L	457	1,164	70
1,1-Dichloroethene	µg/L	7	7	7
1,2-Dichloroethene	µg/L	70	70	70
Vinyl chloride	µg/L	32	147	2
Benzene	µg/L	6.2	5	5
Methylene chloride	µg/L	9.5	5	5

Table N-5. Calculated Attenuation Rates for COCs of the DOSB from an Evaluation of Groundwater Data of Wells Along the Centerline of the Plume

COC	Attenuation Rate (yr^{-1})	Half-life (yr)
Tetrachloroethylene	-0.088	8.3
Trichloroethylene	-0.164	4.4
1,2- Dichloroethene	-0.161	4.3
Cis-1,2- Dichloroethene	-0.159	4.6
Vinyl Chloride	-0.078	9.2

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU

I. SITE INFORMATION			
Site Name:	**D-Area Oil Seepage Basin (631-G) OU**	**Date of Inspection:**	**07/24/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #27**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 95°F**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Groundwater Mixing Zone Monitoring

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

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** **George Joyner** (Name) Post Closure Manager (Title) 6/26/12 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: **(803)952-3324**
   Problems/Suggestions: ☐ Report Attached

ACP Post Closure Waste Site

2. **O&M Staff:** **Richard Feagin** (Name) ACP Post Closure Waste Site 5/8/2013 (Date)
   Inspector/Maintenance Coordinator (Title)
   Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No**.:(803)-952-4416**
   Problems/Suggestions: ☐ Report Attached Only inspection requirement is monitoring well **maintenance. Routine inspections not required by neither ROD nor LUCIPs.**

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

_____

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

_____

_____

_____

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

1. O&M Documents:

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

Remarks: Site Inspections for the surface unit portion are not required by the ROD or LUCIP because the DOSB currently meets unrestricted land use criteria for soils, sediment and surface water. The only site inspections performed are for the 5-Year Remedy Review Reports.

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

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

2. Health and Safety Plans (HASPs):

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

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

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

Remarks: Training Records are complete and up to date per 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: Annual Mixing Zone report and data is posted on ERDMS

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 N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

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

2. O&M Cost Records:

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

Total annual cost by year for review period, if available

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

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

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

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

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

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

Describe costs and reasons: _____

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

A. Fencing

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

Remarks: Gate and fencing around DOSB perimeter, although still being used, is not required. The fencing is a holdover from previous operations.

B. Signs

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

Remarks: _____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

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

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

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

Frequency: Once every 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) Federal Project Director (Title) 09/27/12 (Date) 803-952-7871 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

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

Remarks:

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☐ Applicable ☒ N/A

A. Landfill Surface

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

Areal extent Depth

Remarks:

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

Lengths Widths Depths

Remarks:

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

Areal extent Depth

Remarks:

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

Areal extent Depth

Remarks:

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

Areal extent Depth

Remarks:

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

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

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident
Areal extent_____ Depth_____
Remarks:_____

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

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

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

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:_____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
C. Letdown Channel ☐ 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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☐ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:_____
E. Gas Collection and Treatment ☐ Applicable ☐ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:_____
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:_____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☐ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☐ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

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

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

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

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

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment N-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The DOSB OU deep soils is no further action since RAOs have been achieved by the IRA and bioventing testing. The remedy for shallow soil, surface water, and sediment is no action because no COCs in those media were identified in the RFI/RI Report and Baseline Risk Assessment. The remedy for DOSB OU groundwater is monitored natural attenuation/groundwater mixing zone with institutional controls. Results from the bioventing study indicate that the source of groundwater contamination (i.e., contaminants in the DOSB OU soil) was significantly reduced as a result of the combined IRA and bioventing test and no longer contributes to groundwater contamination.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Monitoring data appears to be consistent with the modeling predictions from the GWMZ application. The concentrations should continue to decrease within the heart of the plume through natural attenuation to levels at or below MCLs. Based on the monitoring data collected to-date, the remedy is functioning as intended in the final ROD. All indications are that the mixing zone is protective of human health and the environment, to date, and is expected to remain protective for the future.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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D-AREA OPERABLE UNIT

I. Introduction

This report is the first five-year review for the D-Area Operable Unit (DAOU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the DAOU at levels that do not allow unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the DAOU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table O-1 lists the chronology of site events for the DAOU.

III. Background

The DAOU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media of concern is surface and vadose zone soil, sediment, surface water, and concrete. Groundwater is addressed separately by the D-Area Groundwater OU.

An area-based remedial strategy has been implemented in D Area; remedial decisions for two surface units in D Area (i.e., the D-Area Rubble Pit and the 488-D Ash Basin) are addressed by the D-Area Expanded OU (DEXOU) Record of Decision (ROD). All other remedial actions for D-Area waste units and facilities are addressed by the DAOU ROD. In 2010, South Carolina Department of Health and Environmental Control (SCDHEC) identified a problem with proceeding to a final ROD for the DAOU because the D-Area Powerhouse (484-D) would still be operational after approval of the final ROD. The U.S. Department of Energy (USDOE), U.S. Environmental Protection Agency (USEPA), and SCDHEC agreed to pursue an Early Action (EA) instead of a final action to allow the project to remain on track and achieve the targeted footprint reduction in DAOU. The scope of the EA ROD (SRNS 2011a) was to implements land use controls (LUCs) for

D-Area waste units and facilities where previous removal actions had been completed or no additional remedial actions beyond LUCs was needed. The D-Area Powerhouse (484-D) must be in standby mode at least six months following startup of the replacement power plant. Due to its operational status, the remedial decision for the D-Area Powerhouse (484-D) is not included in the DAOU EAROD (SRNS 2011a). In addition while the D-Area Coal Pile Runoff Basin (489-DCPRB) remains operational, 25% of the subunit, identified as the northern segment, is addressed and will be closed under the DAOU EAROD. The remaining 75%, southern segment, along with the other currently active facilities of the D-Area Powerhouse (484-D), will be closed under the DAOU final ROD.

Physical Characteristics

D Area is located in the southwest quadrant of the SRS, approximately 900 m (3,000 ft) east of the nearest site boundary, the Savannah River. The DAOU is approximately 85 hectares (210 acres) and is composed of surface units and source areas in D Area that are potentially responsible for contaminating groundwater. The following subunits comprise the DAOU:

- Bubble Tower Subunit consisting of 717-D Maintenance Facility, D-Area Heavy Water Facility (DHWF), and Fire Fighting Training Facility (approximately 38.6 hectares [95 acres]);
- Moderator Processing Subunit consisting of 420-D Concentrator Building, 420-2D Rework Handling Facility, 421-2D Moderating Handling Storage Building, 421-D Finishing Building, 421-4D Drum Storage Building, and 772-D Control Laboratory/Supervisor's Office (approximately 6 hectares [15 acres]);
- Powerhouse Subunit consisting of 489-DCPRB, D-Area Waste Oil Facility (484-10D) (WOF), D-Area Powerhouse (484-D), water treatment plant, and 483-D Combined Spills (Approximately 40.6 hectares [100 acres];
- Miscellaneous Units consisting of 904-50G Outfall and D-Area Asbestos Pit (080-20G);

- D-Area Inactive Process Sewer Lines (DIPSL), which is located in the Bubble Tower, the Moderator Processing, and the Powerhouse subunits (approximately 4,260 linear m [14,200 linear ft]);
- Electrical Transformers; and
- Miscellaneous Buildings.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the SRS (WSRC 1999) designates the DAOU as being within an industrial area. The future land use for the DAOU is reasonably anticipated to remain industrial with the USDOE maintaining control of the land.

History of Contamination

SRS produced special nuclear materials for the U.S. Department of Defense (USDOD) between 1952 and 1988. The reactors that were used to produce the special nuclear materials required heavy water (deuterium oxide) as a neutron moderator. Historically, heavy water was produced at D Area at the DHWF (i.e., Bubble Tower Subunit). D Area also contained the Heavy Water Rework Facility that purified the SRS inventory of used reactor moderator. The inactive facilities within the DAOU that pose a potential risk to humans and/or the environment are summarized below.

Bubble Tower Subunit operated from the early 1950s until shutdown in January 1982. During its operation the surrounding soil was contaminated by tetrachloroethylene (PCE). The nature and extent of contamination evaluation determined that PCE poses a contaminant migration (CM) problem. There is no risk to future industrial workers or ecological receptors. In addition, there is no principal threat source material (PTSM) associated with this subunit.

The Moderator Processing Subunit was shutdown in the late 1990s. The nature and extent of contamination evaluation determined tritium in concrete and/or soil poses a CM threat at the 420-D, 420-2D, and 421-2D locations.

The Powerhouse Subunit includes the 484-D Powerhouse, the 484-10D WOF, the 489-D Coal Pile Runoff Basin (CPRB), water treatment plant, and the 483-D Combined Spills. The 484-D Powerhouse began operation in 1952, ceased operation in April 2012, and is proposed to be used for military training exercises. The small water treatment plant provided feedwater for the Powerhouse building boilers. Caustic and acid systems were used to regenerate the ion exchange columns used to condition raw water for use in the Powerhouse boilers. The 484-10D WOF, located outside of the Powerhouse on the south side of the building, stored used oil that was burned in the Powerhouse building boilers. The 489-DCPRB is an active facility, currently, receiving runoff from the coal pile south of the D-Area Powerhouse (484-D). Previous operation of the 489-DCPRB has resulted in a metals plume due to low pH infiltration from the basin. Though the quantity of source material was reduced in 2000 (as discussed in Initial Response), the nature and extent of contamination evaluation indicated that arsenic in sediments pose a risk to human and ecological receptors; 2-methylnaphthalene, metals and low pH pose a risk to ecological receptors; and arsenic in surface soil poses a risk to human receptors. An evaluation of the soil at the 483-D Combined Spills area determined that there is no threat to industrial workers or ecological receptors, no contaminant migration threat, and no constituents that constitute PTSM.

The two Miscellaneous Units, 904-50G Outfall and D-Area Asbestos Pit, were removed from operations in 1982 and 1977, respectively. The 904-50G Outfall received process discharges and river water during operation of the bubble towers. There are no refined constituents of concern (RCOCs) for human or ecological receptors at the 904-50G Outfall. No problems were identified that would warrant a remedial action associated with the 904-50G Outfall. The D-Area Asbestos Pit (080-20G) operated between 1973 and 1975 as a disposal site for asbestos insulation and piping from the R Area steamlines. The pit also received asbestos, metal, scrap, and concrete from the bubble towers in 1974. The pit was estimated to contain 3,290 m^3 (4,300 ft^3) of buried waste and has been closed to disposal activities. The D-Area Asbestos Pit (080-20G) was characterized under the Site Evaluation program. The results of the investigation determined that the asbestos pit poses no threat to human health or the environment. However, should asbestos be brought to the surface, there would be potential for exposure.

The D-Area Inactive Process Sewer Lines, composed of vitrified clay pipe and reinforced-concrete pipe, were constructed in 1952 to carry wastewater from various heavy water processing facilities associated with the OU to a drainage ditch south of the 489-DCRB. Process sewer wastewater was contaminated principally with tritium and hydrogen sulfide. Samples were obtained from within the DIPSL manholes and from various locations beneath the DIPSLs. No COCs were identified. However, the manholes associated with the DIPSLs will be plugged and grouted as an engineering control to restrict access to impacted areas (i.e., residual contaminants in the DIPSLs) and for general safety.

Electrical transformer substations were located throughout D Area and were often included with facilities during decommissioning activities. In the 1980s, transformers were switched from PCB oil to mineral oil, where feasible. In 1986, USEPA performed a detailed assessment of SRS compliance with the Toxic Substances Control Act (TSCA) and found records of analysis, storage, and disposal of PCB materials to be in compliance. As of 1996, SRS had replaced or rendered non-PCB all of the site's transformers and large capacitors that were regulated due to PCB content. There are no records indicating a spill or release from the transformers while they were operated with PCB oil; therefore no samples were collected during decommissioning. During pre-work plan characterization, visual inspections of the remaining concrete pads were performed with no evidence of spills on the pads. There are no problems warranting action for the electrical transformer substations.

The D-Area miscellaneous buildings were used for administrative purposes, general storage, etc. These building were classified through the Facility Decommissioning Evaluation process as Simple Model Decommissioning and have been deactivated and decommissioned with concurrence from USEPA and SCDHEC. Simple Model Decommissioning is performed for clean buildings with only normal safety risks associated with decommissioning. No sampling is required for these buildings decommissioned under the Simple Model and there are no problems warranting action.

Initial Response

In 1975, the D-Area Asbestos Pit (080-20G) was closed and backfilled with soil to cover the waste. A maintenance action was performed in 2011 to remove woody vegetation growth and to implement institutional controls at the D-Area Asbestos Pit (080-20G) to prevent the potential for an unacceptable exposure to asbestos if the cover is breached and asbestos containing material is brought to the surface.

In 2000, a maintenance action was performed at the 489-DCPRB to excavate 7,650 m^3 (10,000 yd^3) of coal fines from the 489-DCPRB sediments, significantly reducing the quantity of source material.

A treatability study to address the tritium in concrete and soil at the Moderator Processing Subunit was conducted in two stages during 2009 and 2010. After incorporating lessons learned, a removal action was started in the Moderator Processing Subunit to remove the tritium in concrete and soil with the operation of an On-Unit Thermal Treatment System from October 21, 2010 to September 8, 2011. The purpose of the removal action was to reduce the potential leaching of tritium in vadose zone soils and concrete slabs that would result in maximum contaminant level (MCL) exceedance in the groundwater.

In 2010, a removal action was started in the Bubble Tower Subunit with the installation of an eleven MicroBlower™-equipped soil vapor extraction (SVE) system to remove volatile organic compounds (VOCs). The purpose of the removal action was to reduce the potential leaching of PCE in vadose zone soils that would result in a MCL exceedance in the groundwater. The MicroBlower™ system is anticipated to operate until remedial goals (RGs) are achieved.

In 2011, a removal action was taken in the Powerhouse Subunit with surface water management at the 489-DCPRB, consolidation of the contaminated sediment from the D-006 Outfall (Petroleum Release Site) and 484-10D WOF into the northern 25% of the 489-DCPRB, and application of a soil cover.

Basis for Taking Action

The risks associated with the DAOU as summarized from the EAROD (SRNS 2011a) are provided below and are the basis for taking action at the DAOU.

- PTSM: There are no contaminants that constitute PTSM at the DAOU.
- Human Health Risk: Arsenic associated with the 489-DCPRB poses a risk to the future industrial worker. Subsurface asbestos, at the D Area Asbestos Pit, if brought to the surface would present an exposure risk to human receptors. PCE in the soil near the 717-D Maintenance Shop (Bubble Tower Subunit) and tritium in concrete (420-D/420-2D Facilities of the Moderator Processing Subunit) and soil (420-2D/421-2D Facilities of the Moderator Processing Subunit) pose contaminant migration risks.
- Ecological Risk: Arsenic and 2-methylnaphthalene associated with the 489-DCPRB pose a risk to benthic organisms. Metals (aluminum, beryllium, cobalt, copper, iron, manganese, and zinc) and low pH in surface water present a risk to aquatic ecological receptors.

IV. Remedial Actions

Remedy Selection

Regulatory decisions (i.e., early removal actions) were previously made for the Bubble Tower Subunit, the Moderator Processing Subunit, the Powerhouse Subunit, and Miscellaneous Units and documented in their Action Memorandums (SRNS 2009a, 2009b, 2009c). Cleanup goals established for the DAOU subunits (including goals identified for the early removal actions) are based on industrial land use. Therefore, hazardous substances will remain at the DAOU at levels that post a threat to human health and prevent unrestricted land use. The response action, of LUCs, selected in the EAROD (SNRS 2011a) for a portion of the DAOU will prevent land disturbance activities and protects against unrestricted (i.e., residential) use. This will facilitate protecting the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

In September 2010, SCDHEC identified a problem with proceeding with a final ROD given that the D-Area Powerhouse (484-D) would still be operational after approval of the ROD. Therefore, USDOE, USEPA, and SCDHEC agreed to pursue an EAROD. This would allow the project to remain on track and achieve the targeted footprint

reduction. The scope of the EAROD would apply LUCs for all remaining subunits and areas.

The RCOCs and RGs for the subunits, as identified in the EAROD (SRNS 2011a) are provided in Table O-2. No PTSM is identified for the DAOU. The removal actions would achieve RGs.

An exposure risk will likely be present, if debris is brought up from the subsurface at the D-Area Asbestos Pit.

The RAOs identified in the EAROD (SRNS 2011a) for the DAOU after completion of the removal actions are as follows:

- Protect industrial workers from exposure to asbestos-containing waste in subsurface soil at the D-Area Asbestos Pit; and
- Ensure protection against unrestricted (i.e., residential) land use at all areas in the DAOU.

The removal actions that have been accepted as final actions within the DAOU, and their associated RAOs, are as follows:

- Reduce the potential leaching of PCE in the Bubble Tower Subunit vadose zone soils that would result in an MCL exceedance in groundwater (SRNS 2009a);
- Reduce the potential leaching of tritium in the Moderator Processing subunit vadose zone soils and concrete slabs that would result in an MCL exceedance in groundwater (SRNS 2009b); and
- Prevent exposure of industrial workers to arsenic contaminated soil at D-Area WOF, D-Area Powerhouse (484-D) and ecological receptors to contaminated soil at 489-DCPRB (SRNS 2009c);

The following removal actions have been completed

- Treatment of the tritium contaminated soil at the Moderator Processing Subunit with an on-unit thermal detritiation system;
- Removal of arsenic contaminated soil at the D-Area WOF;

- Consolidation of contaminated soils from D-006 Outfall, D-Area WOF and 489-DCPRB and placement under a 0.6-m (2-ft) soil cover over the 489-DCPRB.

The selected early action for the DAOU as stated in the EAROD (SRNS 2011a) is Land Use Controls (LUCs) for the Bubble Tower Subunit, Moderator Processing Subunit, Northern 25% portion of the 489-DCPRB, Asbestos Pit, DIPSLs, electrical transformer pads, and miscellaneous building pads. The DAOU LUCs will consist of the following:

- Physical access control into D Area. Access is controlled by a fence and guardhouse and is monitored by SRS security personnel. Only authorized personnel may enter.
- Signage and monuments will be located at the DAOU boundaries to alert onsite workers to the presence of hazardous substances and to prevent unknowing entry and unrestricted use.
- Administrative controls as managed through the SRS Site Use/Site Clearance Program to require authorization before beginning any excavation activity at the DAOU.
- Maintenance of the soil covers for the D Area Asbestos Pit, the northern section of the 489-DCPRB, and the Bubble Tower to ensure that there is no erosion damage and to prevent unauthorized excavation or construction activities.
- Plugging and grouting of the manholes associated with the DIPSLs as an engineering control to restrict access to impacted areas and for general safety.
- Site maintenance, such as inspections, general housekeeping, repair of erosion damage and other routine maintenance, is to be conducted as needed.

There is no threat to human health or ecological receptors at the 904-50G Outfall, the DIPSLs outside of the former industrial area, electrical transformer pads and miscellaneous building pads. Therefore, no LUCs are needed for these areas.

Remedy Implementation

Implementation of the remedial actions included the following activities for the specific subunits:

Bubble Tower Subunit

- Installing a SVE system consisting of eleven MicroBlower™-equipped to treat a volume of 3,085 m^3 (4,033 yd^3) of PCE contaminated soil below a surface area of 990 m^2 (11,000 ft^2) (SRNS 2011c).

- Installing a 0.3-hectare (0.7-acre) cover system consisting of a common fill grading layer, low-permeability flexible membrane liner, geocomposite drainage layer, 20-cm (8-in) of common fill, 10-cm (4-in) of topsoil and establishment of vegetation over the soil contamination area to act as a barrier to prevent soil vapor from short-circuiting the shallow SVE well system.

Moderator Processing Subunit

- Excavating tritium contaminated soil and concrete associated with the 420-D Concentrator Building slab, 420-2D Rework Handling Facility Building slab and the 421-2D Moderator Handling and Storage Building and placing it into the On-Unit Thermal Detritiation Units. Four units were constructed and operated for a total of 17 heating campaigns to treat approximately 1,262 m^3 (1,650 yd^3) (SRNS 2011d) of tritium-contaminated soil and concrete to below CM thresholds. It is estimated that the total tritium removed was 472 Ci. Once materials met the criteria for completion, the unit was emptied and the treated material was backfilled into the excavated areas. The last unit was emptied on August 2, 2011.

- Disposing of 89 m^3 (116.7 yd^3) of waste offsite. This waste consisted of low-level radioactive CERCLA waste (i.e. plastic tarp, cast iron drain piping, tritium contaminated equipment, and cesium-137 waste from the 420-2D pad) and mixed waste (i.e. radiologically contaminated lead joints from the 420-D pad).

Powerhouse Subunit

- Reducing the existing coal storage area with a new berm and a new swale that redirects runoff to the southern section of the 489-DCPRB;

- Improving surface water management at the 489-DCPRB;

- Dewatering the northern 25% of the 489-DCPRB by pumping the runoff into the southern section;
- Consolidating the contaminated sediment from the D-006 Outfall (Petroleum Release Site) (4,208 m^3 [5,500 yd^3]) and D-Area WOF (168 m^3 [220 yd^3]) into the northern 25% of the 489-DCPRB; and
- Installing a 1.9-hectare (4.8-acre) soil cover over the northern 25% of the 489-DCPRB consisting of 2 layers – 50 cm (20 in) minimum of compacted common fill topped by 10 cm (4 in) of topsoil; and
- Installing four warning signs.

DIPSL

- Plugging and grouting 40 DIPSL manholes to abandon-in-place.

Asbestos Pit

- Establishing a maintenance program for the 1-hectare (2.5-acre) native soil cover; and
- Installing four warning signs.

Additionally, implementation of the remedial actions at the DAOU includes establishing LUCs for 67 hectares (165 acres) for the DAOU. Figures O-4 and O-5 provide current photographs of the DAOU.

System Operations/Operation and Maintenance

As of August 2012 the Bubble Tower Subunit SVE (i.e., MicroBlower™ system) is in operation. Operation of SVE was started on November 9, 2010 and has removed 38 lbs of PCE. The SVE is anticipated to operate until RGs are achieved.

After remediation activities are complete, only inspection and maintenance activities will be required at DAOU. LUCs include the following:

- Visual inspections for evidence of damage to the 489-DCPRB, Asbestos Pit and Bubble Tower Subunit cover systems due to erosion, settlement or intrusion by

burrowing animals are being performed annually as a minimum and to address upkeep of the vegetative cover and access control barriers (e.g., the warning signs);

- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required; and
- Institutional controls are being enforced to preclude access through the SRS Site/Use Site Clearance program and SRS site security.

The operation and maintenance (O&M) costs associated with the selected remedy for DAOU include (O&M)costs of the soil cover and land use controls and has a ROD estimated present worth of $2,023,888 discounted at 2.7% per year for 200 years of maintenance activities (SRNS 2011a). The actual (O&M) cost cannot be provided since DAOU remedial activities became operable after FY2011.

V. Progress since Last Review

This is the first five-year review. Therefore, there is no previous protectiveness statement.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Reviewed the data associated with the SVE system for the Bubble Tower subunit and the detritiation for the Moderator Processing subunit (discussed below);
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment O-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

DAOU Bubble Tower Subunit

The remedy for the PCE contaminated vadose zone soils of the Bubble Tower Subunit is operation of a network of MicroBlower™ SVE units. This network facilitates breaking of the transport pathway from the source to the groundwater. The approved Removal Action Report (RAR) for the DAOU Bubble Tower Subunit requires the monitoring results from the SVE system be reported in the five-year remedy review report. Attachment O-2 provides the detailed data associated with the operation of this system. The system operated for two months in 2010, eight months in 2011, and eight months in 2012 and has removed approximately 38 lbs of PCE, 8 lbs of TCE and 102 lbs of other contaminants, mainly found in petroleum products.

Moderator Processing Subunit

The remedy for the tritium-contaminated soils of the Moderator Processing Subunit was treatment by on-site detritiation units. The RAR (SRNS 2011d) provides detail on the construction and operation of these units. The RGs of 120 pCi/g for soil and 68,000 pCi/g for concrete were achieved for tritium removal and the soil/concrete returned to the excavated areas (Table O-3). Detailed data tables are available in the RAR.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the site and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The DAOU was inspected by SRNS and USDOE personnel on July 24, 2012 and September 27, 2012, respectively. No issues were identified for the DAOU during this inspection and interviews.

On January 22, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. Two items requiring maintenance activities were identified during the inspection. The maintenance actions have been completed (SRNS 2013). No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, applicable or relevant and appropriate requirements (ARARs), risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the EAROD (SRNS 2011a). There are several facets to the functioning of the remedy at the DAOU.

LUCs were the selected remedy in the EAROD with a requirement to complete the removal actions for subunits (Bubble Tower, Moderator Processing, and Powerhouse). The LUCs are functioning properly to protect industrial workers from exposure to asbestos-containing waste in the subsurface soils of the D-Area Asbestos Pit and to protect against unrestricted land use of all areas of the DAOU.

The operation of the detritiation units has been successful in meeting the RGs for tritium in the Moderator Processing subunit vadose zone soils and concrete slabs. The removal and consolidation of contaminated soils associated with the 489-DCPRB and WOF under a cover system have been successful in addressing the RAOs to prevent exposure to industrial workers and ecological receptors to contaminated soils.

The MicroBlower™ SVE system is removing volatile organic contaminants, including tetrachloroethylene (PCE), from the vadose zone in support of the RAO of reducing potential leaching of PCE in the Bubble Tower Subunit vadose zone soils.

There were no opportunities for system optimization observed during this review.

LUCs that are in place 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 land use controls (SRS Site Use/Site Clearance Program).

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

ARARs for this OU include those in the EAROD as well as those in the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for the three removal actions. Most of the action-specific ARARs for the removal actions have been met. The action-specific ARARS for the removal actions that still must be met and that have been evaluated include: Toxic Air Pollutants standards (SC.R.61-62.5 Standard 8) (associated with the SVE system for the Bubble Tower subunit) and the protection of fish and wildlife (Fish and Wildlife Coordination Act 16USC 661 et seq.) and conservation of endangered or threatened species (16USC 1531) (for both the Bubble Tower subunit and the 489-DCPRB/D-006Outfall/WOF). Location-specific ARARs for all three removal actions have been met. The chemical-specific ARARs will be met and evaluated through the ongoing groundwater monitoring that is part of the D-Area Groundwater OU. For the LUCs in the EAROD, there are neither location-specific nor chemical-specific ARARs. The relevant ARARs are action-specific and are related to the closure and monitoring of landfills, both the cover systems and groundwater. For those ARARs that will remain applicable until RGs have been met, the requirements set forth by the associated regulations are currently being complied with.

More stringent 2012 PRGs/RSLs at the Powerhouse subunit do not impact the protectiveness of the remedy because excavation of the contaminated media from the D-001 Outfall and DWOF subunits and consolidation of this material into the DCPRB with subsequent installation of a soil cover eliminates the human health and ecological exposure pathways. The soil cover at the Asbestos Pit subunit also prevents exposure of human and ecological receptors to contaminants remaining in place. There have been no changes in the MCL for PCE that would impact SVE operation at the Bubble Tower subunit. Similarly, there have been no changes in the MCL for tritium that would impact the treated soil and concrete that was returned to the excavated area at the Moderator Processing subunit. Finally, more stringent PRGs/RSLs would not impact the LUCs that are in place to prevent residential exposure to contaminated media at the DAOU.

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 exposure pathways, land use or contaminant characteristics. No changes in standards or physical conditions of the DAOU have occurred that would affect the protectiveness of the remedy.

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 at the DAOU from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the DAOU.

X. Protectiveness Statement(s)

The remedy at the DAOU OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with LUCs. All threats to contaminated media at the DAOU were addressed by early removal actions and implementation of LUCs through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the DAOU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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

SRNS, 2009a. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for the Volatile Organic Compound-Contaminated Soil at the Bubble Tower Subunit at the D Area Operable Unit (U),* SRNS-RP-2009-00544, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009b. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for the Tritium-Contaminated Soil and Concrete at the Moderator Processing Subunit at the D Area Operable Unit (U),* SRNS-RP-2009-00542, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009c. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for the 489-D Coal Pile Runoff Basin, D-006 Outfall, and 484-10D Waste Oil Facility at the D Area Operable Unit (U),* SRNS-RP-2009-00805, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011a. *Early Action Record of Decision Remedial Alternative Selection for the D-Area Operable Unit (U)*, SRNS-RP-2010-00162, Revision 1.2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011b. *Early Action Land Use Control Implementation Plan for the D-Area Operable Unit (U)*, SRNS-RP-2011-01166, Revision 1.2, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011c. *Removal Action Report for Volatile Organic Compound-Contaminated Soil at the Bubble Tower Subunit of the D-Area Operable Unit (U)*, SRNS-RP-2010-01727, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011d. *Removal Action Report for the Tritium-Contaminated Soil and Concrete at the Moderator Processing Subunit at the D-Area Operable Unit (U)*, SRNS-RP-2011-01485, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Savannah River Site's Responses to the U.S. Environmental Protection Agency's Comments during the Five-Year Remedy Review Report (SRNS-RP-2012-00011) Regulatory Site Inspections (January 15-16, 2013, January 22-23, 2013, and January 29-30, 2013)*, ERD-EN-2013-0016, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

Various – Inspection Data Sheets - *Field Inspection Checklist for D-Area Operable Unit*, ER-IDS-019-072, Inspections begin in 2012 (annually)

Various – Inspection Data Sheets - *Field Inspection Checklist for D-Area Coal Pile Runoff Basin*, ER-IDS-019-067, Inspections begin in 2012 (annually)

Various – Inspection Data Sheets - *Field Inspection Checklist for D-Area Bubble Tower*, ER-IDS-019-068, Inspections begin in 2012 (annually)

Various – Inspection Data Sheets - *Field Inspection Checklist for D-Area Asbestos Pit*, ER-IDS-019-069, Inspections begin in 2012 (annually)

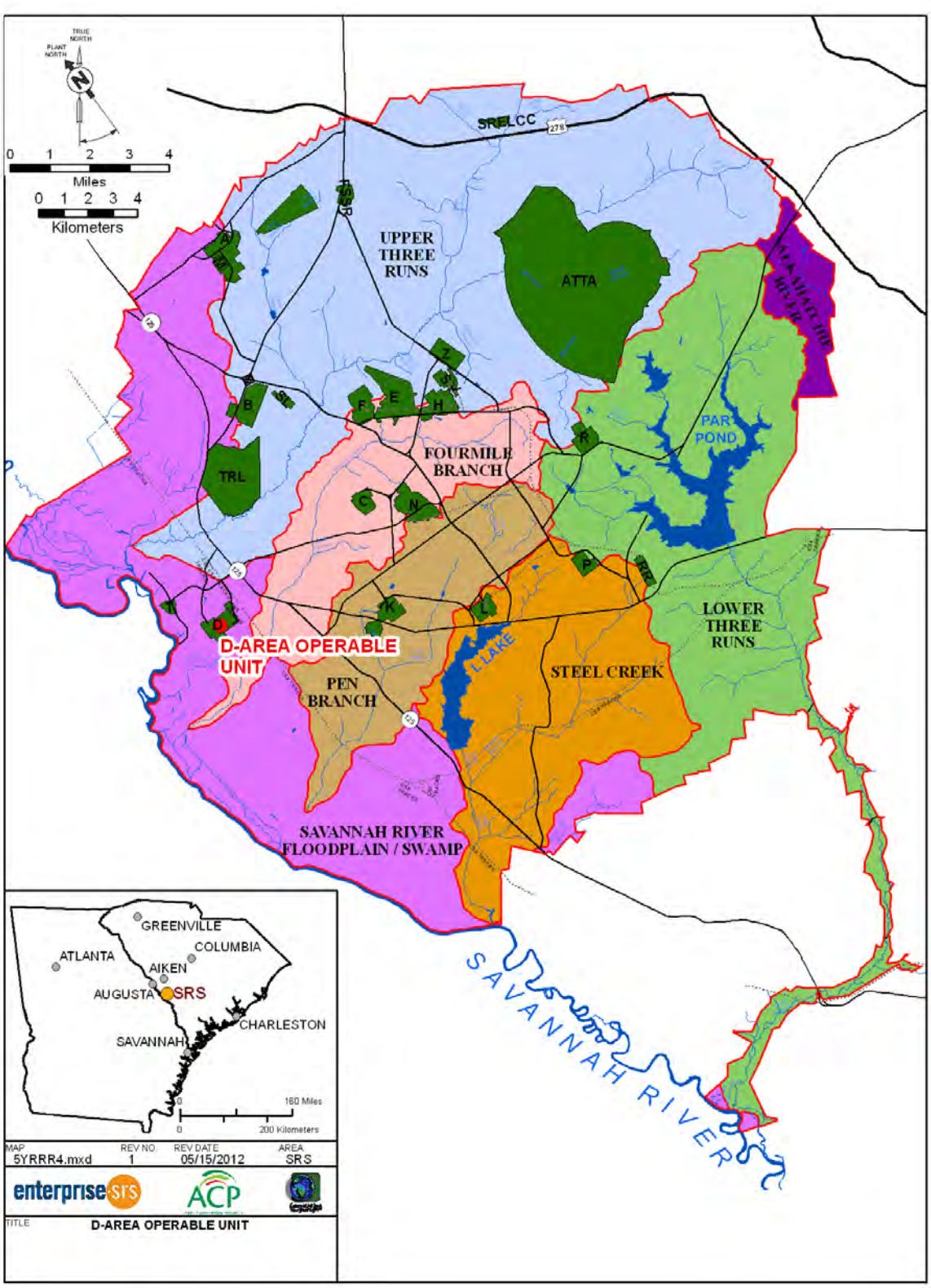


Figure O-1. Location of the DAOU within the Savannah River Site

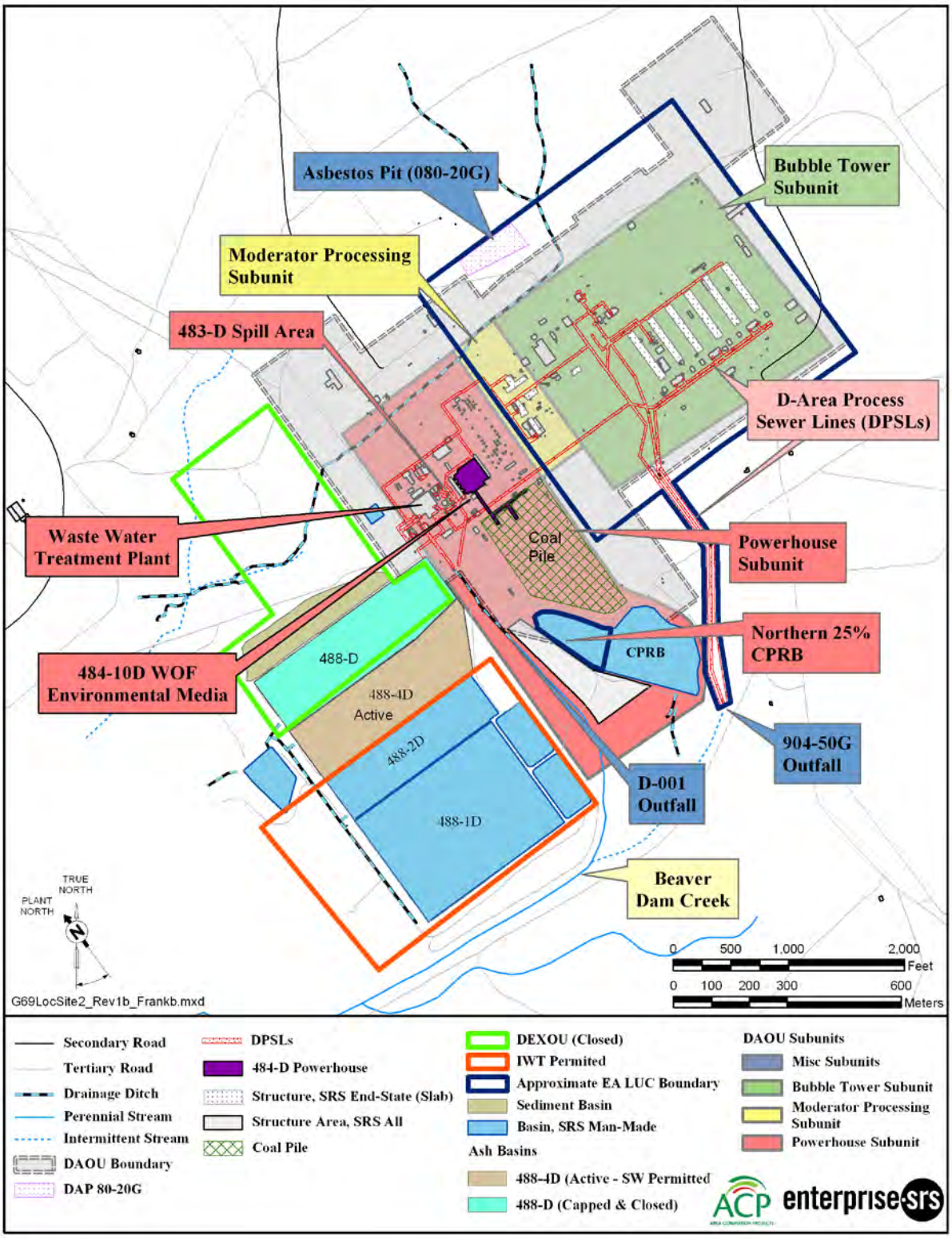


Figure O-2. Location of DAOU Subunits



1982 Aerial Photo



Moderator Sub-unit - 1995



Bubble Towers - 1995

Figure O-3. Early Photos of the DAOU



Figure O-4. 2010 Aerial Photo of DAOU

Bubble Tower Subunit



AsbestosPit



Coal Pile Runoff Basin



Waste Oil Facility



Figure O-5. Current Photographs of the Subunits of the D-Area Operable Unit

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Table O-1. Chronology of OU Events

Event	Date
Bubble Tower Removal Action Start/Complete	July 6, 2010 / November 2, 2010
Bubble Tower Subunit Operations Start/Complete	November 9, 2010 / on-going
Moderator Processing Subunit Removal Action Start/Complete	November 3, 2008 / October 12, 2010
Moderator Processing Subunit Operations Start	March 9, 2009 / August 10, 2011
Powerhouse Subunit Removal Action Start/ Complete	April 11, 2011/ September 8, 2011
Early Action Record of Decision (EAROD) Issuance	September 15, 2011
Final ROD Issuance	TBD
Remedial Action Start/Finish	TBD
Previous Five-Year Reviews	None

Table O-2. RCOCs and RGs for Future Industrial Worker at DAOU

RCOC	Type RCOC	Final RG
Bubble Tower - Soil		
Tetrachloroethylene	CM	20 µg/kg
Moderator Processing		
Tritium concrete Tritium soil	CM CM	68,000 ρCi/g 120 ρCi/g
Powerhouse (489-DCPRB) - Sediments		
Sediments Arsenic 2-Methylnapthalene	HH, Ecological Ecological	8.2 mg/kg 0.07 mg/kg
Powerhouse (489DCPRB) – Surface Water		
Aluminum Beryllium Cobalt Copper Iron Manganese Zinc pH	Ecological Ecological Ecological Ecological Ecological Ecological Ecological Ecological	0.087 mg/L 0.00053 mg/L 0.023 mg/L 0.00362 mg/L 1.0 mg/L 0.12 mg/L 0.0327 mg/L 6.5-9.0

Table O-3. Summary of Confirmatory Sampling for On-Site Thermal Detritiation Treatment of Soils and Concrete associated with the Moderator Processing Subunit (SRNS 2011d)

Event #	Treatment Cell #	Media	# of Records	Maximum Concentration (pCi/g)	Minimum Concentration (pCi/g)
DAOU-HR-TS	2	Soil	5	72.9	31.2
	3	Concrete	2	724	640
	4	Concrete	2	29.7	19.9
		Soil	2	39.2	35.1
	1	Concrete	11	17.4	ND
		Soil	4	38.4	9.88
DAOU-HR-TS10	4	Soil	5	104	77.2
DAOU-HR-TS11	1	Concrete	7	189	10.3
	1	Soil	5	55.1	17.5
	3	Soil	5	ND	ND
	2	Soil	5	15.9	7.79 (J)
	4	Soil	5	67.7	22.6
	1	Soil	5	64.3	21.9
	2	Soil	5	7.14 (J)	5.1 (J)
	3	Soil	4	5.48	4.4
DAOU-HR-TS2	1	Soil	4	54.4	12
DAOU-HR-TS3	1	Soil	5	29.3	15.2
DAOU-HR-TS4	2	Soil	5	133	68.3
DAOU-HR-TS5	1	Soil	5	40.2	19.7
DAOU-HR-TS9	3	Soil	3	69.8	45.3
		Concrete	2	48.9	40.7
	1	Concrete	2	541	119
	2	Soil	4	142	102

Note: Sampling events occurred over multiple dates. Thus, multiple listing of a treatment cell for a single media within a single event indicates separate sampling events.

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit

I. SITE INFORMATION			
Site Name:	**D-Area Operable Unit**	**Date of Inspection:**	**07/24/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #63**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 95°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Soil Vapor Extraction, On-Unit Thermal Detritiation Unit, Consolidation

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance*, ER-SOP-019 and *D-Area Coal Pile Runoff Basin Field Inspection Checklist*, ER-IDS-019-067, *D-Area Bubble Tower Field Inspection Checklist*, ER-IDS-019-068, *D-Area Asbestos Pit Field Inspection Checklist*, ER-IDS-019-069

Attachment O-1 Five-Year Review Site Inspection Checklist – D-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 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per 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: SCDHEC Air Quality Permit, NPDES Permit SC 0000175

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☒ Air	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Water (Effluent)	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks:

10. Daily Access/Security Logs: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Daily Operational Log

Attachment O-1. Five-Year Review Site Inspection Checklist – D-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
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☒ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition_____

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area 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.) Walk-through

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/27/12 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area 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: Vegetation mowed routinely.
VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent Depth Remarks:
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths Widths Depths Remarks:
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent Depth Remarks:
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent Depth Remarks:
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent Depth Remarks:

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

_____

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☐ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:_____
E. Gas Collection and Treatment ☐ Applicable ☐ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:_____
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:_____

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☒ Good Condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☒ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☒ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☒ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☒ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: SVE systems at the Bubble Tower Subunit

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment O-1. Five-Year Review Site Inspection Checklist – D-Area Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedial action for the DAOU is SVE with MicroBlowers™ is to prevent the migration of VOCs from the contaminated soils to groundwater above the MCLs, and institutional controls and a 1-foot soil cover to protect remedial workers and future industrial workers from unacceptable exposure to VOCs. The SVE system is operating in the Bubble Tower Subunit and is functioning as expected.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures are adequately maintaining the integrity of the Bubble Tower Subunit SVE system. The O&M procedures consisting of annual site inspections and site maintenance (cover system and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. There are no issues requiring corrective actions
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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Attachment O-2. D-Area Bubble Tower Subunit SVE Monitoring Report

MicroBlower™-equipped soil vapor extraction (SVE) wells are installed and operating at 11 locations associated with the D-Area Bubble Tower Subunit of the D-Area Operable Unit (DAOU). The SVE system is located within the areal extent of the vadose zone contaminated with tetrachloroethylene (PCE). Construction was completed on November 8, 2010 with operation of the SVE system beginning November 9, 2010.

The Bubble Tower Subunit is approximately 38.6 hectares (95 acres) in area and includes the bubble towers, firefighting training facility, and the 717-D maintenance facility. These facilities have undergone deactivation and demolition and only the concrete building slabs and residual soil contamination remain. An area east of the 717-D Maintenance Facility has been identified as a source zone for PCE contamination and the focus of the SVE operations. In general there is a vertical trend of increasing concentration with depth in the soil column to the water table. It is estimated the area requiring treatment is approximately 980 m^2 (10,890 ft^2) with a total depth of 3 m (10 ft).

Based on the contaminant fate and transport evaluation, PCE was identified as a contaminant migration remedial contaminant of concern (CM RCOC) exceeding the CM threshold of 0.02 mg/kg in soil (SRNS 2011a). The remedial action objective (RAO) is to prevent migration of PCE from vadose zone soil to groundwater at concentrations exceeding MCLs.

The SVE wells are constructed of 0.6-m (2-in) schedule 40 PVE with 1.5 m (5 ft) screens placed 1.5 to 3 m (5 to 10 ft) below ground surface (bgs) for each well. The depth to water is approximately 3 to 3.6 m (10 to 12 ft) bgs (SRNS 2009). The MicroBlower™ system will likely remove the bulk of the PCE within the vadose zone early in the operation period, an extended time period of operation may be needed to reach the remedial goal (RG). At the time the representatives from U.S. Department of Energy, U.S. Environmental Protection Agency, and South Carolina Department of Health and Environmental Control determine that degradation to groundwater has been halted and/or the threat to groundwater has been eliminated, SRS will collect confirmatory soil samples to ensure the RG of 0.02 mg PCE/kg of soil has been met.

Data Summary

Calculations based on flow rates, run times and contaminant concentrations, have determined that approximately 38 lbs of PCE have been removed from the soils at the Bubble Tower Subunit over the period 2010 through 2012 (Table O-2-1). Eight pounds of trichloroethylene (TCE) and an additional 107 lbs of other contaminants have also been removed (Table O-2-2). The majority of these contaminants constitute those compounds typically found in petroleum products.

The average concentration of TCE for the eleven SVE wells during 2010 at the start of remediation was 3.19 ppmv and the average PCE concentration was 4.38 ppmv. During 2011, the average concentration for TCE was 0.29 ppmv and for PCE 4.13 ppmv from the SVE wells. And finally, during 2012, the average concentrations for TCE was 0.043 ppmv and for PCE 0.32 ppmv from the SVE wells. As noted the concentrations of both TCE and PCE have decreased significantly. These analyses represent an approximate 100 times decrease in TCE concentrations over the period and over a 10 times decrease in PCE concentrations.

Summary of Operation

The DAOU Bubble Tower Subunit remediation by SVE via eleven 0.6-m (2-in) SVE wells with MicroBlower™ was initiated on November 9, 2010. An internal exemption from air permitting based upon calculations of potential to emit (PTE) of TCE and PCE was obtained prior to startup. The MicroBlower™ ran without incident from November 9, 2010 until December 17, 2010. A reevaluation of the PTE for air emission was conducted in this time frame considering the possible impact of petroleum products known to have been in the area. All eleven SVE wells were sampled on December 15, 2010 and the vapor samples analyzed. On December 18, 2010 all eleven MicroBlower™ were shut down to evaluate the results of the vapor sampling and the reconsideration of possible air emissions. An additional sampling event occurred on March 3, 2011 when the MicroBlower™ were temporarily restarted for the sampling of vapors from each of the SVE wells. The internal exemption was revised May 24, 2011 to account for additional constituents from the co-located petroleum products. The MicroBlower™ remained down until May 26, 2011 when all eleven MicroBlower™ were brought back on-line.

The MicroBlower™ have operated since May 26, 2011 through the duration of this reporting of August 31, 2012. Individual MicroBlower™ have gone down on occasion due to a variety of

causes, but all eleven MicroBlower™ have operated from 10,000 to 12,000 hours since starting on November 9, 2010. This represents a 71% uptime utility for the entire period. However since the restart of the MicroBlower™ in May 2011, the uptime has been 93%.

An additional sampling event was conducted on July 18, 2012 for analysis of vapors from the MicroBlower™ at each SVE well.

References

SRNS, 2009. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan and RFI/RI Report with Baseline Risk Assessment for the D-Area Operable Unit (U)*, WSRC-RP-2007-4079, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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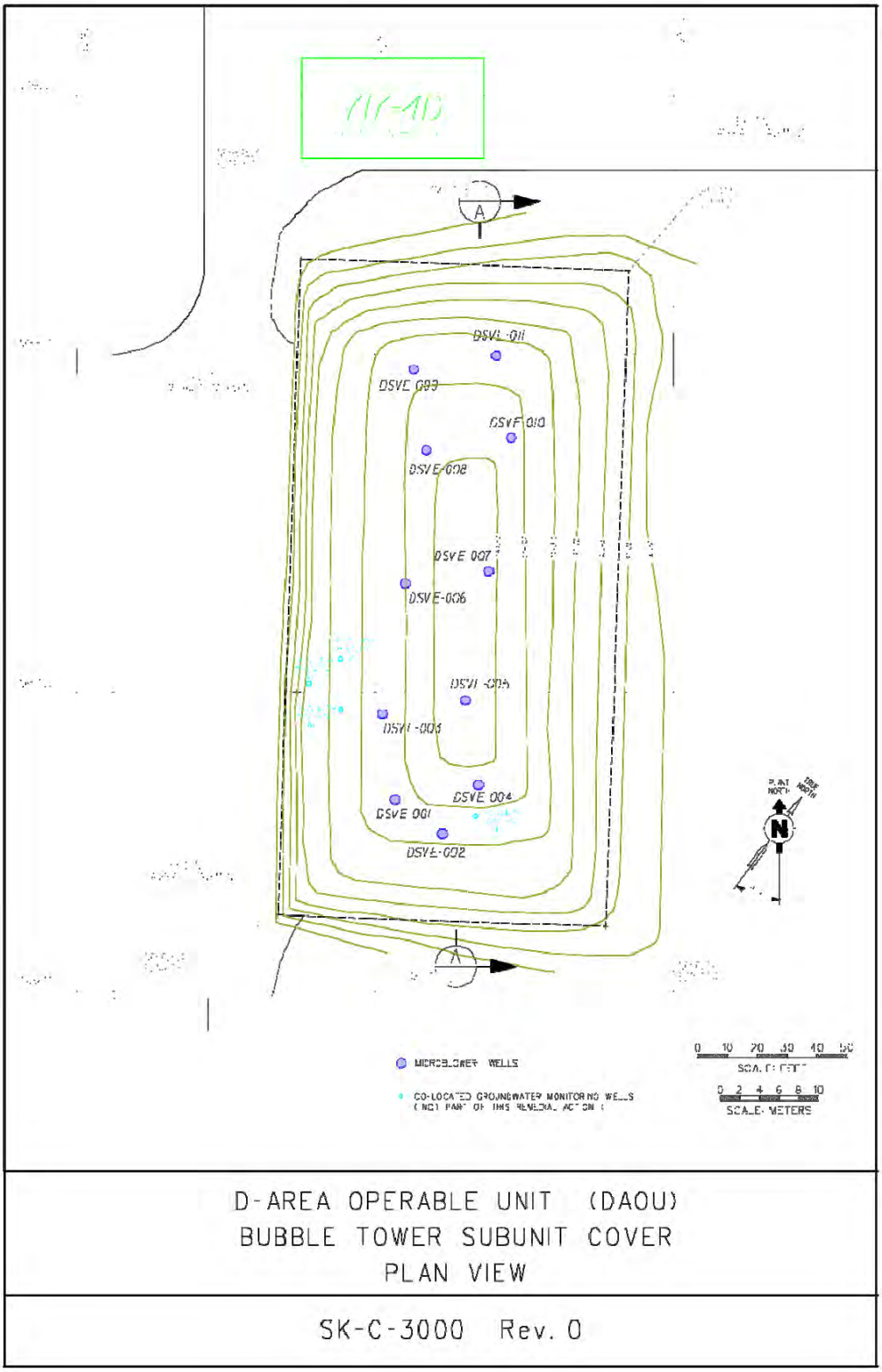


Figure O-2-1. Layout of SVE wells for the DAOU Bubble Tower Subunit MicroBlower™ system.

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Table O-2-1. Operating Data and PCE Concentrations in the Off-Gas for the DAOU Bubble Tower Subunit SVE wells per Well per Year

Unit Emissions	Average Flowrate (cfm)	Vacuum Pressure (in H2O)	PCE (ppmv)
DSVE 001 (2010)	7	11.5	0.057
DSVE 001 (2011)	6.1	1	0.0062
DSVE 001 (2012)	3.5	10.8	0.012
DSVE 002 (2010)	11.4	12	0.048
DSVE 002 (2011)	7.51	1.5	0.0078
DSVE 002 (2012)	3.35	13.5	0.0026
DSVE 003 (2010)	14	10.5	0.434
DSVE 003 (2011)	8.68	3	0.008
DSVE 003 (2012)	1.25	6	0.017
DSVE 004 (2010)	5.5	15	0.059
DSVE 004 (2011)	5.1	1	0.0038
DSVE 004 (2012)	3.29	13.5	0.0034
DSVE 005 (2010)	8.8	13	0.056
DSVE 005 (2011)	6.85	1	0.0044
DSVE 005 (2012)	3.76	14	0.0044
DSVE 006 (2010)	8.8	15	0.189
DSVE 006 (2011)	5.93	3	0.0702
DSVE 006 (2012)	1.18	12.5	0.049
DSVE 007 (2010)	8.1	14	0.426
DSVE 007 (2011)	6.11	0.5	0.0232
DSVE 007 (2012)	4.12	13	0.0036
DSVE 008 (2010)	9.3	14.5	
DSVE 008 (2011)	5.4	4.5	44.195
DSVE 008 (2012)	1.5	12.5	2.9
DSVE 009 (2010)	4	15	30.251
DSVE 009 (2011)	2.66	0.5	0.2112
DSVE 009 (2012)	1.32	13	0.55
DSVE 010 (2010)	6	14	4.286
DSVE 010 (2011)	3.87	2	0.5798
DSVE 010 (2012)	1.74	13	0.0026
DSVE 011 (2010)	2.5	15	8.038
DSVE 011 (2011)	1.91	1	0.2996
DSVE 011 (2012)	1.33	9.5	0.0074

Note: The highlighted flow rates are estimated values based on 2010 and 2012 flow rates.

Table O-2-2. Summary Table of Contaminant Concentrations in the Off-Gas of the DAOU Bubble Tower Subunit SVE System

Year	PCE (lbs)	TCE (lbs)	BTEX (lbs)	Hexane (lbs)	Methyl Isobutyl Ketone (lbs)	Methyl Ethyl Ketone (lbs)	Isopropyl benzene (lbs)	Total Contaminants (lbs)
2010	4.66	6.26	0.00	0.00	0.00	0.00	0.00	*10.91*
2011	32.76	1.84	41.43	37.90	5.51	0.17	0.28	*119.89*
2012	0.81	0.08	13.38	7.33	0.85	0.06	0.12	*22.63*
Totals	*38.23*	*8.18*	*54.81*	*45.23*	*6.36*	*0.22*	*0.40*	*153.43*

Note: Constituent data other than PCE and TCE are not available for 2010

E-AREA LOW LEVEL WASTE FACILITY (643-26E) OPERABLE UNIT

I. Introduction

This report is the first five-year review for E-Area Low Level Waste Facility (LLWF) (643-26E) (Slit Trench Disposal Units 1 - 5). The review was conducted in September 2012. Contaminants have been left in place and radiological contaminated waste has been disposed at the E-Area LLWF (Slit Trench Disposal Units 1 – 5) at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the E-Area LLWF (Slit Trench Disposal Units 1 – 5) is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table P-1 lists the chronology of site events for the E-Area LLWF (Slit Trench Disposal Units 1 – 5).

III. Background

The E-Area LLWF is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulated unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The E-Area LLWF is not identified as a Solid Waste Management Unit under the Resource Conservation and Recovery Act (RCRA). Therefore, an SRS RCRA permit modification was not required. The E-Area LLWF was not part of the 1993 FFA because the United States Department of Energy (USDOE) operates and maintains the facility under the authority of the Atomic Energy Act (AEA) and in accordance with USDOE Order 435.1, *Radioactive Waste Management*.

Physical Characteristics

The E-Area LLWF OU is located in the central region of the SRS known as the General Separations Area (GSA), approximately 9.6 km (6 mi) from the nearest site boundary, as shown in Figure P-1. The E-Area LLWF is comprised of 0.81 km^2 (200 acres), although only 0.40 km^2 (100 acres) have been developed for waste disposal. Over the life of the E-Area LLWF, additional disposal units will be constructed as needed.

The E-Area LLWF is located in an area with low to moderate topographic relief, and is drained by several perennial streams. The Slit Trench Disposal Units are remote from standing groundwater and conducive to controlled surface water runoff during storm events. The area slopes from an elevation of about 85.9 m (282 ft) in the southernmost corner to an elevation of 74.4 m (244 ft) in the northern most corner. The site is bordered by three streams with several intermittent streams present within the area boundary (Figure P-2). Runoff is to the north toward Upper Three Runs, to the east toward Crouch Branch, and to the west toward an unnamed branch. Crouch Branch and the unnamed branch discharge into Upper Three Runs. Upper Three Runs is approximately 743.1 m (2,438 ft) north of the facility boundary. The nearest perennial stream is approximately 361.8 m (1,187 ft) northeast of the boundary.

The E-Area LLWF is located along a topographic ridge near a groundwater divide. Shallow groundwater beneath the E-Area LLWF flows northerly, toward Upper Three Runs. The average depth from land surface to the water table beneath the Slit Trench Disposal Units is 16.8 m (55 ft) to 19.8 m (65 ft).

The Slit Trench Disposal Units are below-grade earthen disposal units that are used for disposal of USDOE operational low-level radioactive waste and may be used for disposal of CERCLA regulated low-level radioactive waste.

Five Slit Trench Disposal Units, designated Slit Trench Disposal Units 1 – 5, have been filled to design capacity and have stormwater runoff covers installed. Five other disposal units, designated Slit Trench Disposal Units 6 – 9 and 14, have been sited and waste has been placed within all five of these units. The Slit Trench Disposal Units are identified in Figure P-3. Each Slit Trench Disposal Unit is approximately 6.1 m (20 ft) deep, 47.9 m

(157 ft) wide, and 199.9 m (656 ft) long, and is separated into five individual sections. Each individual section is approximately 6.1 m (20 ft) deep, 6.1 m (20 ft) wide and 199.9 m (656 ft) long (Figure P-4). Approximately 3 m (10 ft) to 4.3 m (14 ft) of undisturbed soil separates each individual disposal section from the next. The excavated soil generated during disposal trench construction is stockpiled for later placement over the disposed waste.

Land and Resource Use

The current land use for the E-Area LLWF is industrial. According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for the E-Area LLWF is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

The E-Area LLWF is currently in the operational phase and access is controlled by SRS facility security and administrative controls. Additional land use controls are not part of the interim remedial action. A final remedial action will be evaluated and conducted in the future for the entire E-Area LLWF according to the requirements of the FFA. The Land Use Control Implementation Plan will be deferred until final closure of the entire E-Area LLWF.

There is no current or projected future use of the groundwater or surface water as a drinking water source at the E-Area LLWF. According to the Land Use Control Assurance Plan (WSRC 1999), SRS property is to be owned and institutionally controlled by USDOE.

History of Contamination (Slit Trench Disposal Units Operations)

Radioactive waste disposal operations at the E-Area LLWF began in 1994. The first Slit Trench Disposal Unit received waste in December 1995. The Slit Trench Disposal Units receive low-level radioactively contaminated soil, rubble, wood debris, concrete, equipment, and job control waste (e.g., contaminated protective clothing, plastic sheeting). The waste is disposed of as bulk waste or contained within B-25 boxes, B-12

boxes, 55-gallon drums, Sealand containers and other metal containers. Figure P-5 depicts waste being placed in an open Slit Trench Disposal Unit during active operation.

The Slit Trench Disposal Units have curie inventory limits established in the Performance Assessment (PA), prepared in accordance with USDOE Order 435.1, *Radioactive Waste Management*. When a Slit Trench Disposal Unit reaches the disposal limit established by the PA (either by the sum of fractions of the curie limit to the actual curie inventory or waste volume), the trench is filled with clean soil. There is no single curie limit for a Slit Trench Disposal Unit. The curie limit for each Slit Trench Disposal Unit is specific for each radionuclide and is controlled using a sum-of-fractions technique to ensure each radionuclide remains below the disposal limit established by the PA for that radionuclide. Radionuclide inventory in a Slit Trench Disposal Unit is controlled by waste acceptance criteria and active management of waste receipts to ensure that limits are never exceeded.

Slit Trench Disposal Units 1 – 5 were determined to be operationally closed when the volume or inventory capacity for each disposal unit was reached. The volume capacity for each Slit Trench Disposal Unit will vary from the nominal capacity. Table P-2 provides the date each Slit Trench Disposal Unit was operationally full, the total volume disposed, the total radionuclide inventory, and the sum-of-fractions.

Initial Response

In accordance with USDOE Order 435.1, the E-Area LLWF is designed, operated, and maintained in a manner that is protective of human health and the environment. Closure of the E-Area LLWF under USDOE Order 435.1 will be conducted in three phases: operational closure, interim closure, and final closure. The E-Area LLWF is currently in the operational period and waste disposal is ongoing. With the exception of Slit Trench Disposal Units 1 – 5 and the Naval Reactor Components Area (643-7E), all other disposal facilities in the E-Area LLWF continue to receive waste.

Operational closure will be conducted during an approximately 30-year operation period as the E-Area LLWF disposal units are filled. Operational closure for the Slit Trench Disposal Units occurs in stages. During disposal activities, trench excavation begins at one end of the trench section and only proceeds as needed toward the other end of the

trench section in order to minimize the time the trench section is open. Waste placement begins at one end of the trench section and proceeds toward the other end. Bulk waste is pushed into the trench section from one end. Containerized waste and large equipment are typically placed in one end of the trench section with a crane. Eventually, containerized waste areas of the trench section are filled in with either bulk waste or clean soil to fill the voids between adjacent containers and the trench section wall. Slit Trench Disposal Units are typically filled to within 1.2 m (4 ft) of the ground surface with waste and backfilled with soil to grade.

Once a section of the Slit Trench Disposal Unit is filled, the clean soil stockpiled during trench section construction is bulldozed in a single lift over that section to produce a minimum 1.2 m (4 ft) thick clean soil layer over the waste (i.e., operational soil cover). The operational soil cover is graded to provide positive drainage off and away from the disposal operation. Subsequent trench sections are filled with waste, covered with an operational soil cover, and graded to promote positive drainage until the entire trench section is filled and covered. The only mechanical compaction that the soil and waste in the trench section receive is from the bulldozer and other heavy equipment moving over the top of a completely backfilled trench. Once a Slit Trench Disposal Unit (i.e., set of five individual sections in the approximately 47.9 m [157 ft] wide by 199.9 m [656 ft] long footprint) has been filled to curie or volume capacity limits and completely covered with a nominal 1.2 m (4 ft) soil cover, it is determined to be operationally closed by the USDOE.

Basis for Taking Action

The E-Area LLWF Slit Trench Disposal Units were approved in 1996 to receive CERCLA waste per the CERCLA Off-Site Rule (OSR), 40 Code of Federal Regulations § 300.440. However, in February 2007, the United States Environmental Protection Agency (USEPA) sent a Notice of Unacceptability (NOU) to the USDOE making the E-Area Slit Trench Disposal Units unacceptable for the receipt of CERCLA waste. The USEPA's NOU stated that through reviews and communications, it was determined that tritium had migrated from the Slit Trench Disposal Units into the vadose zone beneath

the disposal units. The USDOE, however, determined that the tritium migration was expected and consistent with predictions made by the PA, and no exceedance of the USDOE Order 435.1 performance measures had occurred. In July 2007, representatives from the USDOE, USEPA and South Carolina Department of Health and Environmental Control (SCDHEC) met and resolved issues concerning the disposal of CERCLA waste in the Slit Trench Disposal Units. As part of the agreement, the USDOE placed the entire E-Area LLWF on the FFA Appendix C list (satisfying the OSR provision for inclusion in an enforceable agreement). Consequently, the USEPA restored the OSR Acceptability for the Slit Trench Disposal Units, allowing the disposal units to receive CERCLA waste.

In accordance with USDOE Order 435.1, the E-Area LLWF is designed, operated, and maintained in a manner that is protective of human health and the environment. As part of the regulatory agreement for receipt of CERCLA waste, USDOE agreed to evaluate placement of operational stormwater runoff covers over the Slit Trench Disposal Units that have reached operational design capacity as an interim remedial action to mitigate the tritium migration. Design capacity is determined when the curie limit or volume capacity for each Slit Trench Disposal Unit is reached. The curie limit for a Slit Trench Disposal Unit is specific for each radionuclide and is controlled using a sum-of-fractions technique to ensure each radionuclide remains below the disposal limit established by the PA for that radionuclide. This interim remedial action will increase the protection of human health and the environment by adding additional barriers to water infiltration and will significantly reduce the migration of tritium in the vadose zone. The interim remedial action serves as an enhancement to the current protection measures under USDOE Order 435.1. In addition, the agreement to place the E-Area LLWF in the FFA increases regulatory participation in the final closure decisions for the entire E-Area LLWF. In all other respects, the USDOE will continue to operate the E-Area LLWF under its AEA authority.

IV. Remedial Actions

Remedy Selection

The interim remedial action objective established by the Interim Record of Decision (IROD) (SRNS 2009) and Explanation of Significant Differences (ESD) (SRNS 2010a) is as follows:

- Further reduce stormwater infiltration for Slit Trench Disposal Units 1 – 5 by enhancing stormwater runoff during the E-Area LLWF operational period.

Remedy Implementation

The selected interim remedial action was implemented to meet the interim remedial action objective and included the following activities (SRNS 2012):

- Grading the operational soil cover to promote drainage off the Slit Trench Disposal Units;
- Placing grading fill and structural fill over the graded operational soil cover;
- Placing a low-permeability geosynthetic stormwater runoff cover over the structural fill;
- Installing sand on the runoff covers to prevent uplifting from wind;
- Installing and sealing of rubber boots at all cover penetrations (e.g., for lysimeters and neutron probe boreholes) to prevent intrusion of water;
- Installing concrete drainage channels around the perimeter of the covered areas;
- Anchoring the runoff covers to embedded concrete and to the drainage channels;
- Placing riprap where drainage channels open to existing earthen ditches;
- Installing warning barricades, signs, and chains around the covered areas;
- Vegetating disturbed areas outside of the covers, drainage channels, and trenches to prevent erosion; and

- Installing non-slip walkways for operations personnel on the liner for liner protection from pedestrian traffic.

Figure P-6 depicts the stormwater runoff covers for Slit Trench Disposal Units 1 – 5.

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 (SRNS 2010b, SRNS 2012).

The following maintenance activities are ongoing:

- Annual visual inspections of the runoff covers and drainage systems for damage (i.e., tears, cracks) and ineffective drainage (i.e., standing water),
- Necessary repairs to the runoff covers and drainage system for the duration of the operational period, and
- Inspections of warning barricades, including sign postings and chains around the covered areas, to prevent equipment and vehicular traffic on the cover system.

The operation and maintenance (O&M) costs associated with the selected interim remedial action for the E-Area LLWF (Slit Trench Disposal Units 1 – 5) has an ESD estimated present worth of $334,000 (direct dollars) discounted at 2.7% per year for 25 years. There were no repairs performed on the E-Area LLWF (Slit Trench Disposal Units 1 – 5) stormwater runoff covers during FY2011. Because no repairs have been required to date, no additional O&M costs to the E-Area LLWF operations have been incurred associated with maintain the stormwater runoff covers on the Slit Trench Disposal Units 1 -5. Therefore, there are no O&M costs to compare.

Based on the observed lifting of the covers during wind events and weathering due to sun exposure, it is anticipated that the covers will not be intact for the original project duration of 25 years without substantial repair and rework. The observed subsidence has not compromised the integrity of the covers; however, it is anticipated that with time and additional settlement, rework of the soil beneath the covers will be necessary if positive drainage off the disposal units is to be maintained. As such, 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

This is the first review for the E-Area LLWF (Slit Trench Disposal Units 1 – 5). There are no previous protectiveness statements concerning 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 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 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

Based on a review of the FY2010 PA Annual Review (SRNS 2011), 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 Marshall Looper, the O&M facility Engineering Manager, and with Lee Fox, the O&M facility Deputy Director, on October 9, 2012 at the

O&M organization offices. The E-Area LLWF was inspected by SRNS on July 3, 2012 and DOE SR personnel on September 17, 2012. The issues identified for the E-Area LLWF are listed in Table P-3 and are further discussed in Sections VII and VIII.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by DOE SR and SRNS personnel. No significant problems regarding the E-Area LLWF were identified during the inspection. 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 a review of the FY2010 PA Annual Review (SRNS 2011), vadose zone monitoring indicates that migration of radionuclides remain within the PA predictions and continue to meet the performance objectives.

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 short-term and long-term 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 a review of the FY2010 PA (SRNS 2011), 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-meter 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.

VII. Issues

The following issues have been identified during this remedy review:

- Maintenance of the stormwater runoff covers is problematic. Since the only mechanical compaction that the soil placed 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 reaching design capacity. Subsidence beneath the stormwater runoff covers is already evident (see Figures P-7 and P-8) at Slit Trench Disposal Units 1 – 5, and water is pooling in these locations. 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.

- During wind events, the covers have been observed to lift substantially, resulting in mechanical stresses to the cover materials. Sandbags are placed as needed on the covers during high winds to mitigate damage. Multiple fasteners for the stainless steel anchor strips have come off, though the anchor strips are still intact and functioning as designed. With the additional weathering due to sun exposure, the covers are not expected to meet the original project life of 25 years.

- 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 soil cover was planned since the anticipated subsidence would be readily accessible for maintenance and would be cost efficient.

VIII. Recommendations and Follow-up Actions

Table P-3 presents the recommendations for the E-Area LLWF Slit Trench Disposal Units 1- 5.

IX. Protectiveness Statement(s)

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 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 currently in the operational phase, unit specific land use controls have been deferred until final closure of the entire E-Area LLWF. However, access is controlled by SRS facility security and administrative controls.

X. Next Review

The next five-year review is scheduled for no later than January 2019.

XI. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2009. *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

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, March 2013, 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

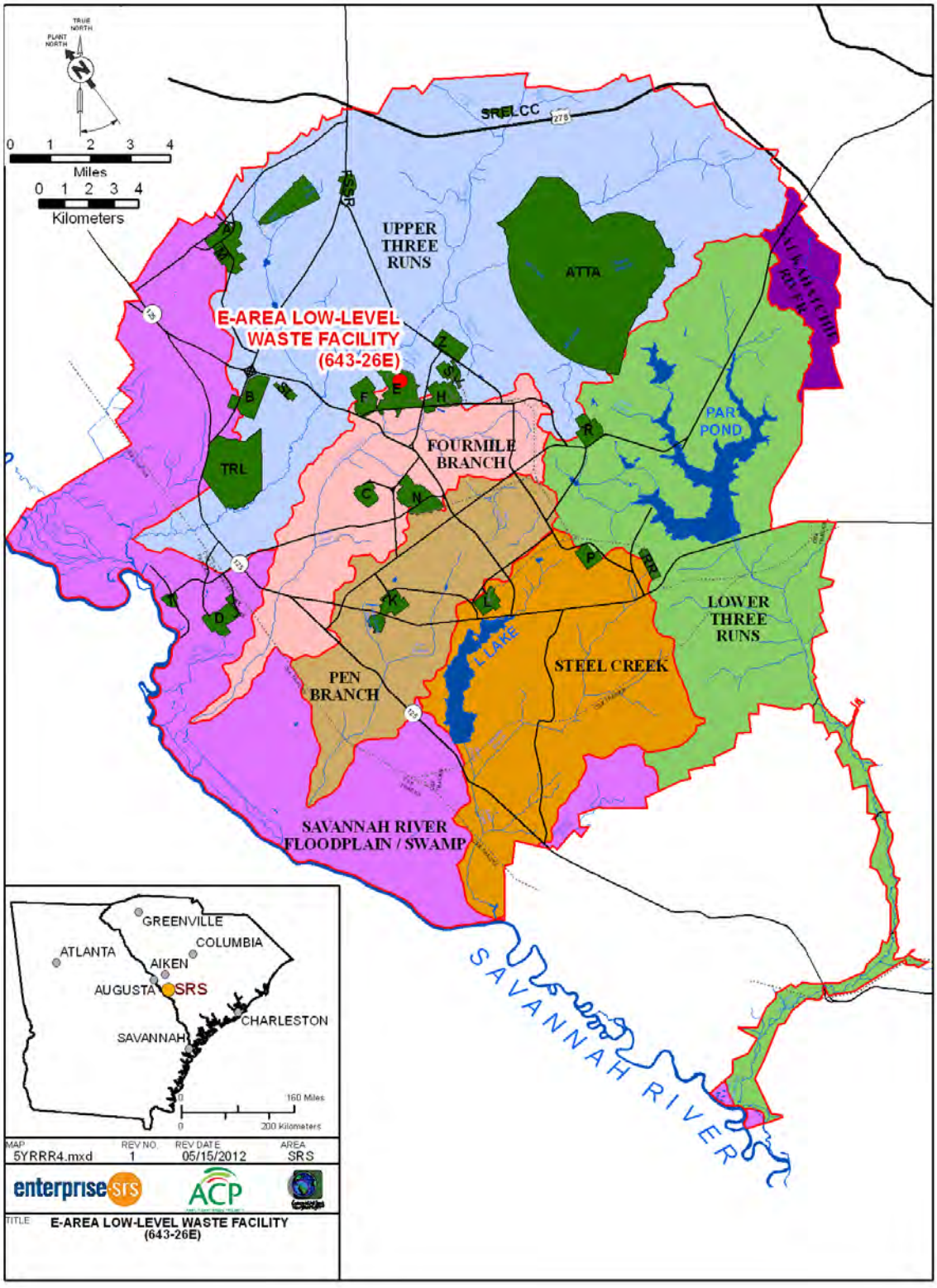


Figure P-1. Location of the E-Area LLWF at SRS

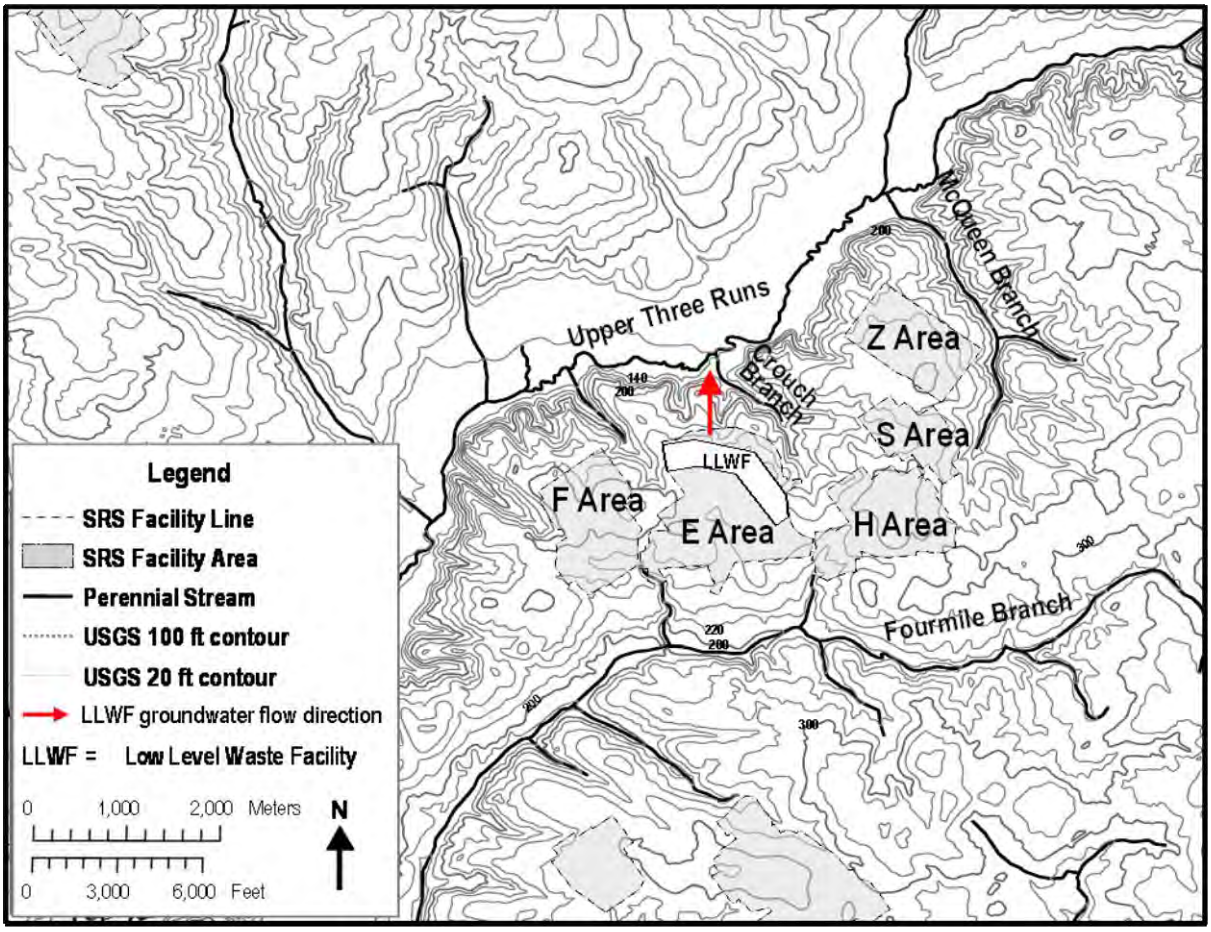


Figure P-2. Upper Three Runs Watershed Stream Locations

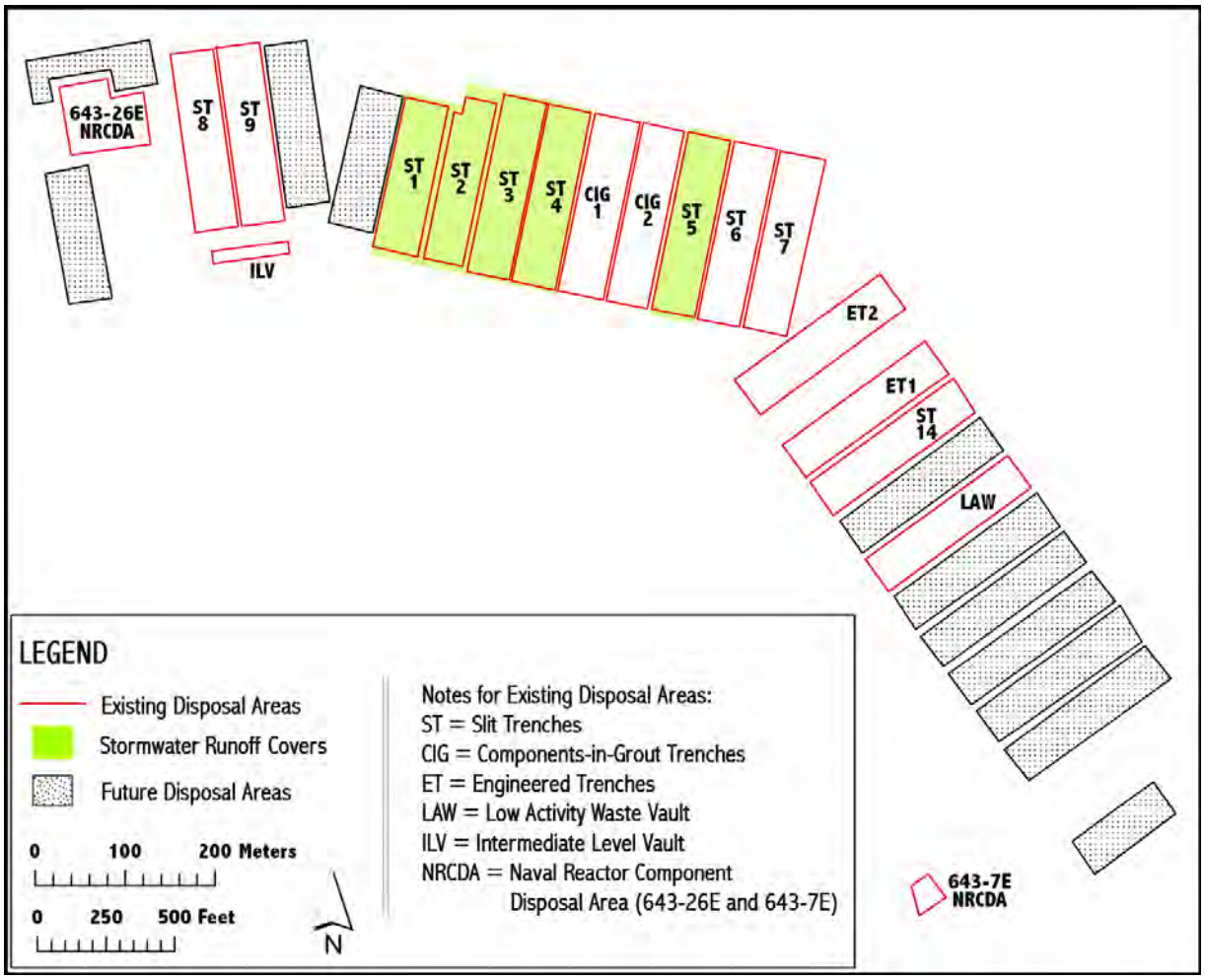


Figure P-3. Layout of the E-Area LLWF

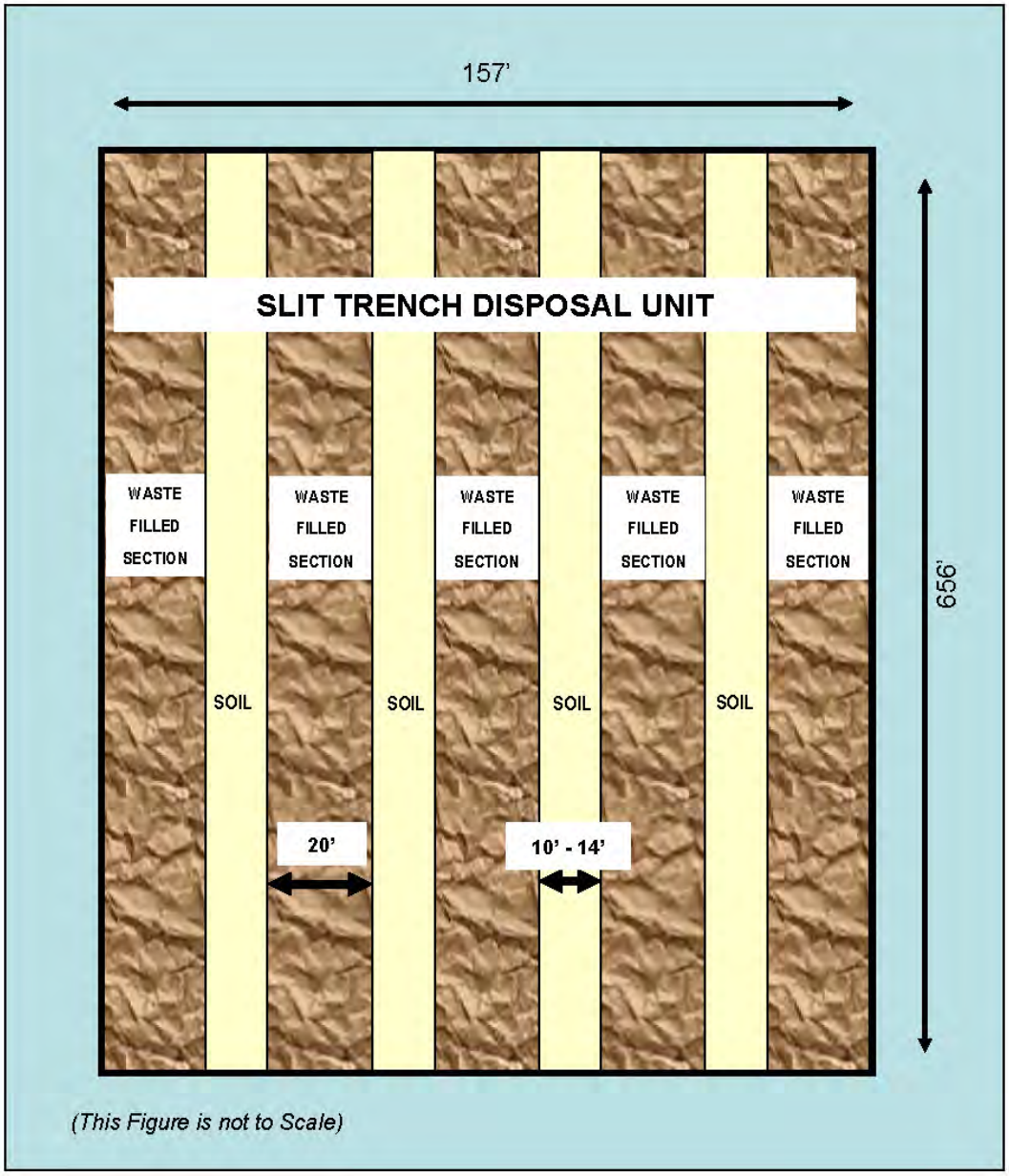


Figure P-4. Typical Slit Trench Disposal Unit Layout



Figure P-5. Slit Trench Disposal Unit Operations (November 2008)



Figure P-6. E-Area LLWF Stormwater Runoff Covers for Slit Trench Disposal Units 1 – 5 (2011)



Figure P-7. **Subsidence of Intact Covers (~10 ft diameter) at Slit Trench Disposal Unit 4 (June 2012)**

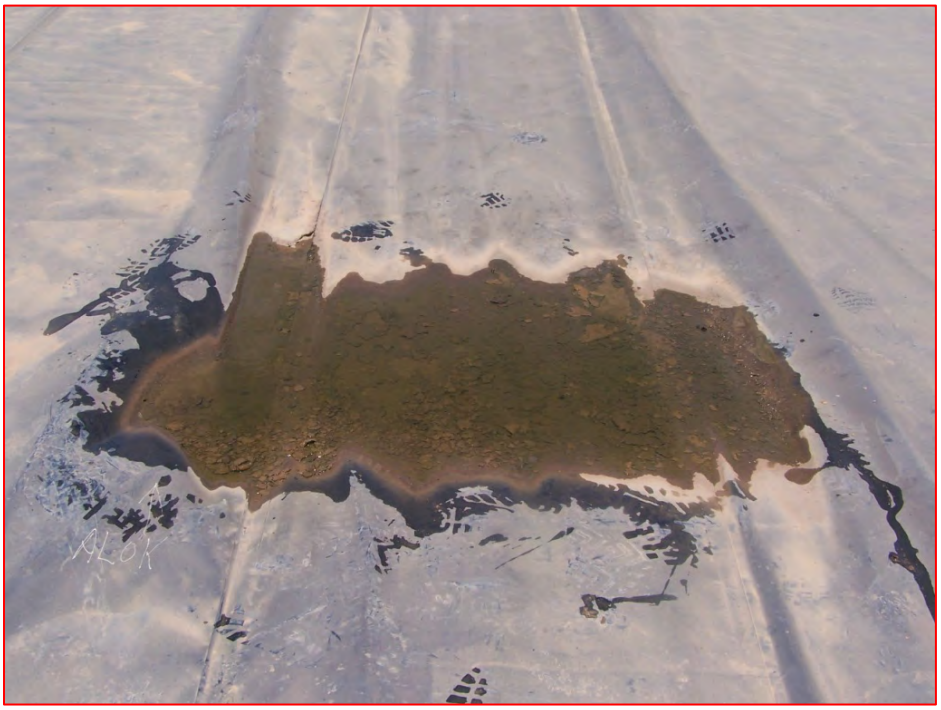


Figure P-8. **Subsidence of Intact Covers (~5 ft diameter) at Slit Trench Disposal Unit 5 (June 2012)**

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Table P-1. Chronology of OU Events

Event	Date
E-Area LLWF added to FFA Appendix C	May 2008
Interim Record of Decision (ROD) Issuance (Slit Trench Disposal Units 1 and 2)	January 22, 2010
Explanation of Significant Differences (ESD) Issuance (added Slit Trench Disposal Units 3 – 5)	April 22, 2010
Remedial Action Start/Complete	May 17, 2010/March 16, 2011
Previous Five-Year Review	None

Table P-2. Final Disposal Volumes, Radionuclide Inventory, and Sum of Fractions for E-Area LLWF Slit Trench Disposal Units 1 through 5

Slit Trench Disposal Unit	Date when Operational Full[1]	Final Disposal Volume[2] [m^3 (ft^3)]	Final Radionuclide Inventory[2] (curies)	Sum of Fractions (SOF)[3]
1	9/19/2003	14,264 (503,728)	39.8	0.85
2	8/31/2006	15,560 (549,496)	164	0.87
3	1/6/2010	16,953 (598,690)	125	0.90
4	8/19/2010	19,193 (677,794)	140	0.99
5	10/16/2006	28,125 (993,225)	127,000	0.99

NOTE:
1. Information provided by email correspondence from D. Sink to K. Vangelas on 2012 August 7.
2. Final disposal volumes and radionuclide inventories were obtained from the Interim Post Construction Report (SRNS 2012).
3. Limit fractions, i.e., the actual disposed radionuclide content divided by the specific radionuclide PA limit, are maintained for each radionuclide. The SOF is the sum of all the individual fractions. Disposal operations are controlled such that the SOF is below one to ensure compliance with the performance objectives. SOFs were obtained from the FY2010 Annual Review (SRNS 2011).

Table P-3. Recommendations and Follow-up Actions for the E-Area LLWF (Slit Trench Disposal Units 1 – 5)

Issues	Recommendations / Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
					Current	Future
Reevaluation of the installation and maintenance activities (for stormwater runoff covers).	Further discussion of how these issues impact future covers is needed with USEPA/ SCDHEC.	USDOE	USEPA/ SCDHEC	Not Applicable	N	N

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5)

I. SITE INFORMATION			
Site Name:	**E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5)**	**Date of Inspection:**	**07/03/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #86**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 90°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☐ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: Fox, Lee (Name) | SWM Deputy Director (Title) | 10/9/12 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.:_____

Problems/Suggestions: ☐ Report Attached Included in text of the Five-Year Remedy Review Report

2. O&M Staff: Looper, Marshall (Name) | SWM Engineering Manager (Title) | 10/9/12 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.:_____

Problems/Suggestions: ☐ Report Attached Included in text of the Five-Year Remedy Review Report

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

4. Other Interviews *(Optional):* ☐ Report Attached _____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See E-Area LLWF Inspection Reports.

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED ***(Continued)***			
2. Health and Safety Plans (HASPs):			
☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201 HAZWOPER.			
3. O&M and OSHA Training Records:	☒ Readily Available	☒ Up to Date	☐ N/A
Remarks: Training Records are complete and up to date per ACP training matrix.			
4. Permits and Service Agreements:			
☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
5. Gas Generation Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
6. Settlement Monument Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
7. Groundwater Monitoring Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
8. Leachate Extraction Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
9. Discharge Compliance Records:			
☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
10. Daily Access/Security Logs:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(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 remedy review report.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☒ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: _____

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(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.) _____

Frequency: _____

Responsible Party/Agent: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Reporting is up-to-date: ☐ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☐ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☐ N/A

Problems/Suggestions: ☐ Report Attached

_____

_____

2. Adequacy: ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: _____

_____

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☐ No vandalism is evident

Remarks: _____

_____

2. Land use changes onsite: ☐ N/A

Remarks: _____

_____

3. Land use changes offsite: ☐ N/A

Remarks: _____

_____

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(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: Survey markers are located and in good condition.
VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent _____ Depth _____ Remarks: Settlement observed – see Figures P-7 & P-8 of this OU-specific review. Covers are intact.
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks: Multiple fasteners for the anchor strips have come off, though the anchor strips are still intact. These will be monitored and will be replaced as needed.
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: Not applicable; no vegetative cover present.

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent Depth

Remarks:

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☒ Wet areas	☐ Location shown on site map	Areal extent
☒ Ponding	☐ Location shown on site map	Areal extent
☐ Seeps	☐ Location shown on site map	Areal extent
☒ Soft subgrade	☐ Location shown on site map	Areal extent

Remarks: Settlement observed – see Figures P-7 & P-8 of this OU-specific review report. Covers are intact.

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)

1. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:

2. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:

3. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks: Monitoring is conducted under the E-Area Monitoring Program and is not part of the interim remedial action. Monitoring data is used to ensure PA performance objectives are not exceeded.

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☒ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

VII. COVER SYSTEMS ***(Continued)***
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:** ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☒ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☒ Applicable ☐ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☒ Siltation not evident Remarks: Ponds are functioning as designed.
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☒ Erosion not evident Remarks:_____
3. Outlet Works: ☒ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☒ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks: Small cracks were observed in the concrete drainage channels on the perimeter of the covers. The cracks were repaired with a concrete epoxy.

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

IX. **GROUNDWATER/SURFACE WATER REMEDIES *(Continued)***
C. Treatment System ☐ Applicable ☐ N/A
1. Treatment Train (Check components that apply)**:** ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters_____ ☐ Additive (e.g., chelation agent, flocculent)_____ ☐ Others_____ ☐ Good Condition ☐ Needs maintenance ☐ Sampling ports properly marked and function ☐ Sampling/maintenance log displayed and up-to-date ☐ Equipment properly identified ☐ Sampling ports properly marked and function ☐ Quantity of groundwater treatment annually_____ ☐ Quantity of surface water treatment annually_____ Remarks:_____
2. Electrical Enclosures and Panels *(properly rated and function)***:** ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Tanks, Vaults, Storage Vessels: ☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance Remarks:_____
4. Discharge Structure Appurtenances: ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
5. Treatment Building(s): ☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks:_____

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment P-1. Five-Year Review Site Inspection Checklist – E-Area Low Level Waste Facility (643-26E) (Slit Trench Disposal Units 1 - 5) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The selected interim RA for E-Area LLWF Slit Trench Disposal Units 1 – 5 is the installation of operational stormwater runoff covers to further reduce stormwater infiltration by enhancing stormwater runoff during the E-Area LLWF operational period. The remedy is currently effective and functioning as designed with the exception of subsidence noted in the OU-specific remedy review report.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures are adequately maintaining the integrity of the E-Area LLWF stormwater runoff covers. The O&M procedures consisting of routine site inspections and site maintenance (cover system) and E-Area LLWF site controls have been implemented. Since covers are intact and functioning as intended, there are no issues requiring corrective actions at this time.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. Mechanical degradation of covers based on observed lifting of covers during wind events and due to settlement of the soil and material beneath the covers is expected to reduce the life of the covers and require unscheduled repairs.
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Recommendations provided in the OU-specific review report.

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EARLY CONSTRUCTION AND OPERATIONAL DISPOSAL SITES (ECODS) L-1, N-2, P-2, R-1A, R-1B, AND R-1C OPERABLE UNIT

I. Introduction

This report is the first five-year review for the Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table Q-1 lists the chronology of site events for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU.

III. Background

ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is listed as a Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is surface and subsurface soil.

Due to the similar history and nature of contaminants located at these ECODS, the six ECODS (L-1, N-2, P-2, R-1A, R-1B, and R-1C) were grouped together in a single decision document.

Physical Characteristics

Twenty-five ECODS have been identified at SRS. Six of the ECODS, L-1, N-2, P-2, R-1A, R-1B, and R-1C, were selected for remedial action because of their similar history and nature of contaminants. These six ECODS are located in the southern portion of the SRS (Figures Q-1 and Q-2). The ECODS were typically shallow (less than 3.6 m [12 ft]

below ground surface [bgs]) land disposal pits created during construction of area support buildings. ECODS L-1, N-2, and P-2 consist of two trenches 18 by 45 m (60 by 150 ft) each. ECODS L-1 is located immediately east of L Area within the Steel Creek Integrator Operable Unit (IOU). ECODS N-2 is located near the southwestern edge of N Area within the Pen Branch IOU. ECODS P-2 is located immediately south of P Area within the Steel Creek IOU. ECODS R-1A, R-1B and R-1C are trenches 12 by 24 m (40 by 80 ft) each and are located northeast of R Area with the Lower Three Runs IOU.

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River* (WSRC 1999) designates ECODS, L-1, N-2, P-2, R-1A, R-1B, and R-1C as being outside of a site industrial area. However, according to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for this OU is reasonably anticipated to be industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The ECODS were used between 1951 and 1955 to dispose of waste material associated with the construction of SRS facilities. Construction waste was buried in these shallow, elongated trenches, with some trenches also used as burn pits for combustible waste disposal.

Initial Response

After waste disposal operations ended, the trenches were backfilled with at least 0.3 m (1 ft) of natural soil. Site Evaluation Reports (SERs) were developed for ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C and contain detailed information and analytical data for the investigations conducted. The investigations determined that the ECODs were not likely to be viable candidates for a No Further Action remedial decision since they contained polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), metals, and potentially friable asbestos. ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C were subsequently transferred to Appendix C of the FFA as a RCRA/CERCLA OU for further evaluation. An abbreviated RCRA Facility

Investigation/Remedial Investigation (RFI/RI), Baseline Risk Assessment (BRA), and Corrective Measures Study/Feasibility Study (CMS/FS) were prepared for each of the ECODs and presented in a Statement of Basis/Proposed Plan (SB/PP).

Basis for Taking Action

The RFI/RI/BRA/CMS/FS evaluations determined that there were no refined contaminants of concern (RCOCs) that warranted a remedial action for human health (i.e. industrial worker and residential receptors), ecological receptors, contaminant migration concerns, or principal threat source material (PTSM). However, asbestos is likely present in the buried waste and there is the potential for friable asbestos exposure to human receptors if buried debris below 0.3-m (1-ft) depth were brought to the surface. The USDOE exercised the option to proceed directly to a response because there is a potential threat of release and exposure to friable asbestos.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (SRNS 2009), the remedial action objective (RAO) developed for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is as follows:

- Prevent human exposure to contaminants including buried asbestos present in the subsurface soils that may present a risk to a future industrial worker or resident.

As stated in the ROD, the selected remedy for the ECODS is land use controls (LUCs) (i.e., institutional controls) to limit access to the areas.

Remedy Implementation

Implementation of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU remedial action included the following:

- Establishing a maintenance program for the ECODS native soil backfill that covers 0.44 hectares (1.1 acres) for ECODS R-1A, R-1B, and R-1C; 0.07 hectares

(0.17 acres) for ECOD P-2; 0.19 hectares (0.46 acres) for ECODN-2; and 0.06 hectares (0.16 acres) for ECOD L-1.

- Establishing LUCs for 2.57 hectares (6.34 acres) (0.71 hectares [1.76 acres] for ECODS R-1A, R-1B, and R-1C; 0.98 hectares (2.42 acres) for ECOD P-2; 0.53 hectares (1.31 acres) for ECOD N-2; and 0.38 hectares (0.94 acres) for ECOD L-1) to prevent land disturbance activities and to prevent exposure to subsurface soils that may contain friable asbestos. LUCs will consist of signage at the waste unit and use restrictions via the Site Use/Site Clearance program.

- Implementation of existing access controls to prevent exposure to trespassers, as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F. 1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

System Operations/Operation and Maintenance

There are no system operational requirements.

Maintenance requirements consist of annual site inspections and site maintenance (if needed to repair erosion damage, cover depressions [i.e., subsidence] and upkeep of warning signs).

The operation and maintenance (O&M) cost associated with the selected remedy for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU includes the annual inspections and institutional controls. The ROD estimated O&M cost has a present worth of $638,940 discounted at 3.9% per year for 30 years. The actual O&M cost since the remedial action was completed in the beginning of FY11 until the end of FY11 is $3,482. The actual O&M costs (Table Q-2) are lower than expected because repairs have not been necessary and the remedial action was not implemented until FY11. The ROD estimate had O&M starting in FY08.

V. Progress since Last Review

This is the first five-year review that the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU have undergone. The remedial action construction activities are complete and the remedy has been implemented. A Correct Measures Implementation Report/Remedial Action Completion Report was issued in March 2011 (SRNS 2011).

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment Q-1; and
- Reviewed changes in standards and to-be-considered guidance.

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 for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU, LUCs and maintaining the native soil cover, is effective in preventing human exposure to buried asbestos. The site maintenance (i.e., repair of erosion damage and warning signs) and use restrictions via the SRS Site Use and Site Clearance Programs restrict invasive and permanent installation activities at the waste unit. Annual site inspections are being performed and indicate the integrity of the native soil cover is intact and no erosion or subsidence has occurred. Warning signs are also present and legible.

There have been no changes in the physical conditions of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU that would affect the protectiveness of the remedy.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site operations, conditions, or activities that currently prevent the remedy for the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for this OU.

X. Protectiveness Statement(s)

The remedy at the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with LUCs and maintenance of the existing native soil cover. All threats to contaminated soil at the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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

SRNS, 2009. *Record of Decision Remedial Alternative Selection for the Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2 and R-1A, -1B, -1C, Operable Unit (formerly Site Evaluation Areas) (U)*, SRNS-RP-2009-00072, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2010. *Land Use Control Implementation Plan for the ECODS L-1, N-2, P-2 and R-1A, -1B, -1C Operable Unit (U)*, SRNS-RP-2009-01373, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2011. *Corrective Measures Implementation Report/Remedial Action Completion Report for Early Construction and Operational Disposal Site L-1, N-2, P-2 and R-1A, -1B, -1C Operable Unit (U)*, SRNS-RP-2010-01524, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, L-Area ECODS L-1*, ER-IDS-019-053, Inspection period 2007 through 2011 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, N-Area ECODS N-2*, ER-IDS-019-054, Inspection period 2007 through 2011 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, P-Area ECODS P-2*, ER-IDS-019-055, Inspection period 2007 through 2011 (annually)

Various - *Inspection Data Sheets – Field Inspection Checklist, R-Area ECODS R-1A, R-1B, and R-1C*, ER-IDS-019-052, Inspection period 2007 through 2011 (annually)

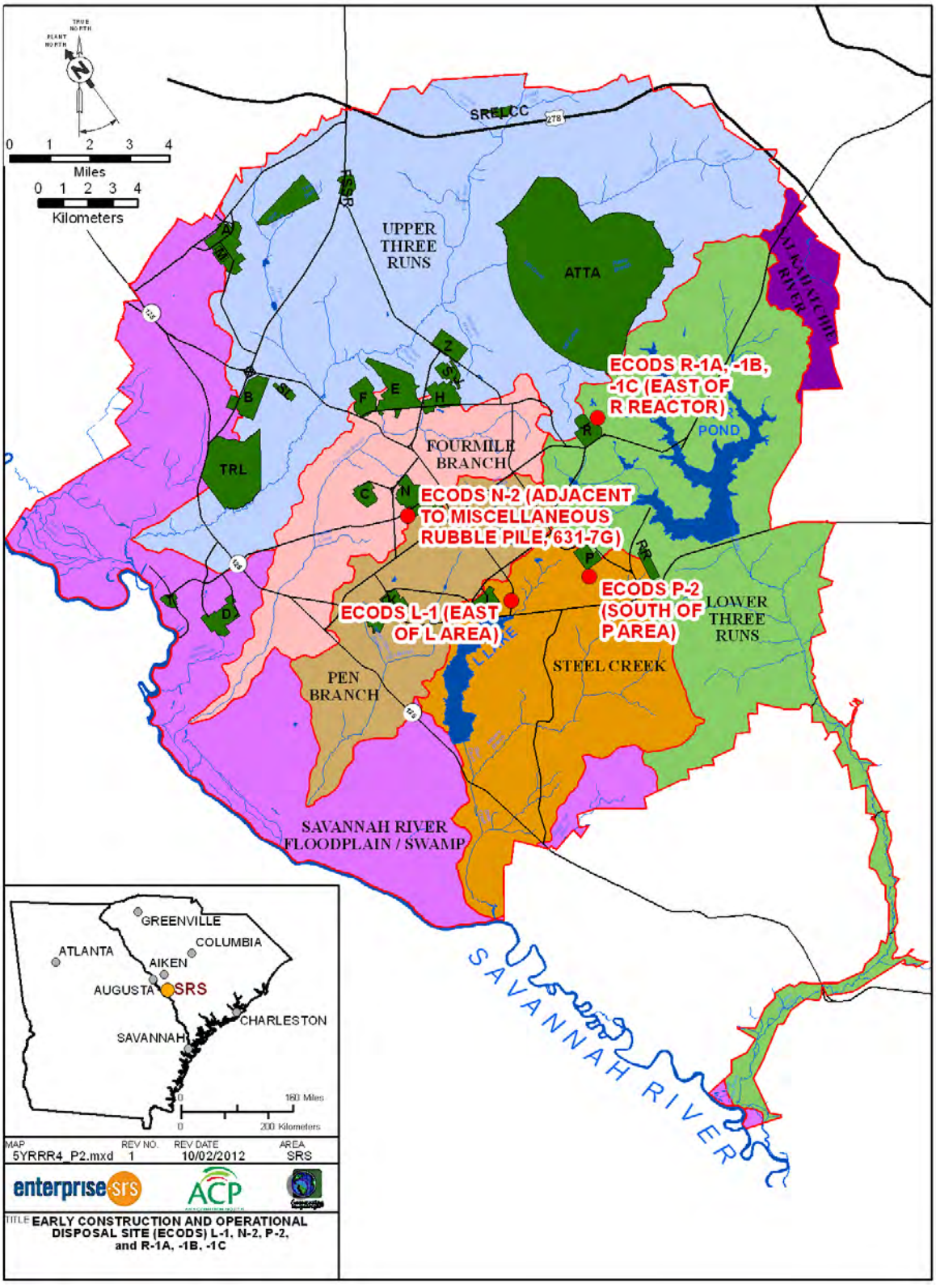


Figure Q-1. Location of the ECODS L-1, N-2, P-2, R-1A, R-1B, and R-1C OU

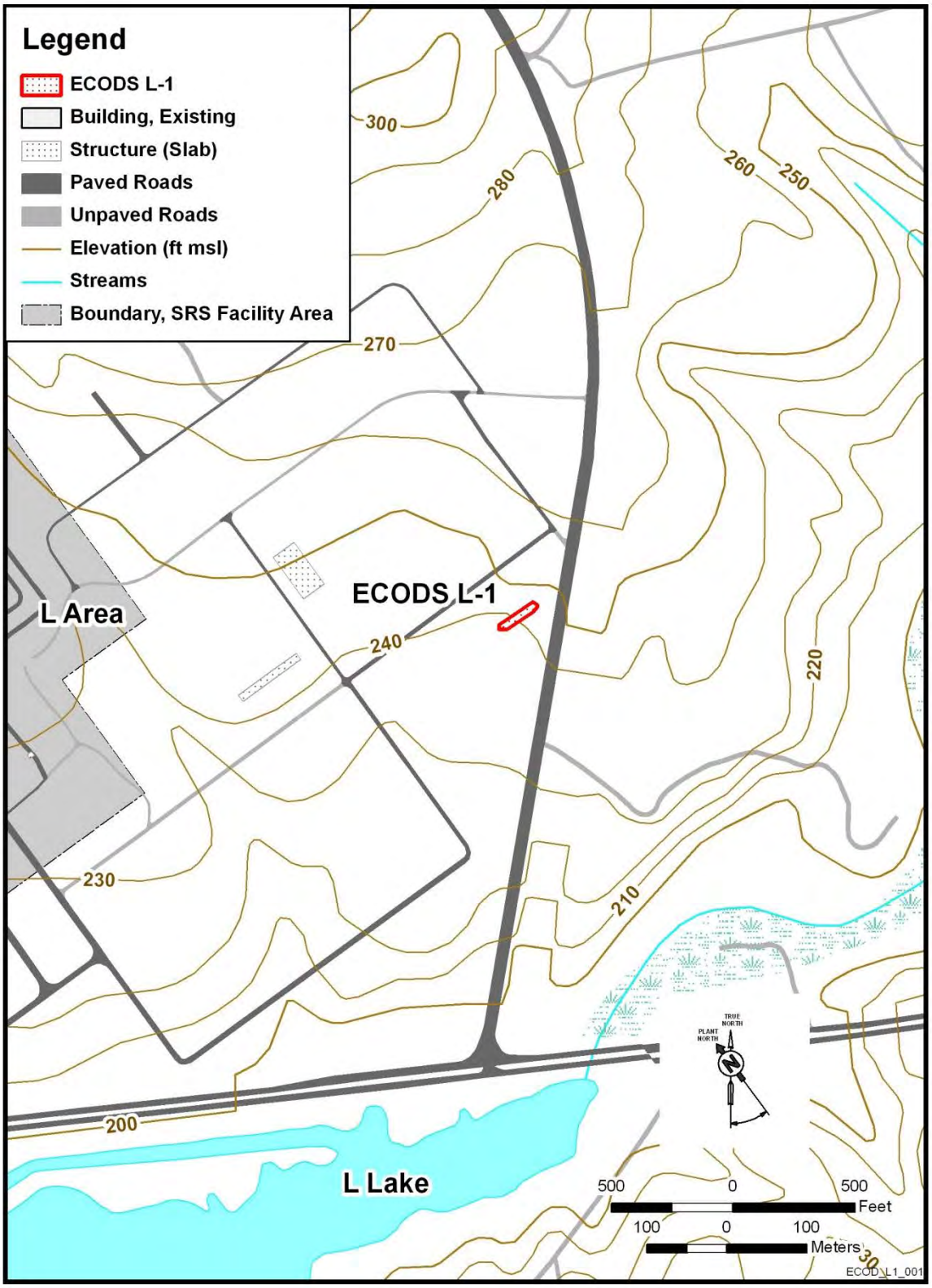


Figure Q-2. Layout of the ECODS L-1

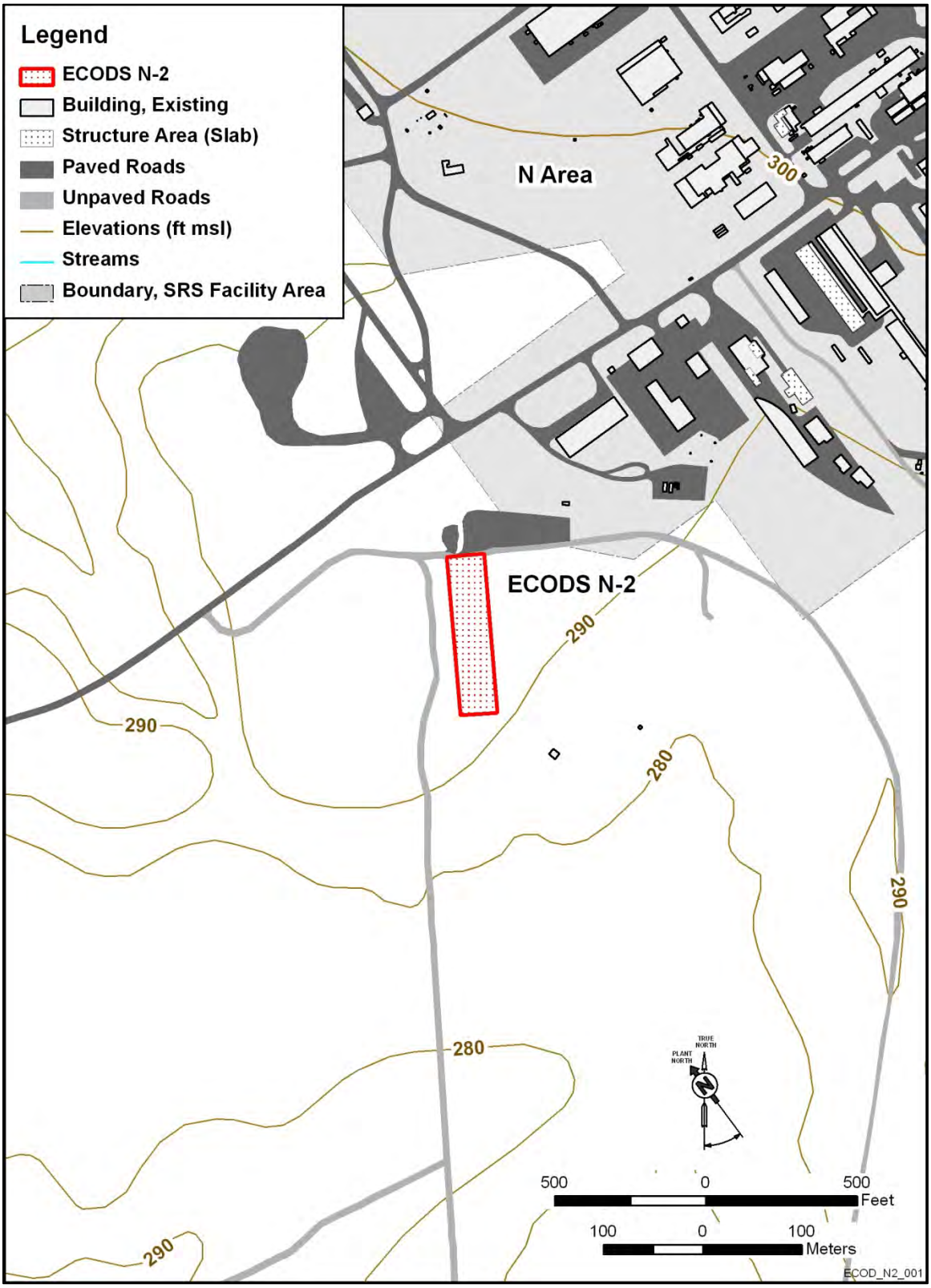


Figure Q-3. Layout of the ECODS N-2

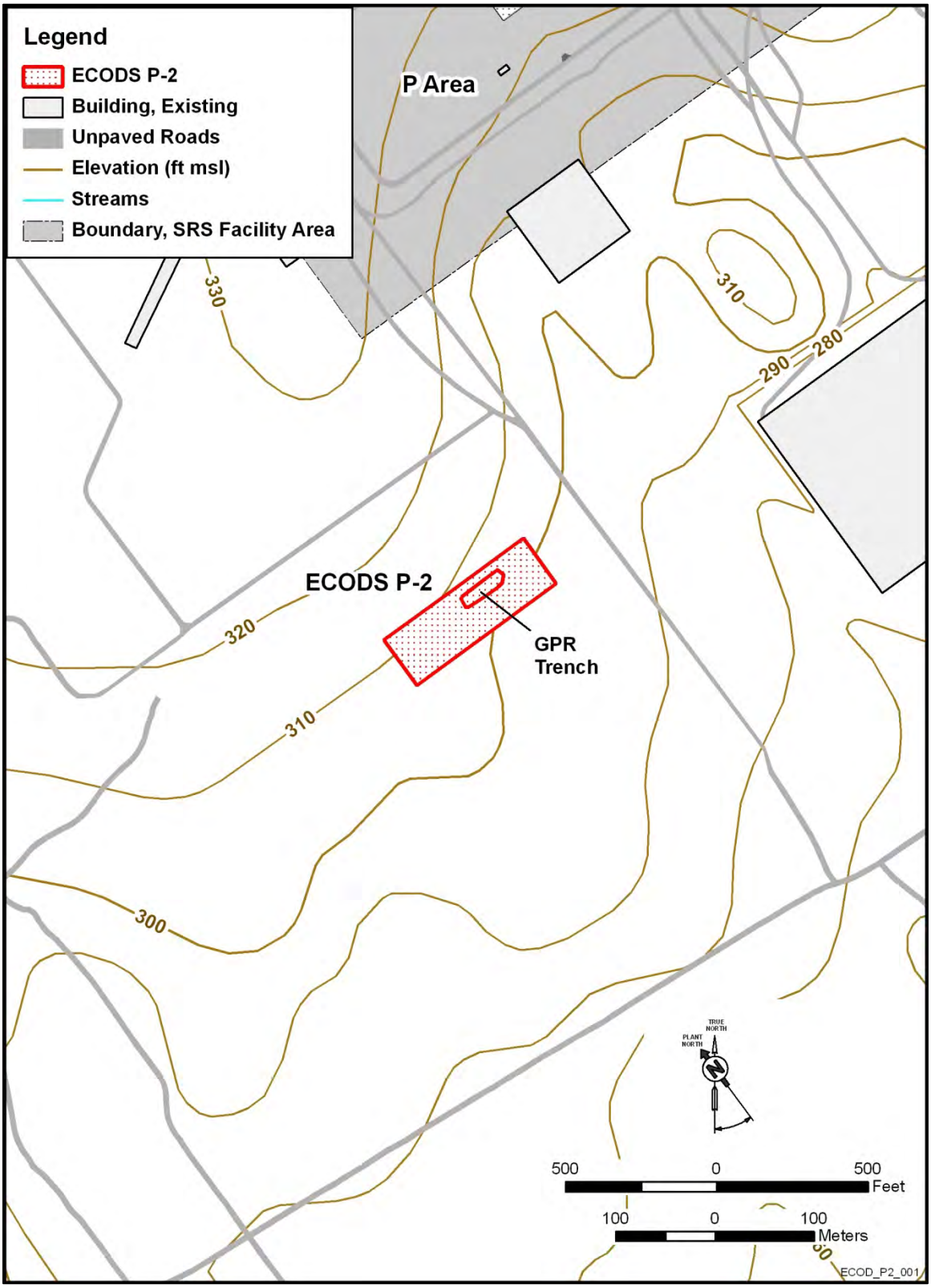


Figure Q-4. Layout of the ECODS P-2

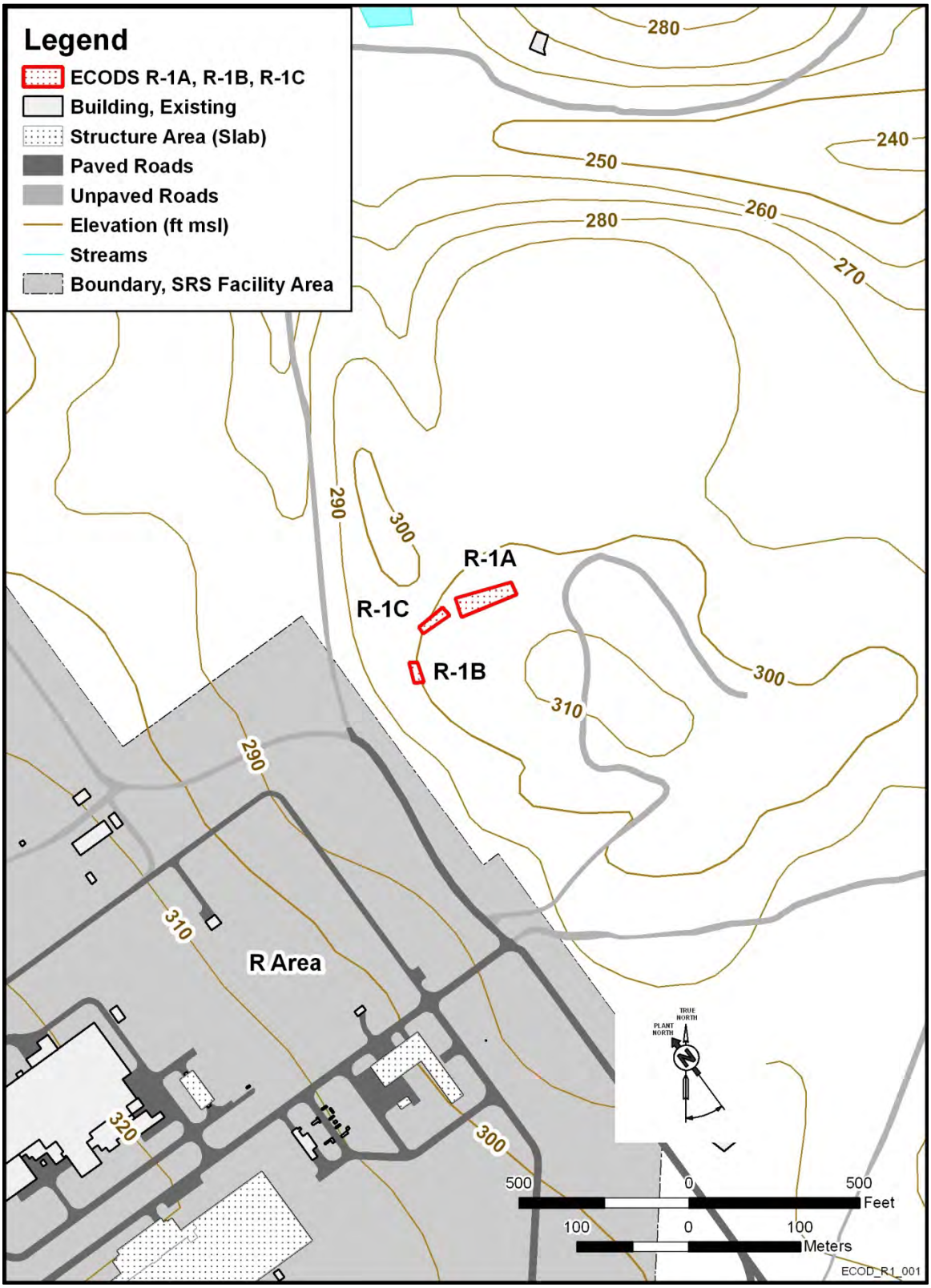


Figure Q-5. Layout of the ECODS R-1A, -1B and -1C



Figure Q-6. **Photo before Remediation (clockwise from upper left) ECODS L-1, N-2, R-1A, -1B and -1C, and P-2**



Figure Q-7. **Current Photographs of ECODS - clockwise from upper left - L-1, N-2, R-1A, -1B and -1C, and P-2.**

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Table Q-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	May 2000/May 2002
Record of Decision (ROD) Issuance	March 16, 2010
Remedial Action Start/Complete	August 26, 2010 / November 2, 2010
Previous Five-year Reviews	None

Table Q-2. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	N/A	N/A	N/A	N/A	3,482	3,482
Total ROD Estimated Direct O&M Costs	N/A	10,000	10,000	10,000	10,000	40,000

N/A = Not applicable

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Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit

I. SITE INFORMATION			
Site Name:	**Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit**	**Date of Inspection:**	**08/22/2012 (N-2, R-1A, R-1B, R-1C)** **08/08/2012 (P-2)** **08/01/2012 (L-1)**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #22**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Cloudy and 85F (N-2, R-1A, R-1B, R-1C)** **Clear and 93F (P-2)** **Foggy and 85F (L-1)**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. **Local Regulatory Authorities and Response Agencies** (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Annual site inspections are performed per SRS procedure ER-SOP-019, *Waste Unit Inspection and Maintenance*, ER-IDS-019-052, *Field Inspection Checklist for the R-Area ECODS 1A, 1B, 1C OU*, ER-IDS-019-053, *Field Inspection Checklist for the L-Area ECODS L-1 OU* , ER-IDS-019-054, *Field Inspection Checklist for the N-Area ECODS N-2 OU* , ER-IDS-019-055, *Field Inspection Checklist for the P-Area ECODS P-2 OU* .

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(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 an SSHASP under 29 CFR 1910.1201, HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☒ Location shown on site map ☐ N/A

Remarks: Signs are in good condition (as of 10/1/2012)

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

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.) Walk-throughs

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: John Knox (Name) | Federal Project Director (Title) | 10/01/12 (Date) | 803-952-7235 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed of decision document have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey pins were located and in good condition.(one corner at Unit P-2 needs clearing)

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 Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☐ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks: Vegetation mowed routinely

VII. COVER SYSTEMS ☐ Applicable ☒ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☐ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☐ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks:

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

_____

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☐ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☐ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
2. Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A
1. Siltation: ☐ Location shown on site map ☐ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☐ N/A Remarks:_____
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
1. Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plum is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment Q-1. Five-Year Review Site Inspection Checklist – Early Construction and Operational Disposal Sites (ECODS) L-1, N-2, P-2, R-1A, R-1B, and R-1C Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The remedy for this OU is institutional controls to prevent human exposure to contaminants. Selected remedies for the ECODS OU are functioning as intended. There are no issues requiring corrective actions.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the condition of the grass and vegetative cover and warning signs is good. There are no issues requiring corrective actions

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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F-AREA BURNING/RUBBLE PITS (231-F, 231-1F, 231-2F) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) (FBRP) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the FBRP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the FBRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table R-1 lists the chronology of site events for the FBRP OU.

III. Background

The FBRP OU is a Resource Conservation Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with this OU is soil. The groundwater is being addressed as part of the General Separations Area (GSA) Western Groundwater OU.

Physical Characteristics

The FBRP OU is located within the SRS, approximately 914 m (3000 ft) west of F Area (Figure R-1). Upper Three Runs is located approximately 690 m (2,300 ft) northwest of the FBRP. The FBRP consists of two contiguous burning rubble pits (231-F and 231-1F) covering 0.43 hectares (1.05 acres) and one rubble pit (231-2F) covering 0.05 hectares (0.13 acres). Pit 231-F is approximately 84 m (275 ft) long by 19 m (62 ft) wide by 3 m (10 ft) deep. Pit 231-1F is approximately 99 m (325 ft) long by 27 m (89 ft) wide by 3 m (10 ft) deep. Pit 231-2F is approximately 50 m (165 ft) long by 10 m (33 ft) wide by 1.2 – 2.7 m (4 - 9 ft) deep. The local topography of the area is flat upland and the pits are at an elevation of 87 m (290 ft) above mean sea level (msl) and 51 m (170 ft) above the Upper Three Runs Aquifer. The watertable is 21 to 30 m (70 to 100 ft) below ground

surface (bgs) in the area of the FBRP. Surface drainage is to the northwest toward an ephemeral tributary of the Upper Three Runs, about 12 km (7.5 mi) upstream of its confluence with the Savannah River. Figure R-2 shows a plan view of FBRP OU with monitoring wells.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates FBRP OU as being within the site industrial support area. The future land use for the FBRP OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The Burning/Rubble Pits (231-F / 231-1F) operated from 1951 to 1973. During operation of the pits, spent organic solvents, waste oils, rags, paper, plastics, wood, telephone poles, and rubber were disposed of and periodically (monthly) and burned (Figure R-3). In 1973, the burning of wastes ceased at SRS. A layer of soil was placed over the pit debris and then was filled to capacity with rubble such as concrete, brick, tile, asphalt, plastics, wallboard, rubber, and non-returnable empty drums.

The Rubble Pit (231-2F) operated from approximately 1951 to 1970 and was used exclusively as a rubble pit for disposal of dry inert concrete, lumber, cement, fence and telephone poles, brick, tile, wallboard, paneling, metal scraps, drums, electrical conduits, and plastics. No burning took place at Pit 231-2F.

Initial Response

After being filled to capacity in 1978 (231-F / 231-1F) and in 1983 (231-2F), the pits were covered with compacted clay-rich native soil and vegetation established. Figure R-4 is an aerial photograph of the FBRP OU with vegetation established.

A characterization of the unit was performed from May - December, 1993 as part of the RCRA Facility Investigation/Remedial Investigation (RFI/RI) unit assessment. Twelve soil borings were taken within the pits (four in each pit) and four deep soil borings (geohydrologic data) were completed. Seven temporary monitoring wells and six permanent monitoring wells were installed. Approximately 228 soil and water samples were taken for analyses.

Basis for Taking Action

The RFI/RI Report (WSRC 1996a) determined that the majority of contaminants in the FBRP OU are located in the interval from 1.2 m (4 ft) bgs to the bottom of Pits 231-F and 231-1F (3 m [10 ft) bgs). Detailed information regarding the development of constituents of potential concern, the fate and transport of contaminants, and the risk assessment can be found in the RFI/RI (WSRC 1996a) and the baseline risk assessment (WSRC 1996b).

The final constituents of concern (COCs) for soil at Pits 231-F and 231-1F were arsenic, benzo[a]pyrene, heptachlorodibenzo-p-dioxin (HpCDD), cesium-137, and potassium-40. The risks for future residential land use were $2x10^{-5}$ for soil ingestion and $3x10^{-5}$ for direct radiation. For future industrial land use, the risks were $5x10^{-6}$ for soil ingestion and $3x10^{-6}$ for direct radiation.

The final COCs for soil at Pit 231-2F were Aroclor 1254, cesium-137, potassium-40, and strontium-90. The risks for future residential land use were $2x10^{-5}$ for soil ingestion and $5x10^{-6}$ for direct radiation. For future industrial land use, the risks were $4x10^{-6}$ for soil ingestion.

There were no final ecological COCs.

Groundwater Assessment

Contaminant transport modeling included in the BRA (WSRC 1996b) demonstrated that the soil contaminants constitute little or no risk to groundwater. However, groundwater contamination was present downgradient of the FBRP OU at a total risk (future resident) of $1x10^{-4}$ and a hazard index of 3 for all exposure pathways and contaminants. A technical memorandum and summary for the groundwater (WSRC 1998c) demonstrated that the FBRP OU is not the source of the groundwater contamination that was detected

both upgradient and downgradient. Currently, the groundwater in this area is being addressed as part of the GSA Western Groundwater OU.

IV. Remedial Actions

Remedy Selection

The remedial action objectives for this unit are as follows:

- Protect human health (future residents) from exposure to Aroclor -1254, cesium-137, potassium-40, and strontium-90 in Pit 231-2F soil above the $1x10^{-6}$ risk level and from exposure to Aroclor-1254 in Pit 231-2F soil above a hazard index of 1;
- Protect human health (future residents) from exposure to arsenic, benzo[a]pyrene, HpCDD, cesium-137, and potassium-40 in Pits 231-F and 231-lF soil above the $1x10^{-6}$ risk level and
- Protect human health (future industrial worker) from exposure to arsenic, HpCDD, benzo[a]pyrene, cesium-137 and potassium-40 in Pits 231-F and 231-1F and from exposure to PCB-1254 in Pit 231-2F above the $1x10^{-6}$ risk level (WSRC 1997).

The selected remedial action for the FBRP OU consists of:

Institutional controls that will restrict the land to future industrial use (WSRC 1997).

Remedy Implementation

The final remedial action for FBRP OU was land use controls (LUCs) including institutional controls consisting of:

- Installing warning signs to indicate that this area was used to manage hazardous materials;
- Existing SRS access controls (SRS site security) will be used to maintain the use of this site for industrial use only;
- Institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to

ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements; and

- In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner in compliance with Section 120(h) of CERCLA that includes notification disclosing former FBRP waste management and disposal activities, results from groundwater monitoring, and remedial actions taken on the site. The deed would also include deed restrictions precluding residential use of the property."

Detailed discussion of these elements is provided in the Final Remediation Report (WSRC 1998a). Figure R-5 and R-6 are photographs of FBRP OU in 2012.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following activities are ongoing:

- Semiannual field walk-downs for general site conditions and site maintenance; and
- Groundwater assessment based on data from the ongoing monitoring associated with the GSA Western Groundwater OU.

The Record of Decision (ROD) (WSRC 1997) estimated operating and maintenance (O&M) costs associated with the selected remedy for FBRP OU as a present worth of $8,000 discounted at 5% per year for 30 years of maintenance activities. The total actual O&M cost from remedial action completion in FY98 to fiscal year 2011 is $37,700. The actual cost (Table R-2) is higher than the estimated cost because periodic inspections and site maintenance (e.g., mowing) were not included in the estimated cost.

V. Progress since Last Review

The previous protectiveness statement concluded that because the remedial actions of institutional controls at FBRP OU are protective, the site is protective of human health and the environment.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed documents listed in Section XII, Documents Reviewed,
- Reviewed the groundwater monitoring data presented in Table R-3 to verify that FBRP OU is not the source of groundwater contamination;
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment R-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

Groundwater data, as reported in the annual GSA Western Groundwater OU Scoping Summaries (WSRC 2007, WSRC 2008, SRNS 2009, SRNS 2010, SRNS 2011 and SRNS 2012), was reviewed. As shown in Figures R-7 and R-8, groundwater contaminants present at the FBRP OU are part of larger plumes that originate upgradient of this OU. Table R-3 provides a summary of groundwater data for the GSA Western Groundwater OU West Plume, which the FBRP OU is included. The data show the highest contaminant concentrations emanate from the F-Area facilities with the plumes moving through the subsurface below the FBRP OU. Though tetrachloroethylene (PCE) and trichlorofluoromethane (TCFM) concentrations are highest in FBP series wells, these wells are located upgradient of the FBRP OU indicating these constituents are emanating from the F-Area facilities. The data also indicate that concentrations are decreasing or remaining constant for all the constituents of interest. The ongoing monitoring associated with the GSA Western Groundwater OU provides data supporting the conclusion that the FBRP is not a source of groundwater contamination.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the FBRP OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The FBRP OU was inspected by SRNS and USDOE personnel on July 3, 2012 and October 17, 2012. No issues were identified for the FBRP OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD (WSRC 1997). The selected remedy, institutional controls, is effective in preventing human exposure to contaminants above the $1x10^{-6}$ risk level. Semiannual site inspections are being performed and indicate the integrity of the native soil cover is intact and no problems have occurred. For this five-year review, the unit was inspected to confirm the signs were posted and inspection records were reviewed to confirm semiannual inspections had been conducted for accuracy and legibility of identification and warning signs, for visible subsidence or erosion of the waste unit, for proper vegetation growth, for mowing, etc. All other routine maintenance activities (i.e., mowing, etc.) and corrective actions have been implemented and documented.

An opportunity for system optimization was identified during this review. Based on the lack of findings during the semiannual site inspections and the effectiveness of institutional controls in preventing human activity at this OU, it is recommended that the inspection frequency be reduced from semiannual to annual.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Still Valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Minor changes in standards and to-be-considered guidance have been identified. The COCs and remedial goals (RGs) are presented in Table R-4. Although there have been small changes to the U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) and Preliminary Remediation Goals (PRGs) for several of the COCs, the RAOs continue to be met by the remedial action. More stringent 2012 PRGs/RSLs do not impact the protectiveness of the remedy since the LUCs that have been established prevent exposure of human receptors (i.e., residents) to remaining soil contaminants left in place.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU. Due to the 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 this constituent at the FBRP in 2009. Fifty-one records were reviewed over the period 2009 through 2012 representing six sampling events and eight individual wells. All results were non-detects, providing evidence that 1,4-dioxane is not a COC for the FBRP.

Additionally, the selected remedy continues to be protective as the exposure pathways have been eliminated through implementation of the remedy. Based on this assessment and review of exposure assumptions, the remedial action objectives used at the time of remedy selection are still valid.

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 operation, conditions, or activities that currently prevent the remedy for the FBRP OU from being protective.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions concerning FBRP OU are listed in Table R-5.

X. Protectiveness Statement(s)

The remedy at the FBRP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with LUCs to prevent exposure to or ingestion of contaminated soil. All threats to contaminated soil at the FBRP OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the FBRP OU for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for January 2019.

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

SRNS, 2009. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1996a. *RCRA Facility Investigation/Remedial Investigation Report for the F-Area Burning/Rubble Pits (231-F, 231-1F, & 231-2F)* (U), WSRC-RP-94-938, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996b. *Baseline Risk Assessment for the F-Area Burning/Rubble Pits and Rubble Pit* (U), WSRC-TR-94-108, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997. Record of Decision Remedial Alternative Selection for the F-Area Burning/Rubble Pits (231-F, 231-1F, 231-2F) (U), WSRC-RP-96-868, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998a. *Final Remediation Report for the F-Area Burning/Rubble Pits (231-F, 231-1F, 231-2F) (U)*, WSRC-RP-97-193, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998b. *Technical Memorandum and Summary Report for the F-Area Burning/Rubble Pits (231-F, 231-1F, 231-2F) (U)*, WSRC-RP-96-884, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2007. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, F-Area Burning/Rubble Pits 231-F, 231-1F, & 231-2F (U)*, ER-IDS-019-002, Inspection period 2007 through 2011 (semiannually)

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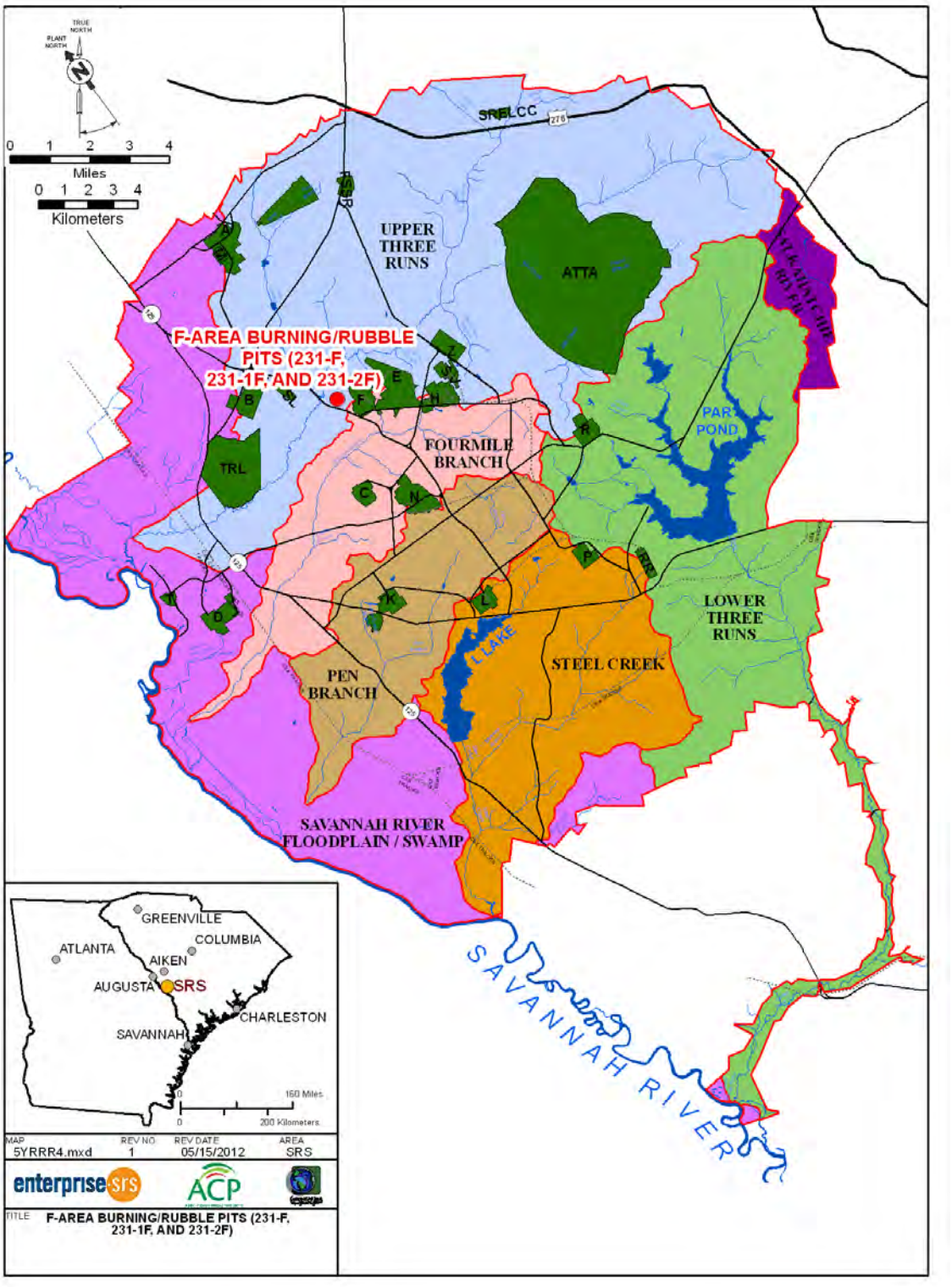


Figure R-1. Location of the F-Area Burning/Rubble Pits (231-F, 231-1F, 231-2F) Operable Unit at SRS

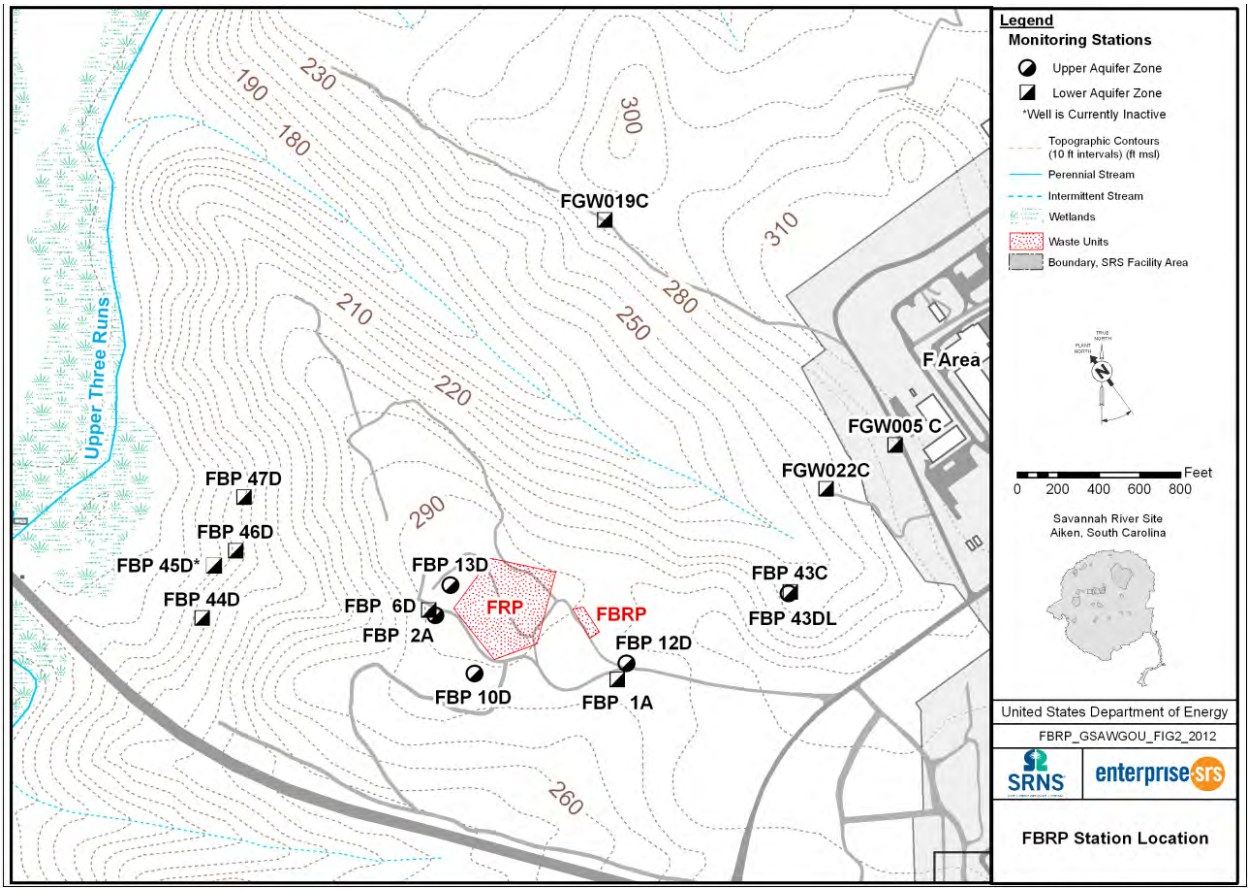


Figure R-2. Location of the F-Area Burning/Rubble Pits (231-F, 231-1F, 231-2F) Operable Unit and Active Monitoring Wells



Figure R-3. Photos of F-Area Burning/Rubble Pits during operational period.
Top photo is an oblique aerial photograph looking east (exact date unknown). The FBRP is the non-forested area in the left foreground. The railroad tie pile is in the extreme left foreground. Bottom left photo is a trench in Pits 231-F and 231-1F (November 1989). Bottom right photo depicts wooden pallets and cardboard boxes disposed in Pits 231-F and 231-1F (September 1973).



Figure R-4. **2010 Aerial photograph of the F-Area Burning Rubble Pits – post operation**



Figure R-5. 2012 Photograph of the F-Area Burning Rubble Pits, 213-F and 231-1F.



Figure R-6. 2012 Photographs of the F-Area Burning Rubble Pits, 231-2F.

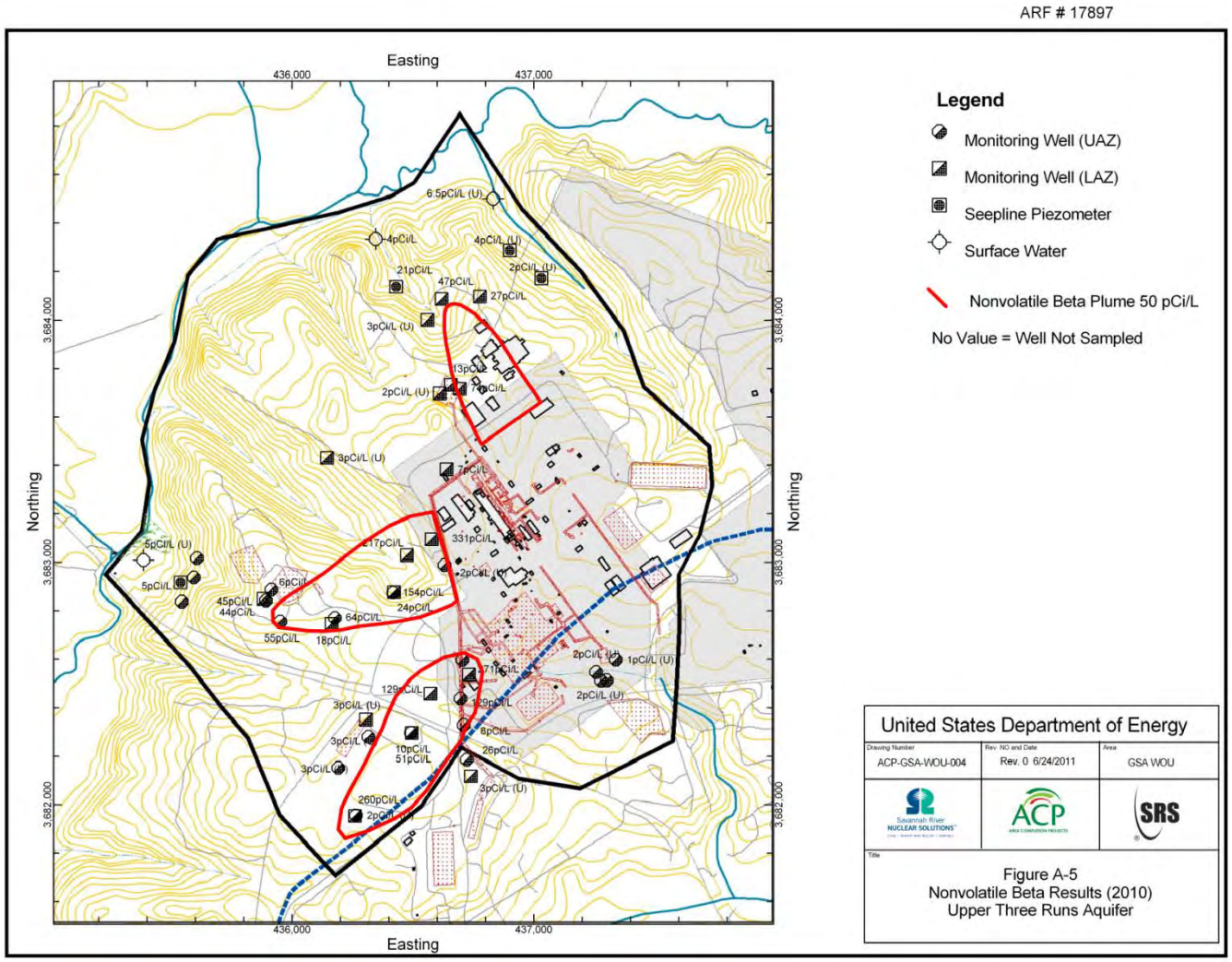


Figure R-7. Non-Volatile Beta Results from 2010 Groundwater Sampling (SRNS 2011)

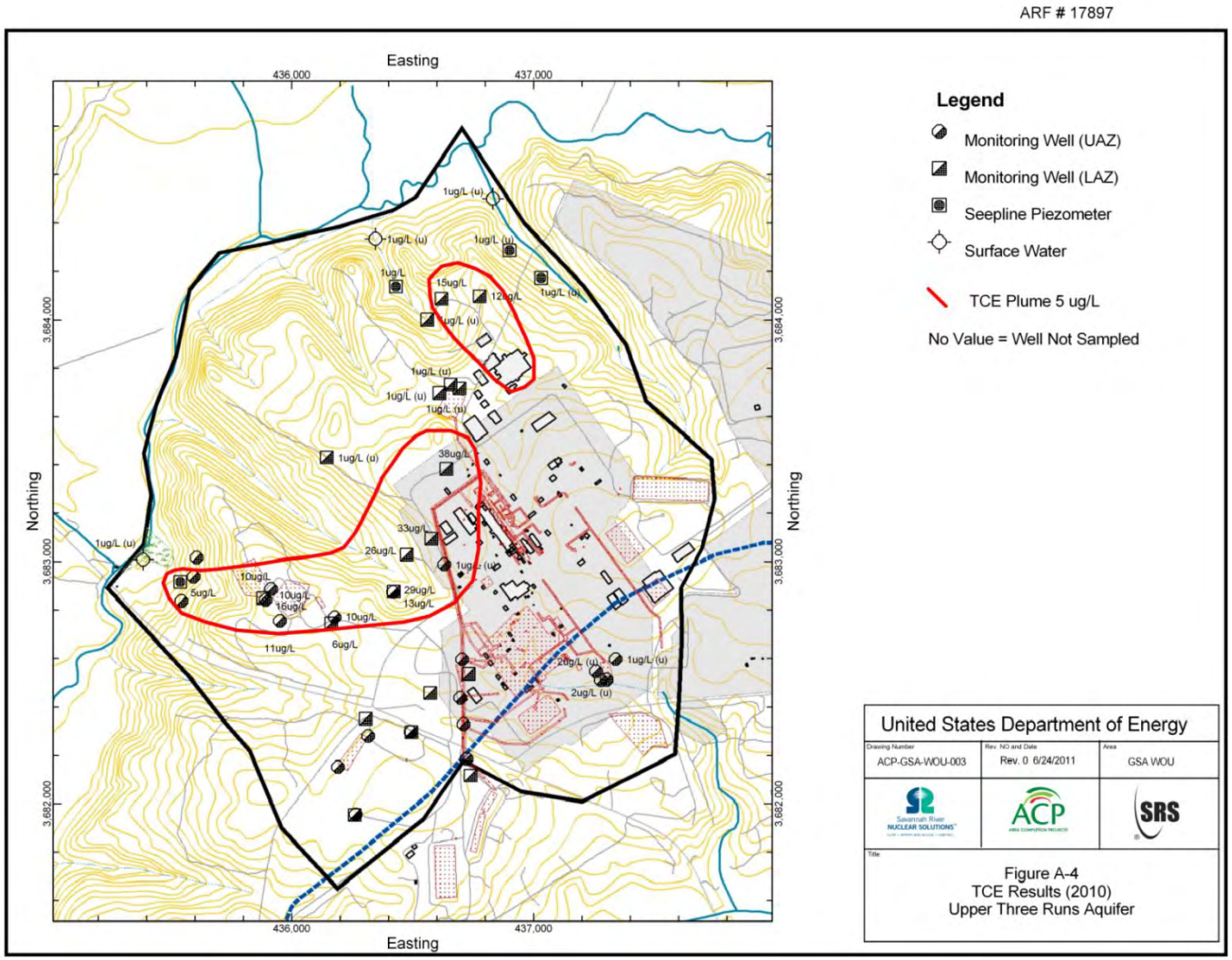


Figure R-8. TCE Results from 2010 Groundwater Sampling (SRNS 2011)

Table R-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	May 4, 1993 / April 25, 1996
Final Record of Decision (ROD) Issuance	April 22, 1997
Remedial Action Start/Complete	April1,1998 / June 30, 1998
Final Remediation Report Approved	April 23, 1998
Previous Five-Year Reviews	June 30, 1997/February 12, 2004/ February 4, 2009

Table R-2. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	6,600	7,400	3,800	3,800	3,300	24,800
Total ROD Estimated Direct O&M Costs*	2,500	0	0	0	0	2,500

*Source of estimate – WSRC 1997, page 15. Every fifth year direct O&M unit cost for remedy review of $2,500 is based on a present worth of $8,000 during 30 years discounted at 5%.

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Table R-3. Summary Groundwater Data for the GSA Western Groundwater OU – West plume as compared to the FBRP OU Wells.

Constituent	MCL	Units	2007		2008		2009		2010		2011	
			Max Conc (well ID)	Max Conc. FBP well	Max Conc (well ID)	Max Conc FBP well	Max Conc. (well ID)	Max Conc FBP well	Max Conc. (well ID)	Max Conc FBP well	Max Conc (well ID)	Max Conc FBP well
Nitrates	10	mg/L	106 (FGW005C)	34.9 (FBP12D)	71.3 (FGW22C)	35.5 (FBP43DL)	77.5 (FGW22C)	33.6 (FBP43DL)	93.7 (FGW22C)	34 (FBP43DL)	89.4 (FGW22C)	31.3 (FBP43DL)
PCE	5.0	µg/L	28.9 (FBP6D)	28.9 (FBP6D)	13.0 (FBP6D)	13.0 (FBP6D)	6.64 (FBP13D)	6.64 (FBP13D)	5.83 (FBP2A)	5.83 (FBP2A)	6.5 (FBP2A)	6.5 (FBP2A)
TCE	5.0	µg/L	52.2 (FBP6D)	52.2 (FBP6D)	44.0 (FGW222C)	28 (FBP43DL)	36.5 (FGW22C)	27.4 (FBP43DL)	33.0 (FGW005C)	28.7 (FBP43DL)	37.9 (FGW005C)	31.3 (FBP43DL)
TCFM	5.0	µg/L	79.5 (FBP12D)	79.5 (FBP12D)	49.9 (FBP12D)	49.9 (FBP12D)	54.8 (FBP12D)	54.8 (FBP12D)	44.0 (FBP43DL)	44.0 (FBP43DL)	39.7 (FBP1A)	39.7 (FBP1A)
Gross alpha	15	pCi/L	25.4 (FGW019C)	ND	1470 (FGW005C)	14 (FBP12D)	1210 (FGW005C)	18.1 (FBP12D)	1320 (FGW005C)	ND	1830 (FGW005C)	11 (FBP2A)
Iodine-129	1	pCi/L	5.48 (FGW005C)	ND	ND	NS	ND	NS	ND	NS	ND	NS
Nonvolatile beta	50	pCi/L	380 (FGW22C)	91.3* (FBP12D)	481 (FGW22C)	127 (FBP43DL)	309 (FGW005C)	190 (FBP43DL)	331 (FGW005C)	154 (FBP43DL)	707 (FGW005C)	215 (FBP43DL)
Strontium-90	8	pCi/L	13.2 (FGW005C)	NS	ND	NS	ND	NS	ND	NS	ND	NS
Technetium-99	900	pCi/L	361 (FGW005C)	NS	ND	NS	ND	NS	ND	NS	ND	NS
Tritium	20	pCi/ml	15.6 (FGW22C)	5.05 (FBP12D)	14.0 (FGW22C)	5.46 (FBP12D)	13.1 (FGW22C)	4.83 (FBP12D)	11.1 (FGW22C)	4.46 (FBP43DL)	10.5 (FGW22C)	3.7 (FBP12D)

* Estimated value

NS not sampled – The FBP wells were sampled for these constituents from 2002 thru 2006 and all results were non-detect, indicating the FBP is not a source of these constituents. After 5 years of non-detects, analysis for these constituents was discontinued.

ND not detected

Table R-4. Review of FBRP Resident Receptor Remedial Goals

COC	Units	Maximum Soil Concentrations[a] Pits 231-F and 231-1F / Pit 231-2F	ROD RGs (1 x 10-6)[b]	ROD RGs (HQ = 1)[c]
Arsenic	mg/kg	1.52E-01; N/A	8.02E-01	N/A
HpCDD	mg/kg	8.30E-03; N/A	7.9E-04	N/A
Benzo[a]pyrene	mg/kg	1.33E+00; N/A	1.62E-01	N/A
Cesium-137	pCi/g	2.77E+00; 9.2E-01	2.79E-01	N/A
Potassium-40	pCi/g	4.8E+00; 3.78E+00	1.03E+00	N/A
Strontium-90	pCi/g	N/A; 1.84E+00	5.13E-01	N/A
Aroclor-1254	mg/kg	N/A; 2.87E+00	N/A	1.57

a Radionuclides have been corrected for decay, T= 19 years; Depth of soil is 0-1.2 m (0-4 ft).

b Remedial Goal (RG) for carcinogenic risk

c RG for noncarcinogenic hazards based on a Hazard Quotient (HQ) = 1.

Table R-5. Recommendations and Follow-up Actions

Issues	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N) Current	Affects Protectiveness? (Y/N) Future
Optimization of Inspection	Request change to the inspection frequency from semi-annual to annual via USDOE letter to the USEPA and SCDHEC to be sent within 45 days of final regulatory approval of the Fourth Five Year Remedy Review Report.	USDOE	USEPA/ SCDHEC	9/30/2014	N	N

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit

I. SITE INFORMATION			
Site Name:	**F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit**	**Date of Inspection:**	**07/03/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #14**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 85°F**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance*, ER-SOP-019 and *Field Inspection Checklist for F-Area Burning Rubble Pit OU*, ER-IDS-019-002.

_____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans ☐ Readily Available ☐ Up to Date ☒ N/A
☐ Contingency Plan/Emergency Response Plan ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix

4. Permits and Service Agreements:

☐ Air Discharge Permit ☐ Readily Available ☐ Up to Date ☒ N/A
☐ Effluent Discharge ☐ Readily Available ☐ Up to Date ☒ N/A
☐ Waste Disposal; POTW ☐ Readily Available ☐ Up to Date ☒ N/A
☐ Other Permits ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air ☐ Readily Available ☐ Up to Date ☒ N/A
☐ Water (Effluent) ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: _____

B. Fencing

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 – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) 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.) Field Walkdown

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/17/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☐ Yes ☒ No ☐ N/A

Reports are verified by the lead agency: ☐ Yes ☒ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) 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: Vegetation is mowed routinely.

VII. COVER SYSTEMS ☐ Applicable ☒ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☐ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☐ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks:

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent _____

☐ Ponding ☐ Location shown on site map Areal extent _____

☐ Seeps ☐ Location shown on site map Areal extent _____

☐ Soft subgrade ☐ Location shown on site map Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

C. Benches ☐ 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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment R-1. Five-Year Review Site Inspection Checklist – F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The remedial action for the FBRP source control unit consists of institutional controls that will restrict the land to further industrial use. The institutional controls are in place and being implemented to provide access control and prevent exposures as intended by the decision documents.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining this unit and the condition of its warning signs is good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Optimization opportunities are provided in Table R-5 of the OU specific report.

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F-AREA GROUNDWATER OPERABLE UNIT

I. Introduction

This is the fourth five-year review for the F-Area Groundwater Operable Unit (OU). This review was conducted from August 2012 through September 2012. The review for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) review requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document. Contaminants remaining at the F-Area Groundwater OU are at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the F-Area Groundwater OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table S-1 lists the chronology of site events for the F-Area Groundwater OU.

III. Background

F-Area Groundwater OU, a media-specific OU, is listed as a RCRA unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for SRS. The media associated with the F-Area Groundwater OU is groundwater.

The F-Area Groundwater OU is the groundwater associated with the F-Area Hazardous Waste Management Facility (HWMF) OU.

Physical Characteristics

The F-Area Groundwater OU lies in the central portion of SRS; approximately 8 km (5 mi) from the nearest site boundary (Figure S-1). The groundwater contamination plume associated with the three earthen unlined F-Area HWMF basins is called the

F-Area Groundwater OU and is observed in a zone which extends from the water table surface to approximately 50 ft below ground surface (bgs) and covers an area of approximately 81 hectares (200 acres).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the F-Area Groundwater OU as being within an industrial area. The future land use for the F-Area Groundwater OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The F-Area HWMF operated from 1955 until 1988. During that time, the facility received approximately 1.8 billion gallons of low-level waste effluents from F-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general-purpose evaporator overheads. The effluents were acidic (wastewater with nitric acid) and low-activity waste solution containing a wide variety of radionuclides and dissolved metals. Tritium was the primary radionuclide released to the basins.

Initial Response

A groundwater monitoring network was installed in the 1950s. In 1986, the determination was made that the basins should be regulated under RCRA as hazardous waste disposal facilities, and closure plans were initiated. The basins were closed by dewatering, physically and chemically stabilizing the remaining sludge, and covering them with a protective multi-layer system to reduce rainwater infiltration. The basin closures were completed in 1991.

In 1992, South Carolina Department of Health and Environmental Control (SCDHEC) issued to SRS a RCRA Part B Permit that specified ongoing groundwater monitoring requirements and a Corrective Action Plan to remediate the contaminated portions of the

uppermost groundwater aquifer. Several of the contaminants exceeded regulatory limits and were targeted for remediation.

Basis for Taking Action

The maximum detected levels of several contaminants (e.g., tritium, iodine-129, and strontium-90) in the F-Area groundwater currently exceed the National Primary Drinking Water Standards and state standards (i.e., maximum contaminant levels [MCLs]). However, potential exposures to the general public are minimized by the distance from the OU to the site boundary, natural attenuation and radionuclide decay, institutional controls, and dilution in receiving streams. The remediation of the F-Area Groundwater OU was designed to meet, as far as practicable, the groundwater protection standards (GWPS) outlined in the RCRA permit (SCDHEC 2003).

The constituents for which monitoring is required are shown in Table S-2. These constituents are identified in the current SRS RCRA Permit (SCDHEC 2003) and listed in the Interim Action Record of Decision (IROD) (WSRC 1995). These constituents are monitored because they were detected at concentrations above the GWPS established in the 1992 SRS RCRA Permit.

IV. Remedial Actions

Remedy Selection

An IROD for the F-Area Groundwater OU was issued in April 1995 (WSRC 1995). A final Record of Decision (ROD) for the F-Area Groundwater OU has not been issued. The final action for this media-specific OU will be documented by modifications to the RCRA permit.

The selected interim action under CERCLA is no further action beyond that required by the corrective action as identified in the SRS RCRA Permit. As specified in the SRS RCRA Permit, the goal of remediation of the F-Area Groundwater Operable Unit is to lower contaminant concentrations in the groundwater associated with the F-Area HWMF to levels specified in the RCRA permit and to minimize the discharge of contaminants to

the adjacent stream. Under RCRA, the corrective action for the F-Area HWMF commenced in 1989, was certified closed in February 1991, and certification of closure was approved by SCDHEC in April 1991 (WSRC 1995). The remedial action objectives (RAOs) of the interim remedial action are to address the potential ecological impacts at the seeplines along Fourmile Branch and to address the ambient water quality standards in Fourmile Branch by remediating this OU (WSRC 1995).

The SRS RCRA Permit set forth a phased approach to remediating the groundwater that required documented evaluations of the performance of the system to determine effectiveness toward meeting the RAOs. The Phase 1 remedy involved groundwater recovery and hydraulic control with treatment of mobile hazardous constituents and radionuclides (except tritium and nitrates) and injection of treated water into the shallow aquifer at the upgradient extent of the plume. The evaluation of this remedy (WSRC 2001) facilitated the following phased success measures to reach the RAOs that are in the current SRS RCRA Permit (SCDHEC 2003):

- Phase 1: Implement a groundwater extraction and injection system to capture and remediate those portions of the contaminant plume delineated by the 10,000 pCi/ml tritium isoconcentration contour;

- Phase 2a: Reduce mass flux of tritium discharging from the plume to Fourmile Branch by 70% and reduce the discharge of the remaining constituents as identified in Appendix IVB-A of the permit (SCDHEC 2003) to Fourmile Branch to levels that are less than the GWPS;

- Phase 2b: Reduce the discharge from the plume of all constituents identified in Appendix IVB-A of the permit (SCDHEC 2003) at the seepline to levels less than the GWPS; and

- Phase 3: Remediate the entire contaminant plume to levels below the GWPS as listed in Appendix IVB-A of the permit (SCDHEC 2003) or evaluate the applicability of Alternate Concentration Limits or a Mixing Zone.

Remedy Implementation

Consistent with the phased approach of the permit, the implementation of the remedy was structured to prevent the plumes from further migration and discharge to Fourmile Branch, treat and/or attenuate the contaminant plumes at and approaching the OU boundary (Fourmile Branch), and treat and/or attenuate all contaminants within the OU. Except for the initial treatment (pump-treat-reinjection), the permit identifies that development work would be needed to select and implement technologies to address the unique conditions presented at this OU. While the treatments that are and have been part of the remedy for this OU are presented chronologically in the following paragraphs, they work synergistically to address the permit requirements and RAOs.

Active Treatment with Pump – Treat - Reinjection

In 1997, SRS designed and built a pump-and-treat system using a water treatment unit (WTU) with a network of injection and extraction wells. The remediation system extracted groundwater downgradient of the seepage basins, passed it through the WTU to remove metals and radionuclides, and re-injected the treated water upgradient to maintain the recirculation loop. To reduce the migration of tritium to Fourmile Branch, the system lengthened the tritium pathway in the extraction/reinjection loop, which allowed more time for tritium decay prior to discharging to Fourmile Branch. Operation of the pump and treat system was suspended October 2003 upon receipt of conditional approval by SCDHEC.

Passive Control of Water Table Gradients and pH Treatment

After successful completion of a small-scale pilot study to demonstrate that raising the pH value of the F-Area groundwater will immobilize metals, a subsurface barrier and gate system and base (alkaline) solution injection system were constructed, replacing the ineffective groundwater pump-and-treat unit. In June 2005, the operation of the base injection system commenced. Base injection operations are currently ongoing. During June 2008, the base injection system was expanded to treat groundwater beneath the wetlands by injecting base through a series of injection wells. The engineered

groundwater barrier walls were expanded in 2010 to add an additional gate and footage of barrier wall. Operations in the new gate commenced in 2011.

The barrier was constructed across the preferential groundwater flow paths leading to the wetlands adjacent to Fourmile Branch. With the expansion of the system, the barrier, composed of low permeability amendments, consists of four walls totaling 750 m (2,500 ft) in length and three gates/funnels. The barrier depth is approximately 30 m (100 ft) and 0.75 m (2.5 ft) thick. The location of the original barrier, the extension, and the injection wells are shown in Figure S-2.

A silver chloride injection field pilot study began in March 2009 to test the potential to capture iodine-129 and form stable, insoluble silver iodide. The pilot study was effective, and a field scale demonstration was implemented in the small central gate. SCDHEC approved a permit modification allowing full-scale operation effective July 20, 2011 which occurred during August and September 2011.

System Operations/Operation and Maintenance

Remedial activities are still in progress that requires operations and maintenance (O&M).

Since 2005, the base injection system that stabilizes the pH in the target zone has operated with periodic injections of base to maintain pH downgradient of the barrier to support sorption of the metals and metallic radionuclides. Since 2005, 35.6 million gallons of base solution were injected through the barrier wall gates. Beginning in 2008, 22.2 million gallons of base solution have been injected through individual injection ports in the wetlands. Additionally, a total of 57.8 million gallons of base solution have been injected into the subsurface.

The injection of silver chloride into the plume to stabilize iodine-129 as silver iodide was deployed in August and September 2011. Approximately 64 pounds of metallic silver was placed into the subsurface during the deployment. Monitoring is ongoing to assess the effectiveness in stabilizing iodine-129 and thus decreasing its concentration in groundwater.

Costs associated with the selected remedy for F-Area Groundwater include O&M costs of the WTU, base injection, and institutional controls. O&M costs at the WTU were about $1 million per month. RCRA documentation does not require estimated project costs to be prepared. Therefore, none are included in this remedy review.

V. Progress since Last Review

The previous protectiveness statement concluded that the interim remedial actions at the F-Area Groundwater OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being maintained by barrier wall and base injection treatment system and are monitored by the groundwater monitoring network, which have all been functioning properly.

There were no recommendations or follow-up actions from the last five-year review.

The following actions have been completed:

- Silver chloride injection - Conducted a pilot-scale study, installed, and performed a field-scale demonstration, and currently evaluating the effectiveness.
- Base injection continues - The existing barrier wall system has been expanded with the extension of the wall and addition of one new gate. Base injection has been initiated in the wetlands through a series of injection wells.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implemented remedial actions are ongoing;
- Reviewed all process and performance monitoring data provided by the annual groundwater monitoring and corrective action reports and provided a technical assessment of whether the treatment systems are functioning as intended by the IROD and whether the shutdown criteria has been achieved;

- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment S-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls and provided current photos of the treatment system (Figure S-3);
- Ensured that all actions required under the RCRA Permit were implemented; and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Stuart Crosby, SRNS Operations Engineering, on July 3, 2012 at the F-Area Groundwater OU. The F-Area Groundwater OU was inspected by SRNS and USDOE personnel on July 3, 2012 and October 17, 2012. No issues were identified for the F-Area Groundwater OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

Data Review

This OU has a unique set of subsurface conditions, facilitated in part by the carrier fluid for the process waste that was discharged to the seepage basins (groundwater contaminant source). This low pH liquid (acid) leached to the subsurface over a 30-plus year period creating a groundwater plume of low pH that has impacted the geochemistry of the subsurface soils, leaching natural metals and minerals, and minimizing the retardation of contaminants. As recognized by SRS, the pH must be addressed to have success in reaching the RAOs and RCRA Permit requirements. Because of the properties of the individual metal and radionuclide contaminants, one remedy will not address all the contaminants. In addition, the only viable approach to tritium, a main contaminant at this site, is increased travel time to receptors to allow for radioactive decay. Thus, the remedial approach implemented at SRS attempts to address all these facets. This technical assessment was conducted to assess progress in addressing the RAOs.

Ecological studies associated with the F-Area GW OU are conducted as part of the Fourmile Branch Integrator Operable Unit (IOU). These studies include ecological benchmark comparisons that compare ecological screening values (ESVs) to sediment, sediment/soil, and surface water media constituent concentrations. The ESVs are derived from ecologically relevant criteria and standards such as National Ambient Water Quality Criteria. Review of the 4th periodic report for this IOU indicates that in terms of community level effects there is no evidence that metals discharged from F Area have degraded fish or macroinvertebrate communities in Fourmile Branch. Aluminum, barium, and mercury may pose a potential threat to wildlife. Aluminum and barium showed a potential threat to wildlife upgradient of SRS operations. Only mercury is a potential issue in lower and middle Fourmile Branch, but there is no evidence that this is associated with discharges from SRS operational areas (i.e., F-Area, H-Area) (SRNS 2012a).

The decrease in pH of the groundwater due to the introduction of the low pH fluid became evident in the wetland areas in the form of a tree-kill zone. The ongoing base injection operations appear to be positively impacting this area. From a visual survey, the tree-kill zone appears to be recovering.

As a condition of the RCRA permit for the F-Area HWMF groundwater, SRS annually calculates and reports the tritium flux to Fourmile Branch. As shown in Table S-3, tritium flux discharges have been reduced by 70%.

A review of surface water data from stations FMC002H, FMC002HD, FMB2BD, and FMC002F for the period encompassing the 2nd, 3rd, and 4th Remedy Reviews (1997-2011) was conducted to assess the effect of the F-Area Groundwater OU treatment systems on Fourmile Branch. Table S-4 presents the contaminants that at any time during the three review periods were detected above the GWPS or MCL. The base injection went into operation during the 3rd Remedy Review period. The data in Table S-4 provides evidence that the base injection operations are having a positive influence on the concentrations of all constituents with the exception of iodine-129. The concentrations of the constituents are decreasing or are below the GWPS and/or MCL. SRS recognizes that iodine-129 will not be treated by the base injection system and thus is investigating

other approaches to remediate the iodine (as discussed below). The data provides evidence that the remedial activities are having a positive impact on the groundwater and Fourmile Branch surface water (Tables S-3 and S-4, respectively). Because all constituents have not reached acceptable levels in the surface water, remediation activities will continue.

A review of the seepline data for the period encompassing the 2nd, 3rd, and 4th Remedy Reviews was conducted to assess the effect of the F-Area Groundwater OU treatment systems on the seeplines. Table S-5 provides a summary of constituents from the seepline sampling locations that have exceeded the GWPS or MCL at any time during the period beginning in 2001 and ending December 31, 2011. Review of the seepline data indicates a downward trend in contaminant levels for the majority of constituents. Of the three constituents identified in the ecological studies as potential threats to wildlife, only mercury was detected above standard with concentrations decreasing after the barrier and gate system with base injection became operational.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

Review of documents, Applicable or Relevant and Appropriate Requirements (ARARs), risk assumptions, and results of the site inspection indicate that the remedy is functioning as intended by the IROD. The IROD identifies no further action beyond that required by the SRS RCRA Permit but stipulates the corrective action will address the potential ecological impacts at the seeplines along Fourmile Branch and will also serve to address the ambient water quality standards in Fourmile Branch by remediating this OU. The implemented treatment strategy is addressing the goal of the remediation, as described in the SRS RCRA Permit: lower contaminant concentrations in the groundwater associated with the F-Area HWMF to levels specified in the RCRA permit and to minimize the discharge of contaminants to the adjacent stream. Ecological assessment of Fourmile Branch indicates no impact from the F-Area HWMF. However, aluminum, barium, and mercury are potential threats to wildlife in Fourmile Branch in the area impacted by

F-Area operations. As part of the Fourmile Branch IOU program, studies of ecological impacts to the Fourmile Branch will be ongoing. Based on the ecological studies, the RAOs of the IROD are being met. The groundwater requirements of the RCRA permit, which the IROD identified must also be satisfied, have not been met. However, the treatment approach is making positive progress towards those requirements. The effective implementation of institutional controls has prevented exposure to, or ingestion of, contaminated groundwater.

There are several opportunities for system optimization associated with this OU. The groundwater monitoring network has evolved since it was initiated in the 1950s. This evolution while supporting specific objectives has resulted in some instances in wells producing redundant data due to proximity. Several wells producing duplicative data have been identified for removal from the sampling network. The temporal changes in the contaminant plumes is of a sufficiently long time that it is recommended that sampling frequencies be revised from semiannual to annual for the full suite of GWPS constituents. However, the quarterly sampling of indicator parameters will be retained to provide warning if conditions change that would warrant a return to semi-annual sampling. Cyanide is recommended for removal from the permitted constituents due to its sporadic detection, both temporally and spatially, from 2000 through March 2012 and research of historical documents finding no evidence of the waste entering the seepage basins being a cyanide bearing waste (SRNS 2012c).

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 standards or to-be-considered guidance identified in the IROD that call into questions the protectiveness of the remedy.

The action specific ARARs have been met with the shutting down and dismantling of the groundwater pump and treat system. The chemical specific ARARs focusing on radiological exposure of the public and personnel and location specific ARARs associated with groundwater remediation must still be met and have been evaluated.

The GWPS set forth in the SRS RCRA Permit (SCDHEC 2003) for the monitored constituents were compared against MCLs, where available. The comparison found two constituents where the GWPS differed from the MCLs, as shown in Table S-6. The GWPS for cyanide is more protective than the MCL, thus SRS is adhering to a more stringent standard. The GWPS for arsenic is less stringent than the MCL. Review of groundwater arsenic data for the F-Area wells monitored as per the RCRA Part B permit for the period Jan 2000 through August 2012 found 92 detects out of 2,223 records. The average detected arsenic concentration is 7.6 µg/L. Of the 92 detects, 16 records were at or above the MCL of 10 µg/L with a maximum value of 90.7 µg/L. These 16 exceedances of the MCL occurred during the time period 2000 through 2006 and are found in five wells. The arsenic groundwater data provide no evidence of an arsenic groundwater issue. Thus, the GWPS being greater than the MCL does not affect the protectiveness of the remedy. The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection are still valid.

Fact sheets provided on the US Environmental Protection Agency (USEPA) webpage regarding emerging contaminants were reviewed for applicability to this OU. Due to the 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 this constituent at selected wells within the F-Area Groundwater OU in 2007. Of the 32 records reviewed from ten wells, all were non-detects, providing evidence that 1,4-dioxane is not a constituent of concern for the F-Area Groundwater OU.

There have been no changes in MCLs (versus GWPS) that would impact the remedy. Because this OU is operated under the RCRA permit, no baseline risk assessment is required therefore changes in toxicity data and risk methods are not relevant. The remedy is progressing as expected.

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

Recommendations and follow-up actions concerning F-Area Groundwater OU are listed in Table S-7.

X. Protectiveness Statement(s)

The remedy at the F-Area Groundwater OU is currently protective of human health and the environment because exposure pathways that could result in unacceptable risks are being controlled by the barrier wall and base injection treatment systems, groundwater monitoring, and implementation of LUCs including physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that restrict site use to industrial use only (via the SRS Site Use/Site Clearance Program), and information devices such as warning signs. However, in order for the remedy to be protective in the long-term, a treatment for iodine-129 must be incorporated. A treatment for iodine-129 has been deployed and an evaluation of effectiveness is expected to be complete in the 2013 to 2014 time period. Long-term protectiveness of the remedial action will be verified by continued groundwater monitoring.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 2003. *South Carolina Hazardous and Mixed Waste Permit, Permit Number SC1 890 008 989, 2003 RCRA Permit Renewal for the Savannah River Site, issued September 30, 2003, Module IV - Groundwater Requirements, Section B, F-Area*

Hazardous Waste Management Facility, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC.

SRNS, 2009. *2008 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U)*, SRNS-RP-2009-00272, Volume I, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *2009 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U)*, SRNS-RP-2010-00172, Volume I, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *2010 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U)*, SRNS-RP-2011-00150, Volume I, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012a. *Periodic Report 4 for the Fourmile Branch IOU (U)*, SRNS-RP-2011-01359, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2012b. *2011 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U)*, SRNS-RP-2012-00045, Volume I, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012c. *EC&ACP Groundwater Monitoring Optimization Report: A Comprehensive, Technical Approach for the Evaluation and Optimization of Groundwater Monitoring and Reporting (U)*, SRNS-RP-2012-0196, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC , 1991. *Closure Plan for the F-Area Hazardous Waste Management Facility*, Revision 10, Volume IV, November 18, 1991, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1995. *Interim Action Record of Decision Remedial Alternative Selection for F-Area Groundwater Operable Unit (U)*, WSRC-RP-94-1162, Revision 1, Westinghouse Savannah River Company, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2001. *F-Area HWMF Corrective Action Phase 1 Evaluation*, WSRC-RP-2001-4014, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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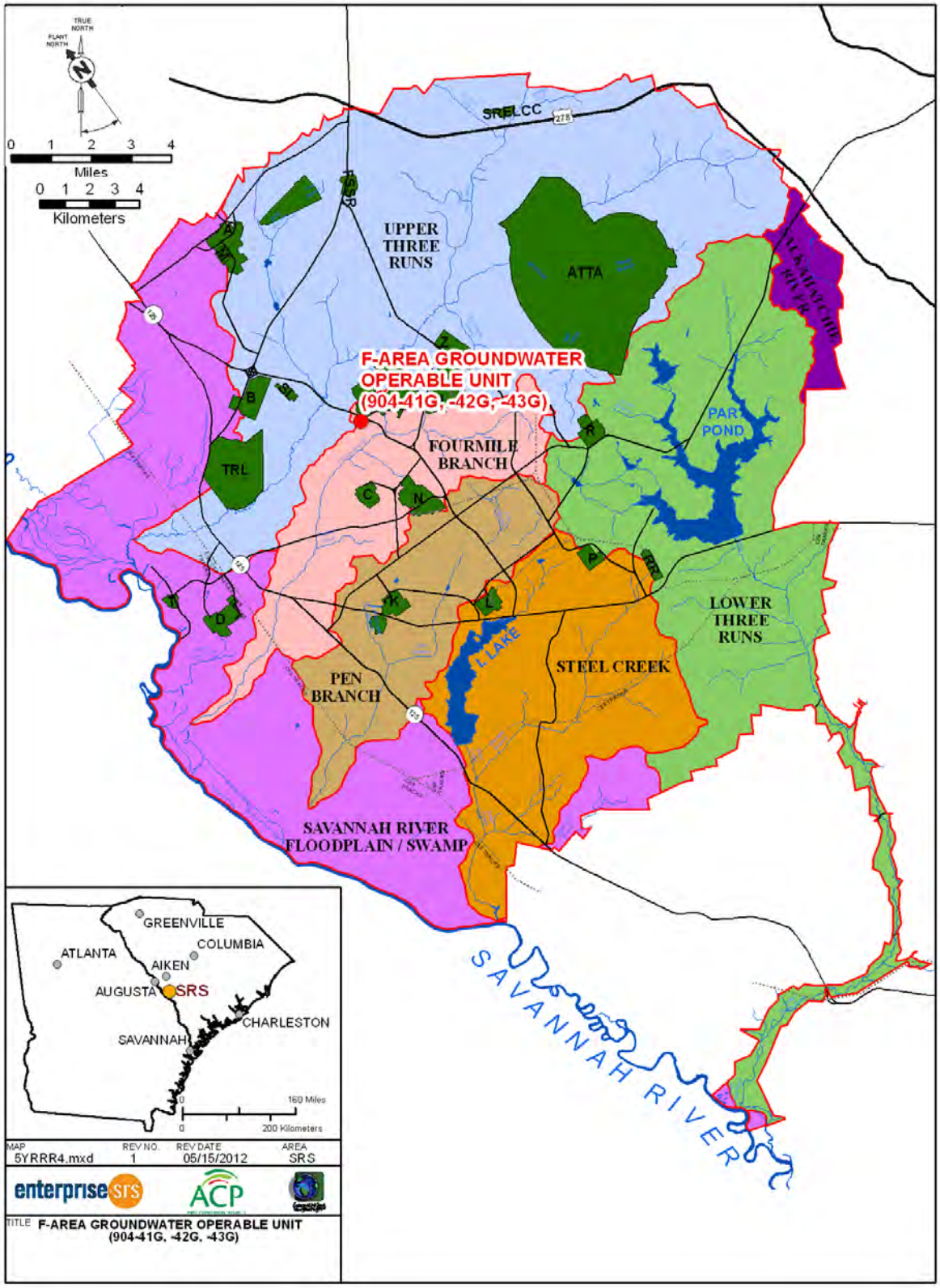


Figure S-1. F-Area Groundwater on Savannah River Site

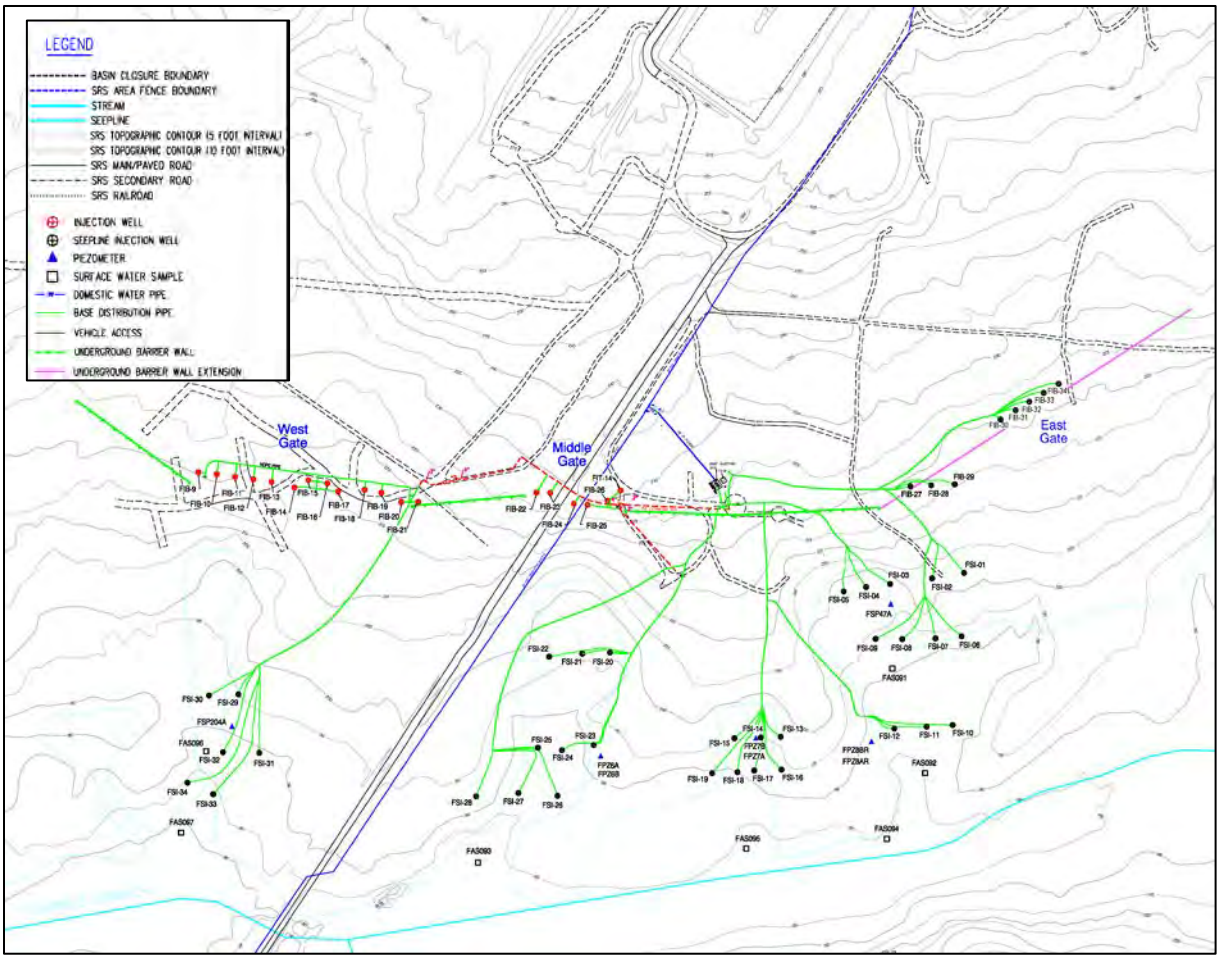


Figure S-2. F-Area Groundwater OU Treatment Systems Locations



Figure S-3. 2012 Photographs of the F-Area Groundwater Treatment System

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Table S-1. Chronology of OU Events

Event	Date
RCRA Closure Plan Approved	June 1989
Corrective Action start	1989
RCRA Closure Certified	February 1991
Interim Action Record of Decision (ROD) Issuance	April 13, 1995
Revised CAP submitted for Alternative Treatment	March 2003
Previous Five-Year Reviews	June 30, 1997 / February 12, 2004 / February 4, 2009

Table S-2. F-Area Groundwater OU/HWMF Monitored Hazardous Constituents

Inorganics
Antimony, Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Cyanide, Lead Mercury, Nickel, Nitrate, Selenium, Silver, Thallium, Vanadium, Zinc
Organics
Benzene, bis(2-Ethylhexyl)phthalate, Phenols, Tetrachloroethylene, Trichloroethylene, Trichlorofluoromethane
Radionuclides
Gross alpha, Gross (nonvolatile) beta, Total radium, Americium-241, Cesium-137, Curium-242, Curium-243/244, Curium-246, Cobalt-60, Iodine-129, Plutonium-238, Plutonium-239/240, Radium-226, Radium-228, Strontium-90, Technetium-99, Thorium-228, Thorium-230, Tritium, Uranium-233/234, Uranium-235, Uranium-238

Per the SRS RCRA Permit (SCDHEC 2003)

* As listed in Final ROD for F-Area HWMF (WSRC 1993) and IROD for F-Area Groundwater (WSRC 1995), these constituents would not necessarily be identified as final or refined COCs under current protocols. These constituents have not necessarily exceeded their respective MCLs or even been detected in local groundwater.

Table S-3. Summary of Calculated Tritium Flux to FMB Associated with the F-Area Groundwater OU

Year	Calculated Tritium Flux (Ci/yr)	% Tritium Reduction (Baseline year of 2000)
2000	650[a]	NA
2003	352[b]	46
2004	352[b]	46
2005	254[b]	61
2006	177[b]	73
2007	173[b]	73
2008	168[b]	74
2009	115[a]	82
2010	240[c]	63[e]
2011	117[d]	80

a - As reported in the Annual CAR (SRNS 2010)

b - As reported in the Annual CAR (SRNS 2009)

c - As reported in the Annual CAR (SRNS 2011)

d - As reported in the Annual CAR (SRNS 2012b)

e - Extensive base injection in the wetlands during 2009 and 2010 led to a temporary increase in tritium flux to FMB

Table S-4. Summary of Constituents from the F-Area GW OU Surface Waters of FMB Detected Above Standards

Constituent	Unit	GWPS or MCL[1]	Maximum Concentration (µg/L) [# of samples]		
			2nd Remedy Review (1997-2001)	3rd Remedy Review (2002–2006)	4th Remedy Review (2007–2011)
Cesium-137	pCi/L	50	110 [12]	12.7 [27]	16.1 (J) [40]
Cobalt	µg/L	3	4.71 (J) [14]	1.3 [27]	1.22 [21]
Gross alpha	pCi/L	15	155 [19]	2.71 [51]	2.3 [53]
Iodine-129	pCi/L	1	0.642 [10]	5.88 [22]	14.5 [53]
Nitrate	µg/L	10,000	0.665 [23]	42.6 [55]	7.48 [51]
Nonvolatile beta	pCi/L	50	207 [19]	26.2 [51]	23.6 [53]
Phenols	µg/L	2	ND [10]	ND [21]	58 (J) [11][2]
Radium, total	pCi/L	5	30.3 [15]	0.66 [30]	0.59 [31]
Radium-226	pCi/L	5	28.7 [15]	0.64 [38]	0.49 [31]
Radium-228	pCi/L	5	22.1 [16]	4.93 [34]	4.08 [24]
Strontium-90	pCi/L	8	13.2 [17]	5.5 [18]	5.6 [41]
Tritium	pCi/L	20,000	506,000 [25]	625,000 [261]	337,000 [298]

NOTE: Constituents that are in italics had detections in the upstream sampling locations that would receive waters from the H-Area GW OU at greater or equivalent concentrations during the same 5 year period as found in the F-Area wells.

[1] The more conservative of the MCL or GWPS was used for comparison

[2] Of the 11 records, 7 were non-detects and 4 were estimated values.

Table S-5. Summary of Constituents from the F-Area GW OU Seepline Detected Above Standards

Constituent	Unit	GWPS or MCL[1]	Maximum Concentration (µg/L) [# of samples]		
			2nd Remedy Review (1997-2001)*	3rd Remedy Review (2002–2006)	4th Remedy Review (2007–2011)
Beryllium	µg/L	4	21.9 [7]	22.3 [254]	10.8 [283]
Cadmium	µg/L	5	14.2 [7]	26.8 [268]	22 [355]
Cobalt	µg/L	3	36.7 [7]	373 [264]	294 [337]
Gross alpha	pCi/L	15	543 [5]	143 [371]	90.1 [369]
Iodine-129	pCi/L	1	1620 [7]	926 [302]	392 [397]
Mercury	µg/L	2	ND [7]	5.89 [272]	2.3 [357]
Nitrate	µg/L	10,000	173,000 [6]	259,000 [351]	201,000 [385]
Nonvolatile beta	pCi/L	50	1070 [5]	1730 [371]	1870 [369]
Radium, total	pCi/L	5	83.8 [6]	98.4 [254]	90.2 [194]
Radium-226	pCi/L	5	77.9 [5]	100.2 [298]	56.3 [370]
Radium-228	pCi/L	5	28.3 [6]	417 [294]	279 [369]
Strontium-90	pCi/L	8	393 [6]	802 [174]	392 [380]
Technetium-99	pCi/L	50	791 [5]	403 [308]	146 [266]
Tritium	pCi/L	20,000	5,190,000 [7]	6,530,000 [501]	3,650,000 [564]
Uranium-233/234	pCi/L	15	238 [6]	113 [307]	48.2 [380]
Uranium-238	pCi/L	15	430 [6]	201 [307]	66.4 [380]

Note: Analytical data reported began in 2001.

[1] The more conservative of the GWPS or MCL was used for comparison purposes

Table S-6. Comparison of Permitted GWPS for the F-Area Groundwater versus MCLs

Constituent	GWPS[1] (µg/L)	MCL[2] (µg/L)
Arsenic	50	10
Cyanide	20	200

1 GWPS as set forth in the SRS RCRA Permit (SCDHEC 2003)

2 EPA MCLs (Feb 2012)

Table S-7. Recommendations and Follow-Up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Optimization of sampling to correlate with rate of change of contaminant concentrations	Reduce sampling for full suite in selected wells from semi-annual to annual	DOE	SCDHEC	4/2013	N	N
Optimization of analyte list	Delete cyanide from the monitoring program	DOE	SCDHEC	4/2013	N	N
Optimization of wells sampled	For well pairs providing redundant data, remove 1 each from the sampling program	DOE	SCDHEC	4/2013	N	N

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Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater)

I. SITE INFORMATION			
Site Name:	**F-Area Hazardous Waste Management Facility (Groundwater)**	**Date of Inspection:**	**07/03/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 93°F**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☒ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☒ Vertical Barriers
- ☒ Other Base injection

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: _____ (Name) _____ (Title) _____ (Date)

Interviewed: ☐ At Site ☐ At Office ☐ By Phone Phone No.: _____

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Stuart Crosby (Name) Operations Engineering (Title) 7/3/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-3021

Problems/Suggestions: ☐ Report Attached _____

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: _____

_____

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Other Permits	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: RCRA Part B Permit, Underground Injection Control Permits

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: _____

B. Fencing

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition. _____

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(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.) Field Walk Down

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/17/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(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:_____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

VII. COVER SYSTEMS *(Continued)*
C. Benches ☐ 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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☐ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:_____
E. Gas Collection and Treatment ☐ Applicable ☐ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:_____
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:_____

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Remarks: _____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident

Areal extent _____ Depth _____

Remarks: _____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A

☐ Vegetation does not impede flow

Areal extent _____ Type _____

Remarks: _____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent _____ Depth _____

Remarks: _____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☒ Applicable ☐ N/A

1. Settlement: ☐ Location shown on site map ☒ Settlement not evident

Areal extent _____ Depth _____

Remarks: _____

2. Performance Monitoring:

Type of Monitoring Potentiometric head _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching Head Differential _____

Remarks: Since installation of the walls, potentiometric heads have been rising on the upstream side and declining on the downstream side and have not reached equilibrium yet.

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: The groundwater extraction system has been removed from service

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☒ Good Condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☒ Filters
☐ Additive (e.g., chelation agent, flocculent)
☐ Others
☒ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☒ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually
☐ Quantity of surface water treatment annually
Remarks: The groundwater extraction system has been removed from service.

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☒ Good Condition ☐ Needs maintenance
Remarks:

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☒ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:

4. Discharge Structure Appurtenances:

☒ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:

5. Treatment Building(s):

☐ N/A ☒ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:

D. Monitoring Data

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks:

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Groundwater Injection Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☒ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: The baseline injection system is operated as needed to maintain desired groundwater parameters.

2. Injection System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

Attachment S-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (Groundwater) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The groundwater extraction/treat/reinjection remedial system functioned as designed . The installation of the barrier wall with base injection in the gates is installed and operating as designed. A treatment for iodine-129 has been implemented with evaluation of the deployment results available in the 2013/2014 timeframe. . The combination of treatments is expected to meet the RAOs and RGs for this OU. The remedies deployed address the potential ecological impacts at the seeplines along Fourmile Branch and the ambient water quality standards in Fourmile Branch by remediating this OU.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Operating and Maintenance programs are well established and functioning to ensure that remedial systems remain in effective service. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. See Table S-7 of this OU-specific review.

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F-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-41G, -42G, -43G) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the F-Area Hazardous Waste Management Facility (904-41G, 904-42G, and 904-43G) (F-Area HWMF) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the F-Area HWMF OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the F-Area HWMF OU is protective of human health and the environment. This report documents the results of the review. The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document.

II. OU Chronology

Table T-1 lists the chronology of site events for the F-Area HWMF OU.

III. Background

The F-Area HWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for SRS. The media associated with the F-Area HWMF OU is soil. The groundwater associated with this unit is managed as the F-Area Groundwater OU.

Physical Characteristics

The F-Area HWMF OU is located in the central portion of SRS, approximately 8 km (5 mi) from the nearest site boundary (Figure T-1). The F-Area HWMF OU consists of three unlined basins, F-1 (904-41G), F-2 (904-42G) and F-3 (904-43G) and the associated

F-Area Inactive Process Sewer Line (FIPSL). Figure T-2 shows the site layout for the F-Area HWMF OU. The dimensions and volumetric capacity of the basins were as follows:

- Basin F-1 – 27 m x84 m x3.2 m (90 ft x 280 ft x 10.7 ft), 1.6 million gallons;
- Basin F-2 –27 m x159 m x3.2 m (90 ft x 530 ft x 10.7 ft), 3.1 million gallons; and
- Basin F-3 –93 m x 216 m x 3.4 m (310 ft x 720 ft x 11.2 ft), 15.8 million gallons.

At the time of closure, the F-Area HWMF had a combined maximum operating capacity of 20.5-million gallons of wastewater.

The FIPSL that was used to convey wastewater to F-Area HWMF is outside the scope of the F-Area HWMF Record of Decision (ROD). The FIPSL RCRA closure action will be completed as a part of the closure of the F-Area Tank Farm and Separations facility to avoid impacting underground and overhead interferences necessary to ensure safe operation of the F-Area facilities (SRNS 2009).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the Savannah River Site (WSRC 1999) designates the F-Area HWMF OU as being within an industrial area. The future land use for the F-Area HWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The F-Area HWMF operated from 1955 until November 7, 1988. During that time, the F-Area HWMF received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general-purpose evaporator overheads.

Significant amounts of nitrate and caustic were received in the basins. Radioactive releases were greater than 99 percent tritium (SRNS 2009). The first soil samples at the

F-Area HWMF were collected in Basin F-3 in 1971, a year after the U.S. Environmental Protection Agency (USEPA) was formed, and five years before RCRA was enacted in 1976. A 1984 soil coring study of all three basins indicated that approximately 90% of the radionuclides, cations, and anions were concentrated within the top 0.3 m (1 ft) of basin soil.

Initial Response

Preventative actions at F-Area HWMF OU were conducted pursuant to the requirements of RCRA per Settlement Agreement 87-27-SW.

Closure of the three basins began in 1989 and was completed in May 1991. The three basins were closed by dewatering; physically and chemically stabilizing the remaining sludges with a layer of granite, limestone, and blast furnace slag; and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.

The FHWMF was certified closed in July 1991 and was accepted by the South Carolina Department of Health and Environmental Control (SCDHEC) in October 1991 as being in compliance with RCRA requirements.

Basis for Taking Action

The constituents of concern (COCs) at the F-Area HWMF are barium, cadmium, chromium, lead, mercury, copper, cyanide, nickel, tetrachloroethylene, trichlorofluoromethane, zinc, gross alpha, gross beta, nitrate, radium-226, radium-228, tritium, americium-241, cesium-137, curium-243/244, curium-246, cobalt-60, strontium-90, technetium-99, uranium-233/234, uranium-238. No remedial goals were established in the ROD for soils (WSRC 2003).

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the F-Area HWMF within the RCRA closure process in 1988. Closure of the F-Area HWMF began in 1989 and was completed in February 1991. Preventative activities at the F-Area HWMF became

subject to CERCLA when SRS was placed on the National Priorities List (NPL) in December 1989. As documented in the ROD, the RCRA closure was selected as the final action under CERCLA. Therefore, no further action under CERCLA was necessary for the F-Area HWMF (WSRC 2003).

The remedial action objectives (RAOs) are to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The F-Area HWMF RCRA preventative action of stabilization and placement of all contaminated materials under a low-permeability cap satisfied both RAOs.

Remedy Implementation

Implementation of the selected final action remedy (i.e., the RCRA preventative action) included the following activities:

- Dewatering the basins to eliminate free liquids and to solidify the remaining waste and residues;
- Stabilizing the remaining waste by using 0.9-1.8 m (3-6 ft) of granite aggregate, 0.3 m (1 ft) of limestone and blast furnace slag to provide a load bearing capacity sufficient to support the cover system; and
- Placing a 2.7-hectare (6.8-acre) low permeability cover system consisting of a layer of backfill, a 0.6-m (2-ft) layer of low-permeability compacted kaolin clay ($1x10^{-7}$ cm/sec), a 22.5-cm (9-in) drainage layer of sand, a geotextile fabric filter, topped with 0.6 m (2 ft) of topsoil to support a vegetative cover.

Figures T-3 and T-4 provide current photographs of the F-Area HWMF.

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are on-going:

- Post-closure groundwater monitoring is required as a condition of the RCRA Hazardous Waste Permit to verify that no unacceptable exposure to potential hazards posed by conditions at the OU occur in the future.
- Monthly site inspections for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any necessary repairs will be made as part of the maintenance program.
- Institutional controls are being enforced to preclude unauthorized access or intrusive activities through the SRS Site/Use Site Clearance program and SRS site security.

Costs associated with the selected remedy for F-Area HWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost data comparison is provided in this remedy review.

V. Progress since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at F-Area HWMF are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls in place while USDOE controls the OU.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;

- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment T-1_with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls;
- Ensured that all actions required under the RCRA Permit were implemented (i.e., annual inspections and maintenance to the soil covers and groundwater monitoring); and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

A review of the monthly site inspection reports was conducted for the period 2007 through 2012. The monthly site inspections, site maintenance (i.e., repair of erosion damage, mowing, and warning signs), and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) continue to maintain the effectiveness of response actions. The most prevalent findings in the inspection reports were active ant mounds and sediment buildup blocking drainage ditch outlets, which in most instances were addressed on the spot. Review of the annual subsidence monitoring reports for the period 2007 through 2011 indicate the monument elevations are within the allowable tolerance. Inspection and maintenance data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The F-Area HWMF OU was inspected by SRNS and USDOE personnel on July 3, 2012 and October 17, 2012. No issues were identified for the F-Area HWMF OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD. The stabilization and placement of a multi-layer low permeability cover system has achieved the RAOs to prevent physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater. The effective implementation of institutional controls has prevented exposure to and ingestion of contaminated groundwater.

O&M of the cover system has, on the whole, been effective based on the review of inspection reports as documented in Section VI.

There were no opportunities for optimization observed during this review.

The institutional controls 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.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

As the remedial work has been completed, the applicable standards set forth in the ROD (WSRC 2003) and RCRA closure plan (WSRC 1991) associated with soils and basin sediments have been met. All standards and TBCs associated with groundwater are discussed in the review of the F-Area Groundwater OU.

There have been no changes in exposure pathways, land use or contaminant characteristics that would affect the protectiveness of the remedy.

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 the F-Area HWMF OU under CERCLA.

X. Protectiveness Statement(s)

The remedy at the F-Area HWMF OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled. All threats to contaminated soil at the F-Area HWMF OU have been addressed through stabilization and placement of all contaminated materials under a low-permeability cap and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the F-Area HWMF OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 2003. *South Carolina Hazardous and Mixed Waste Permit, Permit Number SC1 890 008 989, 2003 RCRA Permit Renewal for the Savannah River Site, issued September 30, 2003, Module IV - Groundwater Requirements, Section B, F-Area Hazardous Waste Management Facility*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC.

SRNS, 2009. *2000 RCRA Part B Permit Application for the F-Area Hazardous Waste Management Facility (F-Area HWMF) Postclosure*, WSRC-IM-98-30, Volume IV, Revision 1, River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1991. *Closure Plan for F Area Hazardous Waste Management Facility*, Volume IV, Revision 10, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2003. *Final Record of Decision Remedial Alternative Selection for F-Area Hazardous Waste Management Facility (U),* WSRC-RP-93-1042, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - Post-Closure Inspection F-Area Hazardous Waste Management Facilities 904-41G, 904-42G, 904-43G, ER-SOP-008, Inspection period 2007 through 2011 (monthly)

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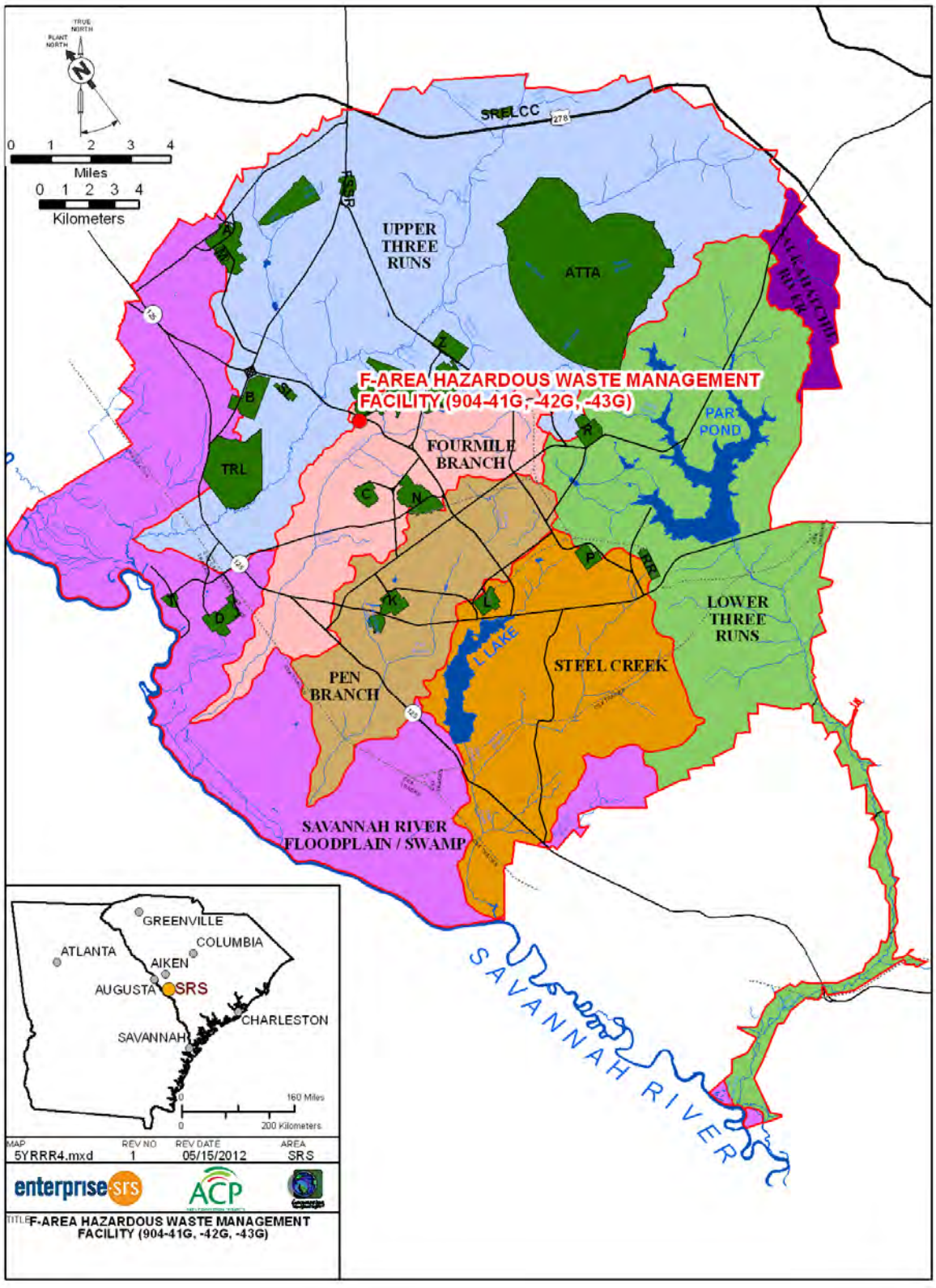


Figure T-1. Location of the F-Area Hazardous Waste Management Facility at SRS

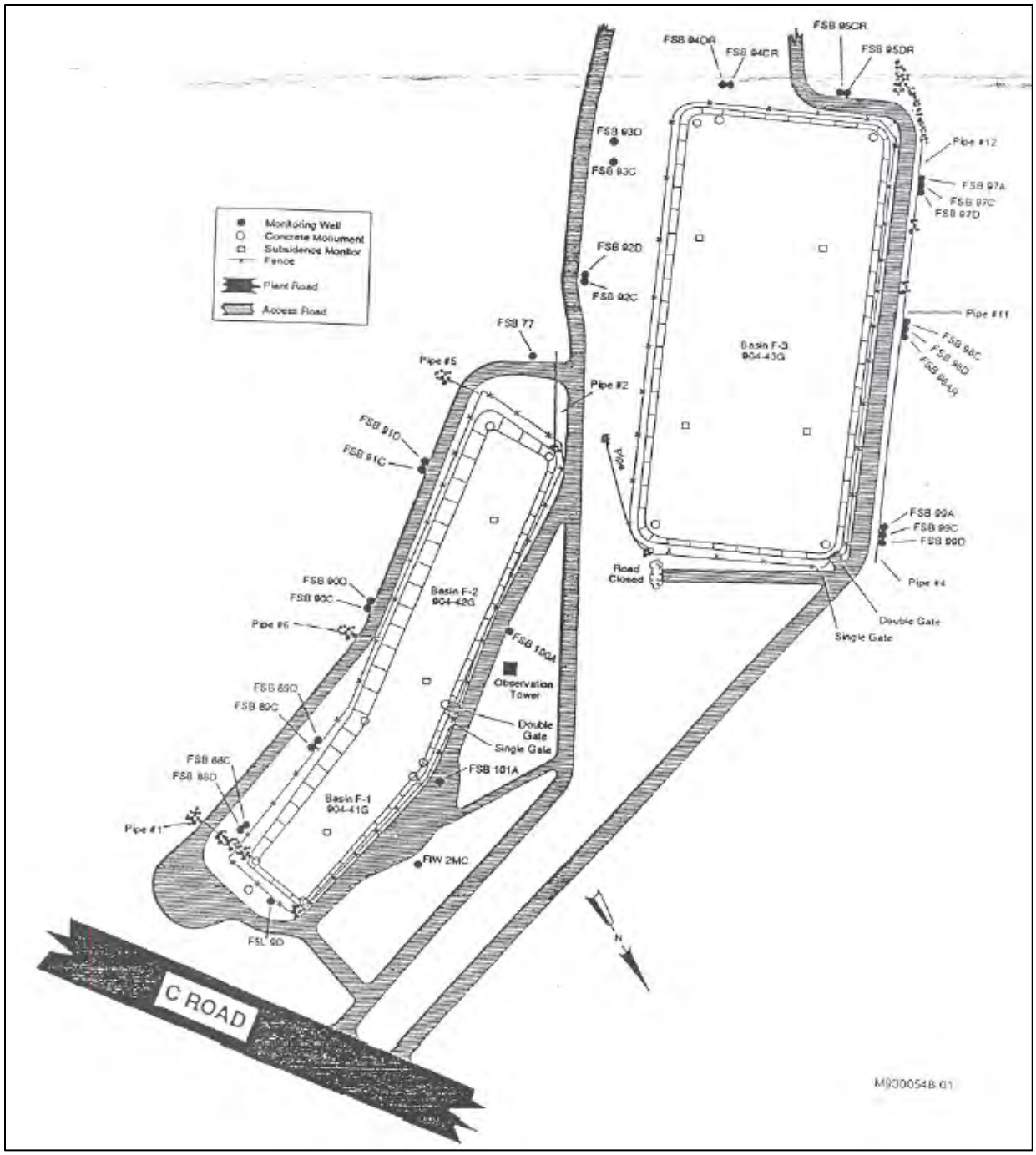


Figure T-2. Site Layout for F-Area Hazardous Waste Management Facility



Figure T-3. Current Aerial Photograph of the F-Area HWMF (2010)



Figure T-4. Current On-Unit Photographs of the Cover System of the F-Area Hazardous Waste Management Facility OU

Table T-1. Chronology of OU Events

Event	Date
RCRA Closure Plan Approved	June 1989
Corrective Action start	1989
RCRA Closure Certified	February 1991
Final Record of Decision (ROD) Issuance	September 10, 1993
Previous Five-Year Reviews	June 30, 1997 / February 12, 2004 / February 4, 2009

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Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU

I. SITE INFORMATION			
Site Name:	**F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU**	**Date of Inspection:**	**07/03/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #6**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 95°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☒ Other Stabilization and Excavation
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Post Closure Inspection F-Area Hazardous Waste Management Facilities 904-41G, 904-42G, 904-43G (U)*, ER-SOP-008 _____

_____

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Other Permits	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: RCRA Part B Permit

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Field Walk Down

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/17/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks:
VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent _____ Depth _____ Remarks:
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent _____ Depth _____ Remarks:
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent _____ Depth _____ Remarks:
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress Areal extent _____ Depth _____ Remarks: Vegetation is mowed routinely.

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay Remarks:_____

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☒ Located ☒ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☒ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
2. Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A
1. Siltation: ☐ Location shown on site map ☒ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☒ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☒ N/A Remarks:_____
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
1. Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment T-1. Five-Year Review Site Inspection Checklist – F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The closure of the three basins (904-41G, -42G, -43G) by dewatering, physically and chemically stabilizing the remaining sludge, and placing a protective multi-layer cover system over them has met the remedial objectives of preventing physical exposure to contaminants and mitigating further migration of contaminants to the groundwater. Selected remedies for the FHWMF OU are functioning as intended. There are no issues requiring corrective actions.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of site inspections and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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F-AREA RETENTION BASIN (281-3F) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the F-Area Retention Basin (FRB) (281-3F) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the FRB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the FRB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table U-1 lists the chronology of site events for the FRB OU.

III. Background

The FRB OU is a Resource Conservation Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS).

Physical Characteristics

The FRB OU includes a basin, designated as 281-3F, and two process sewer lines. The OU is located outside and south of the F-Area perimeter fence, approximately 1,019 m (3,397 ft) north of Fourmile Branch (Figures U-1 and U-2). The basin is approximately 60 m (200 ft) long, 38.7 m (129 ft) wide, and 2.1 m (6.9 ft) deep covering an area of approximately 0.24 hectares (0.6 acres). The two process sewer lines (60-cm [24-in] and approximately 165 m [550 ft] long; 90-cm [36-in] and approximately 210 m [700 ft] long) conveyed and discharged water into the north side of the basin.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the Savannah River Site (WSRC 1999) designates the FRB OU as being within an industrial area. The future land use for the FRB OU is reasonably anticipated to

remain industrial with U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The FRB OU was designed and operated as an unlined temporary storage pond, with a capacity of approximately 1.2-million gallons, for potentially contaminated cooling water from F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. The FRB became operational in 1955 and remained active until 1972. It was closed in December 1978.

Initial Response

After the FRB closure in 1978, soil sampling was performed at the basin and approximately 0.6 m (2 ft) of soil was excavated from the bottom of the basin as a removal action. The basin was backfilled with clean soil and the area was seeded with grass. A total of 969 m^3 (1,267 yd^3) of contaminated soil was removed from the basin and transported to the Old Radioactive Waste Burial Ground (643-E) for permanent disposal.

When the FRB was closed, two sections of the process sewer line that served the basin were abandoned. These included both branches of the pipeline that ran from the F-Area Tank Farm (FTF) and from the F-Area Canyon Facility. The 60-cm (24-in) diameter pipeline that extended from the FTF was sealed off at manhole P37 (805-2F). The 90-cm (36-in) diameter pipeline that extended from the F-Area Canyon Facility was sealed off at manhole P-40. The approximate length of the abandoned portion of the process sewer line located to the north and south of the basin is 345 m (1,150 ft) and is part of this OU.

Basis for Taking Action

Constituents identified as contaminants of concern (COCs) (Table U-2) are present in both the basin and process sewer line areas. Exposures and risks are driven by the COCs in the soils. Carcinogenic risks exist for both the future on-unit worker and hypothetical future on-unit resident in the Basin and Process Sewer Line Areas. The future construction worker is identified as facing a potential carcinogenic risk in the Process

Sewer Line Area. Leaching of strontium-90 from deep soils to the groundwater is estimated to exceed maximum contaminant levels (MCLs) by almost 10-fold in 76 years has been identified as a potential contaminant migration carcinogenic risk to human health in the basin area. The only non-carcinogenic hazard identified for the FRB OU is to the future on-unit resident as a result of potential exposure to metals in soils associated with the basin area. There are no non-carcinogenic hazards associated with the process sewer line area. No ecological risks have been identified with the FRB OU Remedial Actions

Remedy Selection

The FRB, surrounding soils, and groundwater were characterized in detail in 1997 (WSRC 1997a and WSRC 1997b). The results showed that the groundwater was not contaminated and, therefore, would not require remediation. The surface soil in the basin area and the process sewer line area was contaminated primarily with cesium-137, radium-226, and potassium-40. The subsurface soil contained strontium-90, which was identified as a contaminant migration constituent of concern (CMCOC). The basin deep soil, 1.8 to 4.2 m (6 to 14 ft) deep, is contaminated with high levels of radionuclides and is considered to be principal threat source material (PTSM). No COCs were identified for the groundwater. The final soil COCs for the FRB OU are actinium-228, arsenic, cesium-137, lead-212, plutonium-239/240, potassium-40, radium-226, strontium-90, and thallium. The COCs and associated remediation goals (RGs) are presented in Table U-2.

The remedial action objectives (RAOs) for the FRB OU as listed in the ROD (WSRC 1998) are as follows:

- Reduce risks to human health associated with the COCs through external exposure to radiological constituents by direct contact with the basin area soil, surface water, and sewer line area soil, ingestion of basin area and sewer pipeline area soils and pipeline sediment or produce grown in soils with radiological constituents;
- Prevent or mitigate exposure to highly toxic or highly mobile contaminants that represent PTSM; and

- Prevent or mitigate leaching and migration of strontium-90 to groundwater at levels that will cause the groundwater to exceed its maximum contaminant level (MCL) of 8.0 ρCi/L.

The selected remedies as described in the ROD (WSRC 1998) are as follows:

- Basin Soils: Institutional Controls, Grouting, a Low Permeability Cover, and Groundwater Monitoring;
- Former process Sewer Line: Institutional Controls, Pipeline Grouting, Soil Excavation and Disposition in the Basin Soils; and
- Groundwater: No action.

The OU will be physically maintained and institutional controls will remain in place in perpetuity. Short-term institutional controls will include signs posted at the FRB OU indicating the area was used for disposal of waste material and contains buried waste, as well as the SRS Site Use/Site Clearance Programs that prevent excavation of or penetration into the buried waste/contaminated subsurface soils. If the property is transferred to non-Federal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. These actions include a deed notification and a certified survey.

Remedy Implementation

The FRB basin soil remedial actions implemented in accordance with the ROD (WSRC 1998) are listed below:

- Consolidating 32 m^3 (42 yd^3) of hot spot soils by excavating the 1.2 m (4 ft) from the FRB side walls and the hot spots around the process sewer line and transporting the soils to the bottom of the FRB.
- In situ stabilizing of 880 m^3 (11,500 yd^3) of contaminated soil by grouting the FRB deep basin soil approximately 0.6 m (2 ft) above the basin bottom to approximately 1.8 m (6 ft) below the basin bottom or approximately 4.2 m (14 ft) below grade.

- Installing a 0.24-hectare (0.59-acre) low permeability soil cover system with a hydraulic conductivity of $1x10^{-5}$ cm/sec to minimize infiltration of precipitation and serve as a barrier to shield human and ecological receptors from potential soil contamination. The cover system includes three layers (from bottom to top) - a grading layer of common fill, a 0.6-m (2 ft) thick low permeability soil layer, and a 45-cm (18-in) vegetation layer with the top 15 cm (6 in) being top soil mixed with common fill.

- Establishing land use controls (LUCs) for 0.44 hectares (1.07 acres) (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit).

- Implementing SRS access controls (SRS site security).

- Installing warning signs.

The Process Sewer Line soil remedial actions implemented in accordance with the ROD are described below:

- Grouting pipelines and manholes to prevent access to the contaminants within the pipeline.

- Establishing the same institutional controls as for the basin soil.

Results of groundwater modeling indicated the FRB-associated groundwater posed no risk to human health or the environment. No COCs were identified for the groundwater and no remedial action was required (WSRC 1998).

An Explanation of Significant Differences (ESD) to the ROD (WSRC 2000) was approved to modify the remedy. The ESD was issued on June 13, 2001. The original remedy included an estimate of 229 m^3 (300 yd^3) of contaminated pipeline soils that would require excavation and placement into the basin for stabilization along with the existing basin soils. This estimate was based on the amount of soil that would exceed the established 20 pCi/g gross alpha and 50 pCi/g nonvolatile beta screening criteria. During field execution of the selected remedy, it was determined that the estimate of soils

exceeding the 20/50 screening criteria was 2,944 m^3 (3,850 yd^3). The basin had insufficient capacity to hold the increased volume of soil. Although this remaining soils exceeds 20/50 screening criteria, it does not represent a PTSM or contaminant migration concern. SRS achieved the 20/50 screening criteria at the basin sidewalls and outlet structure and drainage ditch areas. Due to the limited basin capacity available for soil treatment, a change was proposed for excavation and treatment of soils representing a PTSM while leaving in place pipeline soils that do not represent a PTSM or migration concern.

The ESD modified the 20/50 screening criteria to the following. "The volume of contaminated soil will be determined by comparing the existing sampling data against the acceptance criteria (concentration levels not to exceed 20 pCi/g alpha and 50 pCi/g for beta and gamma emitters to a 0.6 m (2 ft) depth while leaving any deeper soils (at depths greater than 0.6 m [2 ft]) that do not represent a PTSM or migration concern)." Analytical data indicated that there are no COCs at concentrations that meet the definition of PTSM at any of these hot spot locations. Soils remaining in the vicinity of the pipeline would be designated as Underground Radioactive Materials Area and would remain under institutional control within the existing nuclear facility. This modification to the original remedy is expected to comply with all RAOs as set forth in the ROD (WSRC 2000) while holding the cost and schedule of the remedy approximately constant.

Current photographs of the OU are presented in Figures 3 and 4.

System Operations/Operation and Maintenance

There are no systems operating at the FRB OU.

The FRB OU maintenance activities that have been implemented in accordance with the ROD are as follows:

- Groundwater Monitoring – groundwater sampling data collection is on-going. The monitoring data is evaluated and reported annually to both U.S. Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). Beginning in 2010, the USDOE, USEPA and

SCDHEC agreed that the monitoring data associated with the FRB OU would be included in the annual submittal of the *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)* (SRNS 2010, 2011, 2012).

- Site Inspections – semiannual inspections are performed to verify warning signs, adequate vegetative cover, and erosion controls.

The estimated operation and maintenance (O&M) costs associated with the selected remedy for FRB include O&M costs of the soil cover and institutional controls has a present worth of $29,000, discounted at 7% per year for 30 years of maintenance activities. The actual O&M cost since the remedial action was completed in FY01 until FY11 is $100,000. The actual O&M costs (Table U-3) are as expected.

IV. Progress since Last Review

The protectiveness statement from the last Five-Year Remedy Review Report concluded that the implementation of in-situ stabilization, low permeability cover system, pipeline grouting, and institutional controls is protective of human health and the environment. There were no recommendations or follow-up actions required.

V. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed documents listed in Section XII, Documents Reviewed;
- Reviewed well monitoring data;
- Confirmed implementation of the remedial action;
- Inspected the OU and documented the results on the Inspection Checklist provided in Attachment U-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

In order to evaluate the potential of exposure to human receptors to soils associated with the basin and abandoned process sewer line and the potential exposure to highly toxic or highly mobile contaminants that represent PTSM (i.e., strontium-90), a review of the RI/BRA report (WSRC 1997b), Corrective Measures Implementation Report/Post Construction Report/Final Remediation Report (CMR/PCR/FRR) (WSRC 2001), groundwater data (SRNS 2010, SRNS 2011, SRNS 2012) and the semiannual inspections reports were conducted.

Review of the RI/BRA (WSRC 1997b) and CMR/PCR/FRR (WSRC 2001) indicates the PTSM contaminated soil remaining in the basin is located below the basin bottoms within the stabilized soil matrix over which a cover was placed; thus, breaking the exposure pathways to receptors and minimizing the potential for exposure to PTSM. The maximum concentration of constituents identified as PTSM were reviewed and corrections made for radioactive decay (Table U-4).

Groundwater data associated with the COCs (WSRC 2001) was reviewed (Table U-5) and indicates that all COC constituents are below MCLs. This provides evidence the stabilization of contaminants is effectively inhibiting migration of contaminants in the solidified soils beneath the cap. Of the 662 COC analyses records reviewed, 622 (or 94%) were qualified as definitive level data. TCE was the contaminant detected at this site that had no history of discharge to the FRB and thus is monitored for trigger action as the indicator of contamination from an upgradient source. Review of the TCE data from 1997 through 2011 provides no evidence that concentrations are increasing. Table U-6 provides the concentration ranges for detections of TCE. The well data for TCE was inputted into MAROS for trend evaluation. The results of the evaluation indicated a probably decreasing trend in FRB1 and a decreasing trend in FRB2. No results were returned for FRB3 and FRB4.

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 (8 ρCi/L).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the FRB OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The FRB OU was inspected by SRNS and USDOE personnel on July 3, 2012 and October 17, 2012. No issues were identified for the FRB OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding the FRB OU were identified during the inspection.

VI. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

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. 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 semiannual inspection reports for the period 2007 through 2011 indicate the in-place remedy is functioning properly. The most prevalent findings were active ant mounds which were treated immediately by the maintenance crew conducting the inspections. During this five-year period there were two findings of vegetation blocking signage associated with the unit and one instance of a small hardwood growing on the soil cover. Actions were taken to remove the vegetation and tree within three days of the finding. Review of the inspection reports indicates the maintenance is operating effectively and efficiently.

The institutional controls (i.e., land use controls [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.

An opportunity for system optimization was identified during this review. Based on the lack of findings during the semiannual site inspections and the effectiveness of institutional controls in preventing human activity at this OU, it is recommended that the inspection frequency be reduced from semi-annual to annual.

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 standards or to-be-considered guidance identified in the ROD that call into question 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.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No new information has come to light that could call into question the protectiveness of the remedy.

VII. Issues

There are no issues for this OU.

VIII. Recommendations and Follow-up Actions

Recommendations and follow-up actions concerning FRB OU are listed in Table U-7.

IX. 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., land sue controls) 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.

X. Next Review

The next five-year review is scheduled for January 2019.

XI. 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. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, 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, March 2013, 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 2007 through 2011 (semiannually)

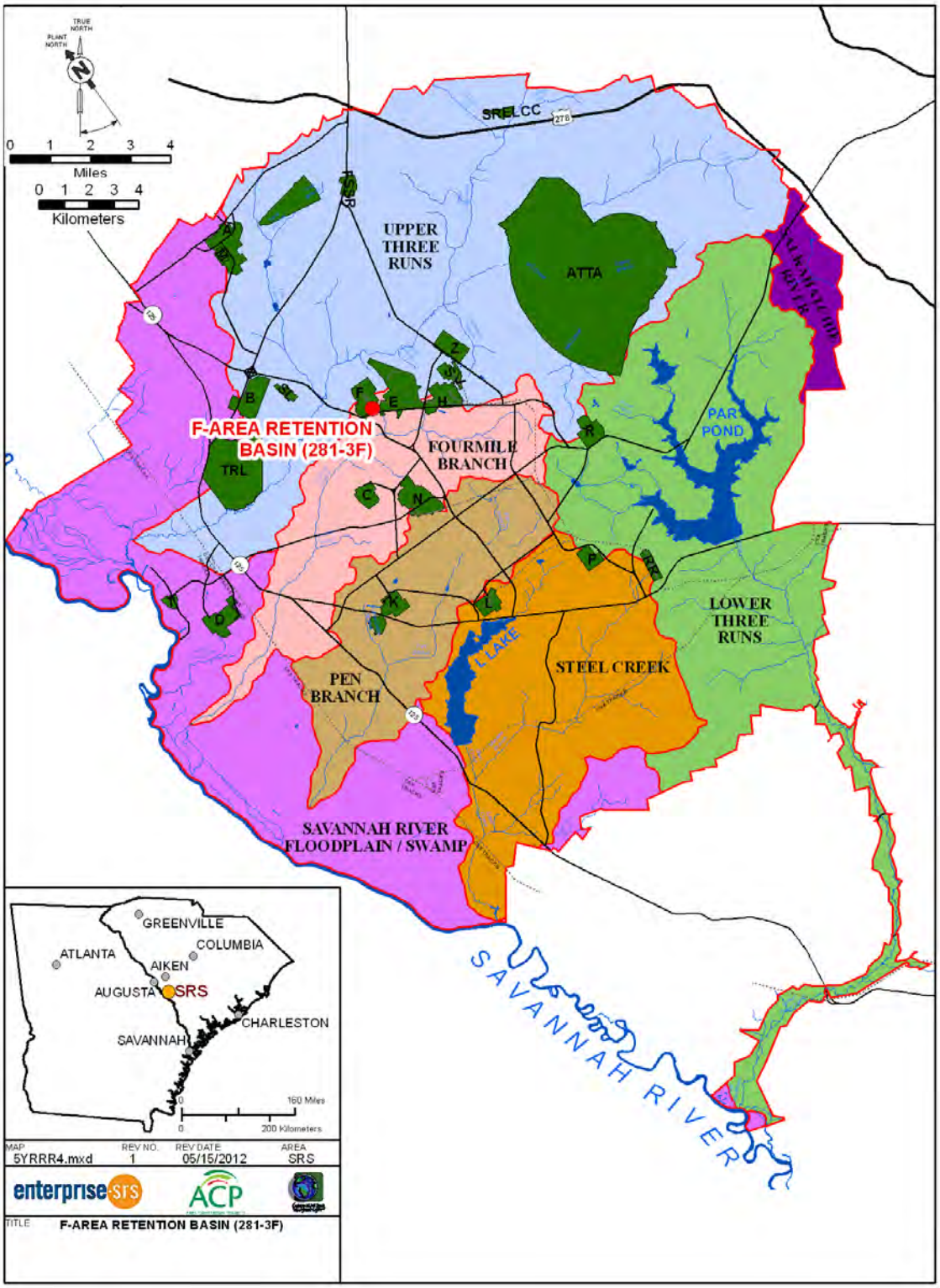


Figure U-1. Location of the F-Area Retention Basin (281-3F) OU at SRS

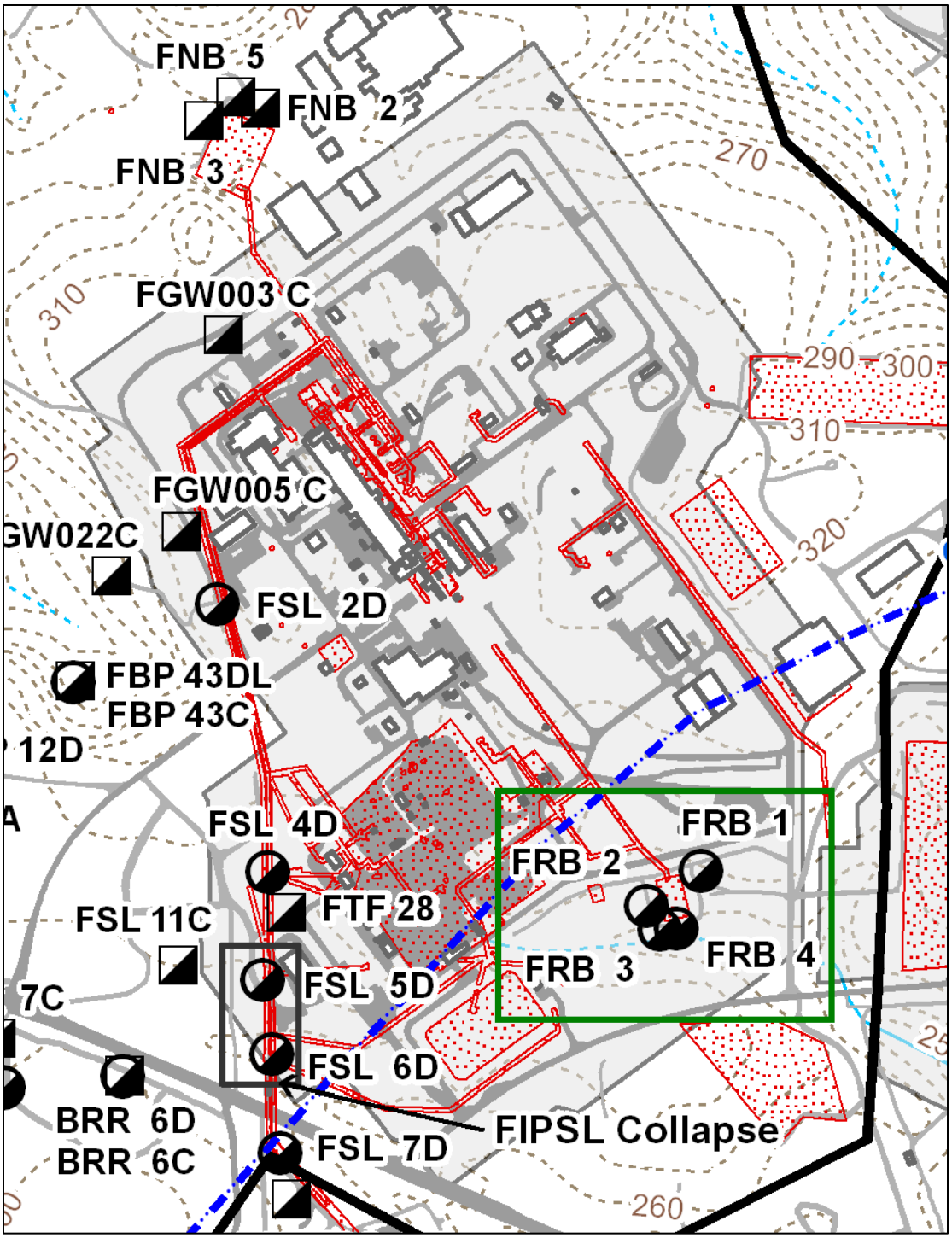


Figure U-2. **Location of the F-Area Retention Basin OU within the F-Area at SRS (the basin and monitoring wells are located within the green box)**



Figure U-3. 2010 Aerial photograph of the F-Area Retention Basin Post-Construction



Figure U-4. 2012 Photograph of the F-Area Retention Basin Post-Construction

Table U-1. Chronology of OU Events

Event	Date
Removal Action (Soil Excavation)	1979
Remedial Investigation (RI) complete	1994/1997
Final Record of Decision (ROD) issuance	October 19, 1998
Remedial Action start/complete	March 17, 1999/February 21, 2001
Explanation of Significant Difference (ESD) issuance	June 13, 2001
Previous Five-Year Reviews	February 12, 2004/February 4, 2009

Table U-2. Final Contaminants of Concern (COC) for FRB OU Soils with Remedial Goals (RGs)

Medium	COC	RG
Former Basin Area		
Surface Soil (0-1 ft)	Cesium-137 Potassium-40 Radium-226 Thallium	0.74 pCi/g 2.53 pCi/g 0.226 pCi/g 25.9 mg/kg
Subsurface Soil (0-4 ft)	Arsenic Cesium-137 Potassium-40 Radium-226 Plutonium-239/240 Thallium	11.1 mg/kg 0.74 pCi/g 2.53 pCi/g 0.226 pCi/g 69.8 pCi/g 25.9 mg/kg
Leachability to Groundwater from FRB Soil	Strontium-90	109 pCi/g
Process Sewer Line Area		
Surface Soil (0-1 ft)	Arsenic Actinium-228 Cesium-137 Potassium-40 Radium-226	11.1 mg/kg 0.202 pCi/g 0.74 pCi/g 2.53 pCi/g 0.226 pCi/g
Subsurface Soil (0-4 ft)	Arsenic Actinim-228 Cesium-137 Potassium-40 Radium-226 Strontium-90	11.1 mg/kg 0.202 pCi/g 0.74 pCi/g 2.53 pCi/g 0.226 pCi/g 233 pCi/g
Sediment within the Pipeline & Manholes	Arsenic Cesium-137 Plutonium-239/240	63.9 mg/kg 1.1 pCi/g 26.3 pCi/g

Table U-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	15,900	7,300	3,700	3,600	3,100	33,500
Total ROD Estimated Direct O&M Costs	2,500*	2,500*	2,500*	2,500*	2,500*	12,500

*Source of estimate – WSRC-RP-97-145, page 63. The annual direct O&M unit cost of $2,500 is based on a Present Worth of $29,000 for 30 years discounted at 7%.

Table U-4. PTSM Contamination at Depth for the FRB OU with Maximum Detected Concentrations

Basin Area			
Medium	Analyte	Maximum Concentration (1995)	Maximum Concentration*
Subsurface Soil at Depth	Cesium-137 Strontium-90 Radium-226	2,200.00 pCi/g 1,080.00 pCi/g 1.37 pCi/g	1,485.00 pCi/g 720.00 pCi/g 1.36 pCi/g

*Corrected for radioactive decay

Table U-5. Review of groundwater data from Monitoring Wells FRB1, FRB2, FRB3 and FRB4

Analyte	Units	MCL	Maximum Concentration 1997 - 2001 [#samples]	Maximum Concentration 2002 -2006 [# of samples]	Maximum Concentration 2007 -2011 [# of samples]
Cesium-137	pCi/L	200	ND [19]	ND [50]	ND [40]
Radium-226	pCi/L	14.7	2.44 [19]	3.84 [48]	2.73 [37]
Strontium-90	pCi/L	8.0	ND [21]	ND [44]	ND [36]
Trichloroethylene	µg/L	5.0	2.4 [25]	1.78 [43]	1.01 [34]
Gross alpha	pCi/L	15	8.53 [37]	8.12 [49]	4.96* [37]
Non-volatile beta	pCi/L	50	11.02 [37]	7.84 [49]	ND [37]

NOTE: * indicates and estimated value

Table U-6. Concentration ranges of TCE by Well.

Well	Concentration Range 1997 - 2001 (µg/L)	Concentration Range 2002 - 2006 (µg/L)	Concentration Range 2007 - 2011 (µg/L)
FRB1	1.14 – 1.23	0.57 – 1.45	0.88 – 1.01
FRB2	1.05 – 2.4	0.56 – 1.78	-
FRB3	1.0 (1 detect)	0.75 – 1.61	-
FRB4	-	0.57 – 1.44	-

NOTE: - indicates values were either non-detects or estimated values

Table U-7. Recommendations and Follow-up Actions

Issues	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Optimization of Frequency	Request change to the inspection frequency from semi-annual to annual via USDOE letter to the USEPA and SCDHEC to be sent within 45 days of final regulatory approval of the Fourth Five Year Remedy Review Report	USDOE	USEPA/ SCDHEC	9/30/2014	N	N

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU

I. SITE INFORMATION			
Site Name:	**F-Area Retention Basin (231-F) OU**	**Date of Inspection:**	**07/03/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #23**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 93°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Groundwater Monitoring; In Situ Stabilization; Soil excavation and disposal (process sewer line soil).

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for F-Area Retention Basin*, ER-IDS-019-009_____

_____

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs were in good condition. _____

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Field Walkdown

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/17/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks:
VII. COVER SYSTEMS ☒ 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.

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent_____
☐ Ponding	☐ Location shown on site map	Areal extent_____
☐ Seeps	☐ Location shown on site map	Areal extent_____
☐ Soft subgrade	☐ Location shown on site map	Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☒ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:
E. Gas Collection and Treatment ☐ Applicable ☒ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☒ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A	
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A	
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____	
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____	
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A	
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____	

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment U-1. Five-Year Review Site Inspection Checklist – F-Area Retention Basin (231-F) OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is in situ stabilization of contaminated soil; low permeability soil cover system; Institutional Controls; groundwater monitoring, pipeline grouting; and excavation and disposal of contaminated soil. The remedy appears to be fully established and functioning as designed. Groundwater monitoring wells are provided to verify the effectiveness of the in situ stabilization.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the waste unit and the condition of its warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Optimization opportunities are provided in Table U-6 of the OU specific report.

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FORD BUILDING SEEPAGE BASIN (904-91G) OPERABLE UNIT

I. Introduction

This is the second five-year remedy review for the Ford Building Seepage Basin (904-91G) (FBSB) Operable Unit (OU). This review was conducted from August 2012 through September 2012. Contaminants have been left in place at the FBSB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the FBSB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table V-1 lists the chronology of site events for the FBSB OU.

III. Background

The FBSB OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS). The media associated with the FBSB OU include soil and groundwater beneath the OU. However, the results of the groundwater investigation contained in the RCRA Facility Investigation/Remedial Investigation (RFI/RI) with Baseline Risk Assessment (BRA) for the FBSB OU, which included a collection of groundwater samples and analyses, have revealed that the groundwater associated with FBSB OU is not contaminated.

Physical Characteristics

The FBSB OU is located approximately in the middle of SRS within the Pen Branch Watershed. The water table is approximately 15 m (50 ft) below land surface and flows southwest. The FBSB and its associated components were constructed in 1964. The FBSB OU includes the following components:

- Unlined Seepage Basin – 36 by 24 m (120 by 80 ft) at ground level, 18 by 7.5 m (60 by 25 ft) at the bottom of the basin, 3 m (10 ft) deep, 567,800-L (150,000-gal) capacity;

- Underground Retention Tank – 22,700-L (6,000-gal) capacity;
- Underground Process Sewer Line between Ford Building and Retention Tank – 5-cm (2-in), 18 m (60 ft) long;
- Underground Piping Process Sewer Line between Retention Tank and Seepage Basin – 5-cm (2-in), 32.4 m (108 ft) long;
- Pumping Station;
- A delisted NPDES Outfall CS-008 and associated riprap-lined earthen drainage ditch;
- Underground abandoned fire hydrant 20-cm (8-in) line; and
- Groundwater associated with the unit.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates FBSB OU as being within the site industrial support area. The future land use for FBSB OU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

From 1964 until 1984, the FBSB received approximately 1.44 million L (380,400 gal) of wastewater generated in the Ford Building during the reconfiguration, repair, and scrapping of reactor heat exchangers and other process equipment. The dominant radionuclide received was tritium (470 curies) along with smaller amounts of cobalt-60, strontium-90, cesium-137 and unidentified alpha emitters. Trace amounts of nonradioactive surfactants, and organic and inorganic constituents may have been released into the basin. There is no record that the basin ever overflowed.

Initial Response

A removal action was taken in 1998 that removed the retention tank, pumping station, and underground piping process sewer lines to an off-unit disposal area. Approximately

2.1 m^3 (2.8 yd^3) of radiologically contaminated soil was containerized and stored at the FBSB OU until final disposition per the remedial decision in the Record of Decision (ROD).

Basis for Taking Action

The field investigations and the operational records identified four potential primary sources of contamination: FBSB, Tank/Process Sewer Line, NPDES Ditch, and the fire hydrant line. The RFI/RI/BRA report concluded that cesium-137, cobalt-60, and europium-154 present in the surface soil in the Seepage Basin Area pose human exposure health risks (greater than 1×10^{-6}) to future industrial workers. Aroclor-1254 represents an ecological risk to insectivorous mammals in the Seepage Basin Area. Arsenic, cesium-137, cobalt-60, and europium-154 are present in the subsurface soil beneath the Seepage Basin Area and present human health risks (greater than 1 x 10-6) to future industrial workers exposed to subsurface soil. Cesium-137 and cobalt-60 are also present in surface and subsurface soils at the Tank/Process Sewer at levels that pose human exposure health risks (greater than $1x10^{-6}$) to future industrial worker. Results of the RFI/RI/BRA concluded that there were no refined contaminants of concern (RCOCs) for the FBSB OU vadose zone, fire hydrant line, NPDES Ditch, and groundwater. There are no contaminant migration RCOCs and no principal threat source material (PTSM) at the FBSB OU.

The soil that required remedial action is located in the Seepage Basin Area (surface and subsurface) and Tank/Process Sewer Line Area (fully contained within a 1.2-m (4-ft) depth). Table V-2 provides the RCOCs and corresponding remedial goals (RGs) identified for the FBSB basin soils and Tank/Process Sewer Line soils.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 2001), the following are the remedial action objectives (RAOs) for the FBSB OU:

Seepage Basin Area Subunit

- Protect future industrial workers at the Seepage Basin Area from exposure to three RCOCs (cesium-137, cobalt-60, and europium-154) that exceed RGs in surface soils 0 to 0.3 m (0 to 1 ft) and four refined COCs (arsenic, cesium-137, cobalt-60, and europium-154) that exceed RGs in subsurface soils 0.3 to 1.2 m (1 to 4 ft deep) (Table V-2).
- Protect current terrestrial ecological receptors (insectivorous mammals) at the Seepage Basin Area from exposure to Aroclor 1254 at levels above the RG (0.0219 mg/kg) in surface soil.

Tank/Process Sewer Line Area Subunit

- Protect future industrial workers at the Tank/Process Line Area from exposure to cesium-137 and cobalt-60 that exceed RGs in surface and subsurface soils (Table V-2).

As stated in the ROD (WSRC 2001), the selected remedy for the FBSB OU was:

- Excavate all contaminated soil exceeding $1x10^{-6}$ risk (for industrial worker) from the Tank/Process Sewer Line Area and disposition the soil into the seepage basin along with the vegetation existing in the basin;
- Remove the containerized soil (contaminated surface soil from the retention tank area) from two B-12 boxes and a 55-gallon drum and disposition the waste into the seepage basin;
- Backfill the remaining volume of the seepage basin and the excavated area of the Tank/Process Sewer Line Area with clean soil from an SRS borrow pit;
- Grade the clean soil to match the surrounding topography and cover the backfilled areas with vegetative cover to minimize erosion;
- Implement institutional controls (i.e., land use controls [LUCs]).

Remedy Implementation

Implementation of the FBSB OU remedial action included the following activities:

- Consolidated approximately 183.6 m^3 (240 yd^3), 505.5 m^3 (1685 yd^3) and 2.14 m^3 (2.8 yd^3) of contaminated soil by excavating to a depth of 1.2 m (4 ft) in the Tank/Process Sewer Line Area and to a width of 0.6 m (2 ft) and a depth of 0.3 m (1 ft) at the bank of the basin, and removing containerized soil (one 55-gallon drum and two B-12 boxes) and transporting the soil with the existing vegetation to the basin bottom, respectively;
- Installed soil covers over the seepage basin (0.09 hectare [0.22 acre]) and the excavated areas of the Tank/Process Sewer Area (0.09 hectare [0.21 acre]) consisting of a minimum of 1.2-m (4-ft) thick common fill layer covered by a 15-cm (6-in) thick vegetative layer for the seepage basin and a 15-cm (6-in) thick crusher run for the tank/process sewer area. The common fill and vegetative layers consisted of clean soil from an approved SRS borrow pit;
- Seeded the seepage basin soil cover for vegetation;
- Established institutional controls for 0.11 hectares (0.28 acres) of the FBSB OU, which include site inspections of the seepage basin cover and the installation of warning signs around the seepage basin. Site inspections of the tank/process sewer area cover are not required because all soils exceeding $1x10^{-6}$ risk (industrial) were removed.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Semiannual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) of the seepage basin cover; and
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit).

The operation and maintenance (O&M) cost associated with the selected remedy for the FBSB OU includes the semiannual inspections, maintenance of the cover, and institutional controls. The ROD estimated O&M cost has a present worth of $116,000

discounted at 7% per year for 30 years. The actual O&M cost since the remedial action was completed in FY03 until FY11 is $96,707. The actual O&M costs (Table V-3) are lower than expected because basin cover repairs have not been needed.

V. Progress since Last Review

The previous protectiveness statement concluded that the remedial actions at FBSB OU are expected to be protective. The final remedial actions of excavation, consolidation, and backfilling of excavated areas along with institutional controls have been functioning properly.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment 1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 by phone call and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The FBSB OU was inspected by SRNS and USDOE personnel on August 22, 2012 and October 16, 2012. No issues were identified for the FBSB OU during this inspection and interviews.

On January 30, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Documents?

The remedy is functioning as intended as demonstrated below:

- The selected remedy of a compacted common fill cover over the FBSB is effective in preventing human and ecological receptors exposure to RCOCs.
- Semiannual site inspections are being performed and indicate the integrity of the common fill cover is intact and no problems have occurred. Waste unit signs that were beginning to fade were replaced in 2011.
- The selected remedy of a removal action at the Tank/Process Sewer Line Area Subunit was effective to protect future industrial workers from exposure to cesium-137 and cobalt-60 that exceeded RGs in the soil. This was accomplished by removing (1.2-m [4-ft]) deep contaminated soils that exceed RGs and land use restrictions for the Tank/Process Sewer Line Area are no longer needed.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

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 FBSB OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by the FBSB soil cover and institutional controls (i.e., LUCs). All threats to contaminated soil at the FBSB OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); administrative controls that maintain the OU for industrial use only; and warning signs and use restrictions via the SRS Site Use/Site Clearance Program. Long term protectiveness is ensured by continued compliance with effective land use controls.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2000. *RCRA Facility Investigation with Baseline Risk Assessment for the Ford Building Seepage Basin (904-91G) Operable Unit (U)*, WSRC-RP-98-4096, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001. *Record of Decision Remedial Alternative Selection for the Ford Building Seepage Basin Operable Unit (904-91G) (U)*, WSRC-RP-2000-4156, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Post-Construction Report/Corrective Measures Implementation Report/ Final Remediation Report for the Ford Building Seepage Basin Unit (904-91G) Operable*

Unit (U), WSRC-RP-2003-4038, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, Ford Building Seepage Basin (904-91G) (U)*, ER-IDS-019-024, Inspection period 2007 through 2011 (semiannually)

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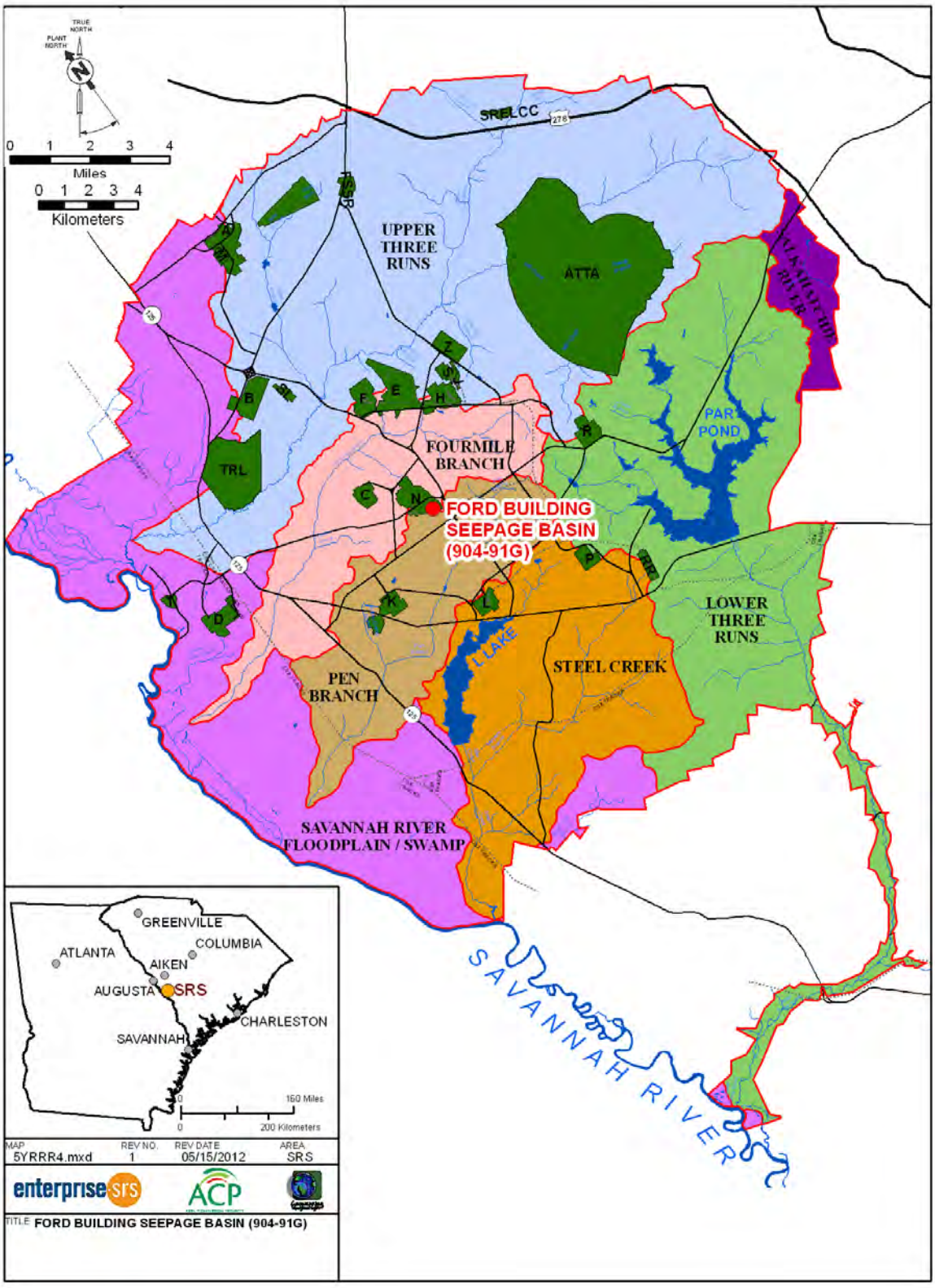


Figure V-1. Location of the Ford Building Seepage Basin Unit

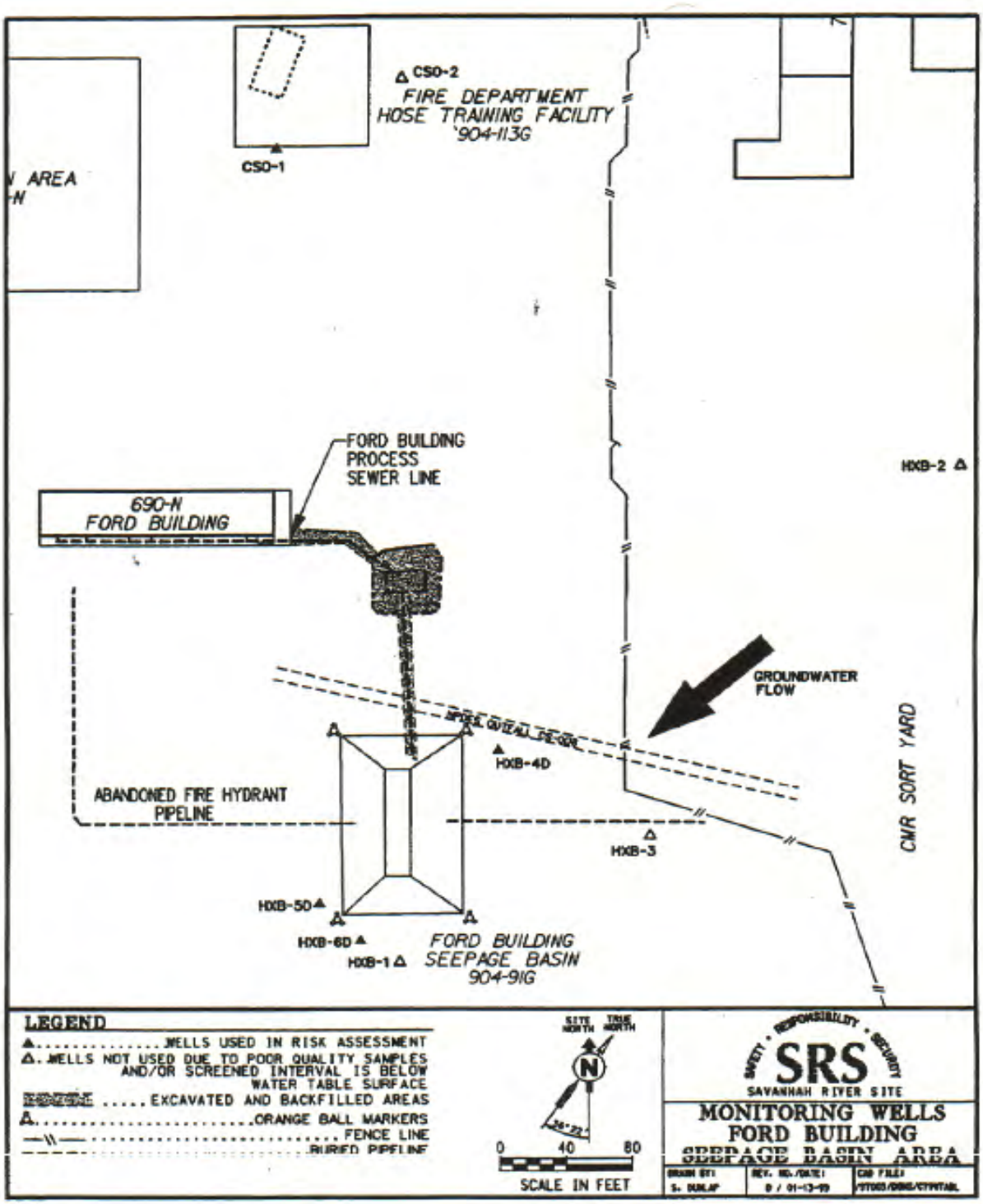


Figure V-2. Layout of the Ford Building Seepage Basin Operable Unit (FBSB) with Limits



Figure V-3. **Oblique Aerial Photograph of the Ford Building Seepage Basin OU (April 1996)**



Figure V-4. Current Photograph of the Ford Building Seepage Basin OU (August 2012)

Table V-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	October 20, 1997 / April 18, 2000
Removal Action Start / Complete	January 1, 1998 / December 31, 1998
Record of Decision (ROD) issuance	February 14, 2002
Remedial Action start/complete	January 27, 2003 / April 22, 2003
Previous Five-Year Reviews	February 4, 2009

Table V-2. RCOCs and RGs Associated with Contaminated Media at FBSB OU

Subunit	Media	RCOC	Type of RCOC	RGs
FBSB Basin	Surface Soil	Aroclor 1254	ECO	0.0219 mg/kg
	Surface/Subsurface Soil	Cesium-137	HH	0.105 ρCi/g
	Surface/Subsurface Soil	Cobalt-60	HH	0.0224 ρCi/g
	Surface/Subsurface Soil	Europium-154	HH	0.0473 ρCi/g
	Subsurface Soil	Arsenic	HH	3.53 mg/kg
Tank/Process Sewer	Surface/Subsurface Soil	Cesium-137	HH	0.105 ρCi/g
	Surface/Subsurface Soil	Cobalt-60	HH	0.0224 ρCi/g

ECO Ecological COC
HH Human health industrial worker
PCB Polychlorinated biphenyl

Table V-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	6,400	7,200	3,700	3,500	3,000	23,800
Total ROD Estimated Direct O&M Costs	30,000	5,000	5,000	5,000	5,000	50,000

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Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU

I. SITE INFORMATION			
Site Name:	**Ford Building Seepage Basin (904-91G) OU**	**Date of Inspection:**	**08/22/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #58**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Cloudy 85°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ **(**Title) _____ **(**Date) _____ **(**Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ **(**Title) _____ **(**Date) _____ **(**Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ **(**Title) _____ **(**Date) _____ **(**Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: Annual site inspections are performed per SRS procedure ER-SOP-019, *Waste Unit Inspection and Maintenance*, and ER-IDS-019-024, *Field Inspection Checklist for the FBSB OU*

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routing O&M activities do not require a SSHASP under 29 CFT 1910.1201, HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs were in good condition. New signs were installed in 2011.

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Candice Freeman (Name) | Federal Project Director (Title) | 10/16/12 (Date) | 803-952-7085 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey monuments were located and in good condition.

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks: Vegetation is mowed routinely.

VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent _____ Depth _____ Remarks:
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent _____ Depth _____ Remarks:
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent _____ Depth _____ Remarks:
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress Areal extent 1 acre Depth _____ Remarks: One acre of grass is maintained over and around the perimeter of the cover system which extends beyond the 0.28 acre land use control area.

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A
Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident
Areal extent Depth
Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent
☐ Ponding ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent
Remarks:

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☒ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:
E. Gas Collection and Treatment ☐ Applicable ☒ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:** ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☒ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
2. Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A
1. Siltation: ☐ Location shown on site map ☒ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☒ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☒ N/A Remarks:_____
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
1. Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment V-1. Five-Year Review Site Inspection Checklist – Ford Building Seepage Basin (904-91G) OU *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The selected remedy for the FBSB OU was excavation, consolidation, backfilling, vegetative cover, and institutional controls to protect future industrial workers and terrestrial ecological receptors from exposure. Selected remedies for the FBSB OU are functioning as intended. There are no issues requiring corrective actions.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of semiannual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the seepage basin soil cover and the condition of the grass and vegetative cover and warning signs is good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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GENERAL SEPARATIONS AREA CONSOLIDATION UNIT

I. Introduction

This report is the second five-year review for the General Separations Area Consolidation Unit (GSACU) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the GSACU OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the GSACU OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table W-1 lists the chronology of site events for the GSACU OU.

III. Background

The GSACU OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for the Savannah River Site (SRS). The media associated with the GSACU OU are soil, sediment, and debris.

Physical Characteristics

The GSACU OU is located in the central portion of SRS, approximately 9.6 km (6 mi) from the nearest SRS boundary (Figure W-1). The GSACU OU consists of four primary waste units (Figure W-2);

- H-Area Retention Basin (HRB) (281-3H) was a single open inactive retention basin 63 m (210 ft) long by 36 m (120 ft) wide by 2.1 m (7 ft) deep and surrounded by a berm (Figure W-3). A process sewer line from the diversion box to HRB and a concrete pipe on the south side of the basin are included in the HRB subunit. The pipe discharged to a concrete spillway along an existing active effluent stream that flows from H Area to Fourmile Branch. The HRB security fence encloses an area of about 0.7 hectares (1.7 acres).

- Warner's Pond (685-23G) is approximately 1.6 hectares (4 acres) in size and is centered in an area that was formerly occupied by a pond approximately 0.4 hectares (1 acre) in size ("Former Pond") (Figure W-3). Additionally, two sections of inactive process sewer lines that are subject to CERCLA and one section subject to RCRA are also include in the subunit.

- HP-52 Ponds (no building number [NBN]) is a site approximately 0.44 hectares (1.1 acres) in size and is centered in an area that was formerly occupied by two small holding ponds (Figure W-3).

- Old Radioactive Waste Burial Ground (ORWBG) (643-E), including 22 underground storage tanks (OSTs 650-01E through 650-22E) is a 31-hectares (76-acre) earthen trench disposal area for solid radioactive waste produced at SRS, as well as for shipments from other United States Department of Energy (USDOE) and Department of Defense facilities (Figure W-4).

Collectively, these waste units are identified as a single OU (Figure W-1) because of their proximity to each other and similar health and environmental threats.

Groundwater is not included as a subunit of the GSACU OU. Groundwater beneath the ORWBG has been contaminated by numerous sources within the Burial Ground Complex (BGC). This groundwater is being evaluated separately under the RCRA Part B permit for the Mixed Waste Management Facility (MWMF). Under that permit, institutional controls are required for as long as groundwater remediation is required, which is anticipated to be 170 years. Groundwater beneath the HRB, HP-52 Ponds, and Warner's Pond has been contaminated by numerous sources in H Area. This groundwater is being evaluated by the General Separations Area Eastern Groundwater OU.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan (LUCAP) for the SRS (WSRC 1999) designates the GSACU OU as being within an

industrial area. The future land use for the GSACU OU is reasonably anticipated to remain industrial with the USDOE maintaining control of the land.

History of Contamination

H-Area Retention Basin

From 1955 to 1972, HRB received non-hazardous radioactively contaminated wastewater from chemical separations facilities and from the H-Area Tank Farm. The exact volumes of wastewater received at the basin and discharged from the basin are not known. In 1973, HRB was replaced by a lined basin.

In May 1956, an undetermined volume of material leaked from the discharge gate on the south side of HRB. SRS constructed a temporary holding pond to contain the material. This area is included in the HRB subunit.

Warner's Pond

Warner's Pond was constructed in 1956 as an emergency holding pond to receive contaminated cooling water from the 221-H (H-Canyon) building that flowed into an effluent stream. Contaminated cooling water was discharged to Warner's Pond on three occasions: 1956 (cooling coil leak), 1960 (source not determined), and 1965 (cooling coil leak that released approximately 300 curies [Ci] of activity). Contaminated water from all three events entered the pond via the effluent stream leading from H Area and was diverted or pumped to HRB or to the H-Area Seepage Basins. Warner's Pond was closed in 1966.

Facility records indicate no listed wastes were managed at the RCRA H-Area Inactive Process Sewer Line (HIPSL) which operated from 1955 to 1982. Effluent was characterized as hazardous due to mercury and chromium concentrations and low pH. Two spills associated with pipeline breaks that occurred in 1978 adjacent to this subunit have been included in the subunit.

HP-52 Ponds

In 1967, during a transfer of high-level waste at the H-Area Tank Farm, some spilled material flowed into a nearby storm sewer and reached the HP-52 outfall. The HP-52

Ponds, two small holding ponds, were constructed to contain the contaminated water. A smaller spill occurred in 1969 when an H-Area Tank Farm waste transfer line ruptured and released high-level waste to the storm sewer and outfall.

Old Radioactive Waste Burial Ground

The ORWBG is part of the central disposal area for solid radioactive waste at SRS known as the BGC. Waste was disposed of at the ORWBG from 1952 until 1974, when the site was essentially filled and the majority of waste disposal operations shifted to other facilities in the BGC.

During its operational history, approximately 201,770 m^3 (263,900 yd^3) of radioactive wastes, including radioactively contaminated hazardous substances, were buried within the ORWBG. Most wastes disposed of in the ORWBG were placed in drums, cans, cardboard boxes, plastic bags, and metal containers and then buried in earthen trenches approximately 6 m (20 ft) deep. At the time of burial, approximately 5.1 million Ci of radioactivity was placed in the ORWBG. Much of the short-lived radioactivity has decayed, but a large inventory of radioactive and hazardous substances remain buried at depth in the ORWBG.

The ORWBG consists of four distinct subunits:

- ORWBG - most waste was placed in the ORWBG from 1952 until 1972. Radioactive, hazardous, and mixed waste remain buried in the ORWBG.
- Twenty-two OSTs - emptied in 1977 (by transferring the liquid solvent from the ORWBG to another facility), the OSTs were originally used to store spent plutonium-uranium extraction solvent from 1953 to 1977. Very little residual liquid and sludge remains in the OSTs.
- Mercury Hot Spot – a distinct area containing approximately 20% (0.16 m^3 [5.7 ft^3]) of the total mercury in the ORWBG. Each burial consists of two or three 1-liter polyethylene bottles filled with elemental mercury, double-bagged, and containerized in 5-gallon cans.

- Radioactive Hot Spots – multiple and distinct areas containing relatively high concentrations of radionuclides (>60 Ci per 6x6 m [20x20 ft] grid cell). Generally these consist of tritium, transuranic isotopes, carbon-14, and fission products such as cesium-137 and strontium-90.

Initial Response

Initially, the four waste units were evaluated separately. The RCRA/CERCLA documents for HRB and the ORWBG were completed through the Corrective Measures Study/Feasibility Study (CMS/FS) stage, and it was determined that there was a preference to remove principal threat source material (PTSM) from HRB and place it at the ORWBG. At this point, PTSM was also identified at Warner's Pond and HP-52 Ponds during pre-work plan characterization work. Given the similar health and environmental threats, similar geologic setting, and proximity of the units, USDOE, South Carolina Department of Health and Environmental Control (SCDHEC), and United States Environmental Protection Agency (USEPA) agreed to consolidate HRB, Warner's Pond, HP-52 Ponds, and the ORWBG into a single OU to expedite remedial action. Actions taken at each subunit by SRS to minimize exposure that occurred prior to approval of remedial actions included:

- HRB – in 1996 trees and vegetation were removed. Prior to the final remedial action, the site was primarily covered with grass and small shrubs.

- Warner's Pond - in 1966, the pond was drained, backfilled with clean soil, and paved with asphalt. In 1996 trees and vegetation were removed. Prior to the final remedial action, the site was primarily covered with grass and small shrubs.

- HP-52 Ponds – contaminated soil from the 1967 and 1969 spills containing approximately 1,200 Ci and 0.5 Ci, respectively, of radioactivity was removed and shipped to the ORWBG. The stream banks below the HP-52 outfall were paved with asphalt to minimize contaminant migration from the soil to the stream and the pond areas were filled with contaminated soil excavated from the stream banks and covered with clean backfill. Stream flow was diverted to redirect flow around the former ponds area and the original effluent ditch was backfilled.

- ORWBG - In 1996, an interim measure/interim action (WSRC 1996) was taken as a source control measure to gain risk reduction before a final action was implemented. In 1998 the interim action of installing an interim soil cover was completed at ORWBG. The soil cover was installed in eight sections, leaving open the Old Solvent Tank (OST) area and several operating and administrative areas. The purpose of the soil cover was to decrease stormwater infiltration into the underlying waste, thereby reducing leachate production and contaminant transport to the groundwater. A second interim action (WSRC 2001) was started in 2001 to empty the 22 OSTs to the extent practical, stabilize the residual fluids, and fill the tanks with grout to stabilize them and allow for the placement and subsequent maintenance of a permanent cover. The physical work for this interim action was completed in March 2003.

Basis for Taking Action

PTSM was identified at HRB, Warner's Pond, HP-52 Ponds, and ORWBG. At HRB, Warner's Pond and HP-52 Ponds, PTSM and soil containing contaminant migration contaminants of concern (CMCOCs) was removed to the extent practicable. At the ORWBG, treatment or removal of the PTSM was and is not practical; consequently, engineering controls, including containment, are used to manage the PTSM.

Radionuclides, metals, and volatile organic compounds were identified as COC for the GSACU OU (WSRC 2002). Two constituents, cesium-137 and strontium-90, were identified as the primary risk drivers. They were used as indicator contaminants for HRB, Warner's Pond, and HP-52 Ponds to guide the remediation and to assess when cleanup goals were met. Remedial goals (RGs) were identified for these two contaminants (Table W-2). No RGs were identified for the ORWBG.

The risks at HRB, Warner's Pond, and HP-52 Ponds are similar in that (1) all three units contain PTSM that presents an unacceptable human health risk to future industrial workers, and (2) cesium-137 is the primary contaminant, both in terms of the principal risk driver and the extent of contamination. Contamination at HRB, Warner's Pond, and HP-52 Ponds poses a threat to current and future industrial workers who may come into

contact with it, and HRB and Warner's Pond represent continuing sources of potential groundwater contamination (WSRC 2002).

The ORWBG contains a very large inventory of short- and long-lived radioactive wastes and other hazardous substances. These buried wastes are considered PTSM and would pose an acute risk to human health and the environment if exposure were to occur. In addition, future leaching of contaminants may further affect groundwater quality under the ORWBG (WSRC 2002).

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 2002), the remedial action objectives (RAOs) for the HRB, Warner's Pond, and HP-52 Ponds are as follows:

- Treat and/or remove PTSM by treating and/or removing cesium-137 and strontium-90 at levels above the RGs (Table W-2), to the extent practical;
- Control migration and leaching of strontium-90 that could result in groundwater contamination in excess of maximum contaminant levels (MCLs) beneath each unit by removing soil above the RGs (Table W-2), to the extent practical; and reducing infiltration through any residual contamination above RGs; and
- Protect human and ecological receptors from surface materials containing cesium-137 and strontium-90 above RGs (Table W-2).

As stated in the ROD (WSRC 2002), the RAOs for the ORWBG are as follows:

- Minimize the exposure risk to workers (current and future) and prevent or mitigate inadvertent human intrusion;
- Minimize ecological intrusion in to the buried waste and redistribution/mobilization (erosion) of contaminants from the waste unit to the surrounding areas; and
- Mitigate future leaching of contaminants to groundwater.

As stated in the ROD (WSRC 2002), the selected remedy for the GSACU OU includes the following activities:

- For the HRB, Warner's Pond, and HP-52 Ponds manage standing surface water by solidification and consolidation with the excavated soils and/or by treatment, excavate industrial PTSM materials and soil containing CMCOCs above RGs, as well as inactive pipelines that are encountered during excavation activities. Those not accessible are to be grouted in place. The excavated material and soil, as well as any vegetation in contact with PTSM, are to be transferred to areas of the ORWBG that have not been covered by the native soil cover. Following excavation activities, the risk of remnant material will be evaluated. In order to mitigate any residual risk exceeding RGs, the excavations will be backfilled with clean soil. Surface water drainage at Warner's Pond will be restored to a natural state by removing the berms that cause ponding of water. Upon completing construction activities, a post-construction report will be prepared and institutional controls will be implemented.

- For the ORWBG construct a low-permeability geosynthetic cover system (with soil hydraulic conductivity of less than $1x10^{-7}$ cm/sec). This will include the areas where consolidate materials from HRB, Warner's Pond and HP-52 Ponds were placed. Following construction, institutional controls will be implemented. Before institutional controls are terminated, intruder barriers will be installed over the long-lived persistent radioactive hot spots to deter inadvertent human intrusion.

Remedy Implementation

The selected remedy met the RAOs at GSACU OU by implementing the following activities (WSRC 2008):

- Managing standing surface water in the HRB, Warner's Pond, and HP-52 Ponds;

- Consolidating PTSM-contaminated media at the ORWBG by excavating and transporting 12,400 m^3 (16,200 yd^3) from the HRB, 18,800 m^3 (24,600 yd^3) from Warner's Pond, and 7,760 m^3 (10,150 yd^3) from the HP-52 Ponds;

- Installed low permeability geosynthetic covers with a nominal in-place saturated hydraulic conductivity of $1x10^{-7}$ cm/sec or less over the ORWBG (29 hectares [72 acres]), HRB (0.85 hectares [2.1 acres]), and Warner's Pond (1.3 hectares

[3.2 acres]) units and placed compacted soil backfill over the excavated areas of HP-52 Ponds unit (0.65 hectares [1.6 acres]). A photograph of the covered facility is shown in Figure W-5.

- Implemented land use controls (LUCs) for 31.7 hectares (78 acres) in ORWBG, 0.9 hectares (2.3 acres) in HRB, 0.7 hectares (1.7 acres) in HP-52 Ponds and 1.6 hectares (4 acres) in Warner's Pond for a total of 34.9 hectares (85.9 acres). LUCs include the following:
  - Warning signs at the OU boundaries to alert on-site workers to the presence of hazardous substances and to prevent unauthorized entry and unrestricted uses.
  - Institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program to restrict disturbance of the cover system and waste at each unit and to prevent drinking water use of contaminated groundwater. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements.
  - SRS access controls to prevent exposure to trespassers, as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

Figures W-5 and W-6 present current photographs of the GSACU OU.

System Operations / Operation and Maintenance

There are no system operational requirements. The following maintenance activities are being taken to maintain the cover systems as long as the waste remains a threat to human health or environment.

- Annual site inspections of HRB, HP-52 Ponds, and Warner's Pond, and quarterly site inspections of the ORWBG for evidence of damage to the cover system due to erosion or intrusion by burrowing animals are being performed annually as a

minimum. The inspections also address upkeep of the vegetative cover and access control barriers (e.g., the warning signs, fence).

- 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.

The estimated operation and maintenance costs (O&M) associated with the selected remedy for GSACU OU include O&M costs of the soil cover and institutional controls has a present worth of $3,900,000 discounted at 3.9% per year for 500 years of maintenance activities (WSRC 2002). The actual O&M cost since the remedial action was completed in FY07 until FY11 is $395,300. The actual O&M costs (Table W-3) are lower than expected because significant cover system repairs have not been needed.

V. Progress since Last Review

The previous protectiveness statement concluded that the remedial actions at GSACU OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The final remedial actions were not evaluated in the previous five-year review because the remedial action had just been completed. The final remedial actions of excavation, removal, and the backfilling of excavated areas along with institutional controls and contaminated soil consolidation under a low permeability geosynthetic cover system have now been installed and have been functioning properly.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the 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 W-11 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls;
- Reviewed changes in standards and to-be-considered guidance; and
- Ensured that all actions required under the RCRA Permit were implemented.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the GSACU OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The GSACU OU was inspected by SRNS and USDOE personnel on August 22, 2012 and October 17, 2012. No issues were identified for the GSACU OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection. A minor item noted during the inspection of the GSACU OU, documented with response (SRNS 2013), had no impact on the protectiveness of the remedy.

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.
- Quarterly (ORWBG) and annual (HRB, Warner's Pond, and HP-52) 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 (CMI/RAIP) 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 Mixed Waste Management Facility (MWMF). This has resulted in a tritium reduction within the plume of approximately 40%. 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.

An opportunity for system optimization was identified during this review. Based on the lack of findings during the quarterly site inspections of the ORWBG and the effectiveness of institutional controls in preventing human activity at this OU, it is recommended that the inspection frequency for the ORWBG be reduced from quarterly to annual. The other sub-units of the GSACU OU are currently monitored annually.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

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

Recommendations and follow-up actions concerning GSACU OU are listed in Table W-4.

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. land use controls), 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, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 2013. *Savannah River Site's Responses to the U.S. Environmental Protection Agency's Comments during the Five-Year Remedy Review Report (SRNS-RP-2012-00011) Regulatory Site Inspections (January 15-16, 2013, January 22-23, 2013, and*

January 29-30, 2013), ERD-EN-2013-0016, 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, March 2013, 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 2007 through 2011 (annually)

Various – *Inspection Data Sheets* - F*ield Inspection Checklist, Warner's Pont (U)*, ER-IDS-019-043, Inspection period 2007 through 2011 (annually)

Various – *Inspection Data Sheets - Field Inspection Checklist, HP-52 (U)*, ER-IDS-019-044, Inspection period 2007 through 2011 (annually)

Various – Inspection Data Sheets - Field Inspection Checklist for Old Radioactive Waste Burial Ground Bldg. 643-E (U), ER-IDS-019-027, Inspection period 2007 through 2011 (annually)

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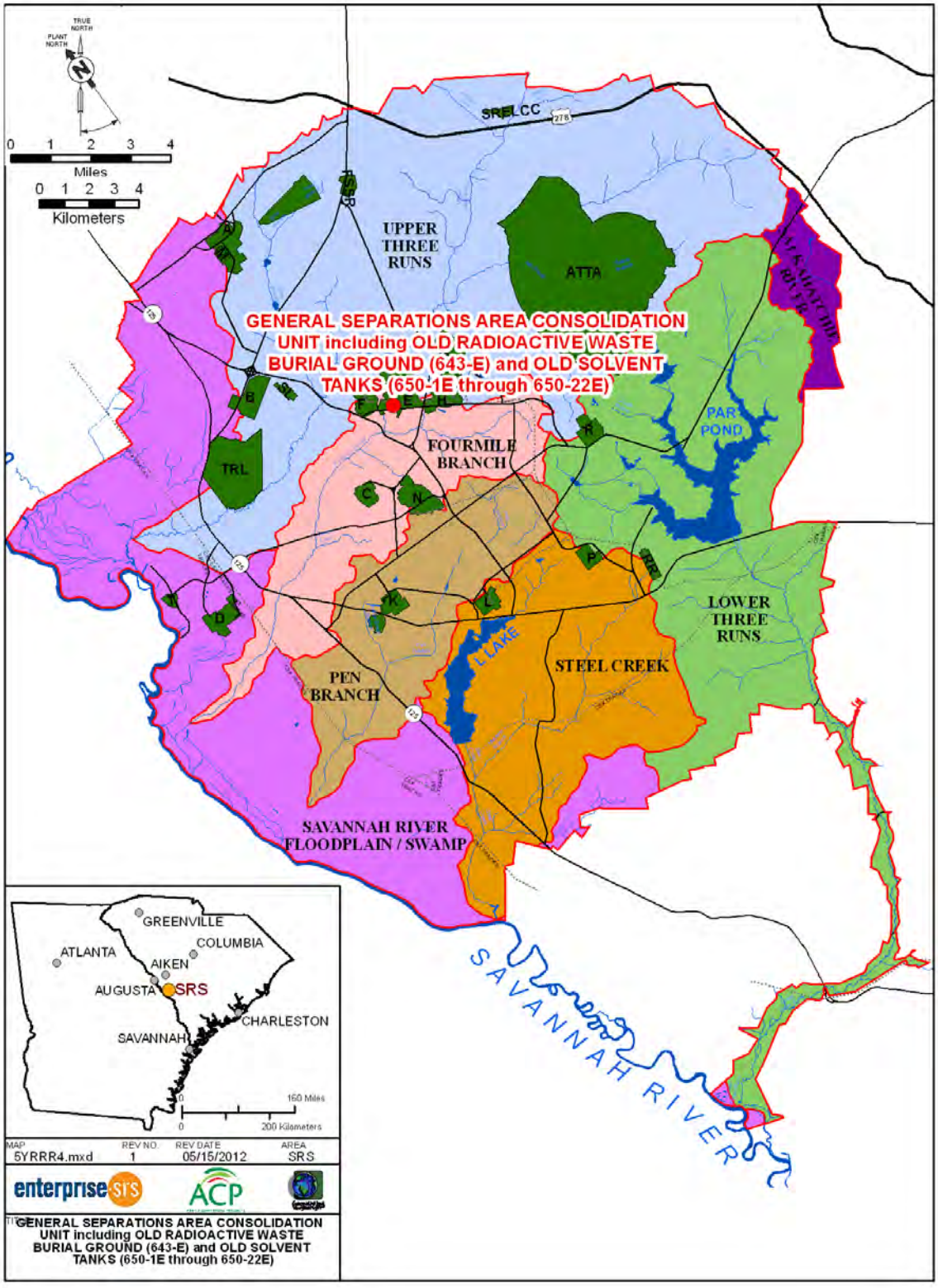


Figure W-1. Location of the General Separations Area Consolidation Unit

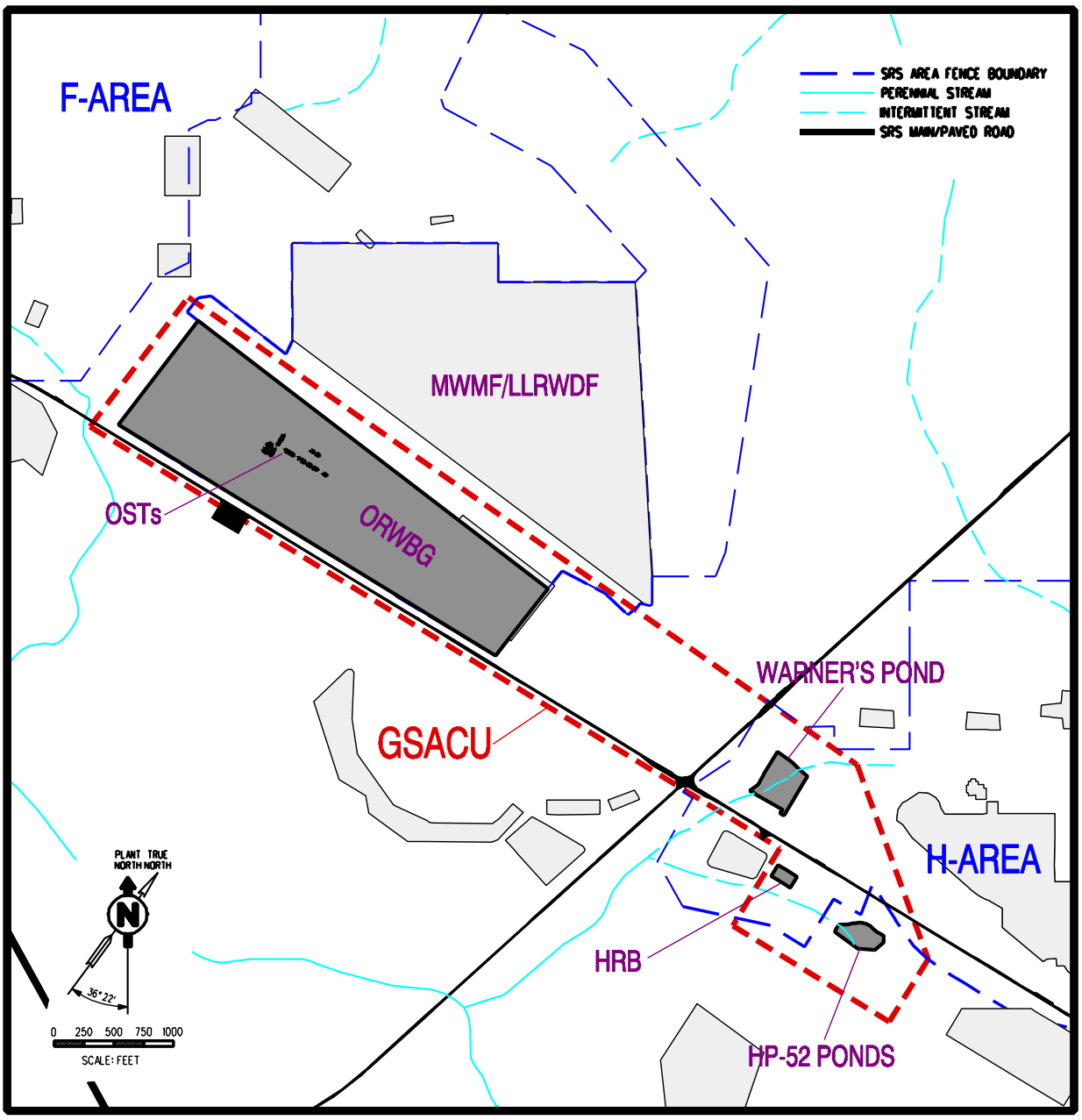


Figure W-2. General Separations Area Consolidation Unit Four Primary Waste Units

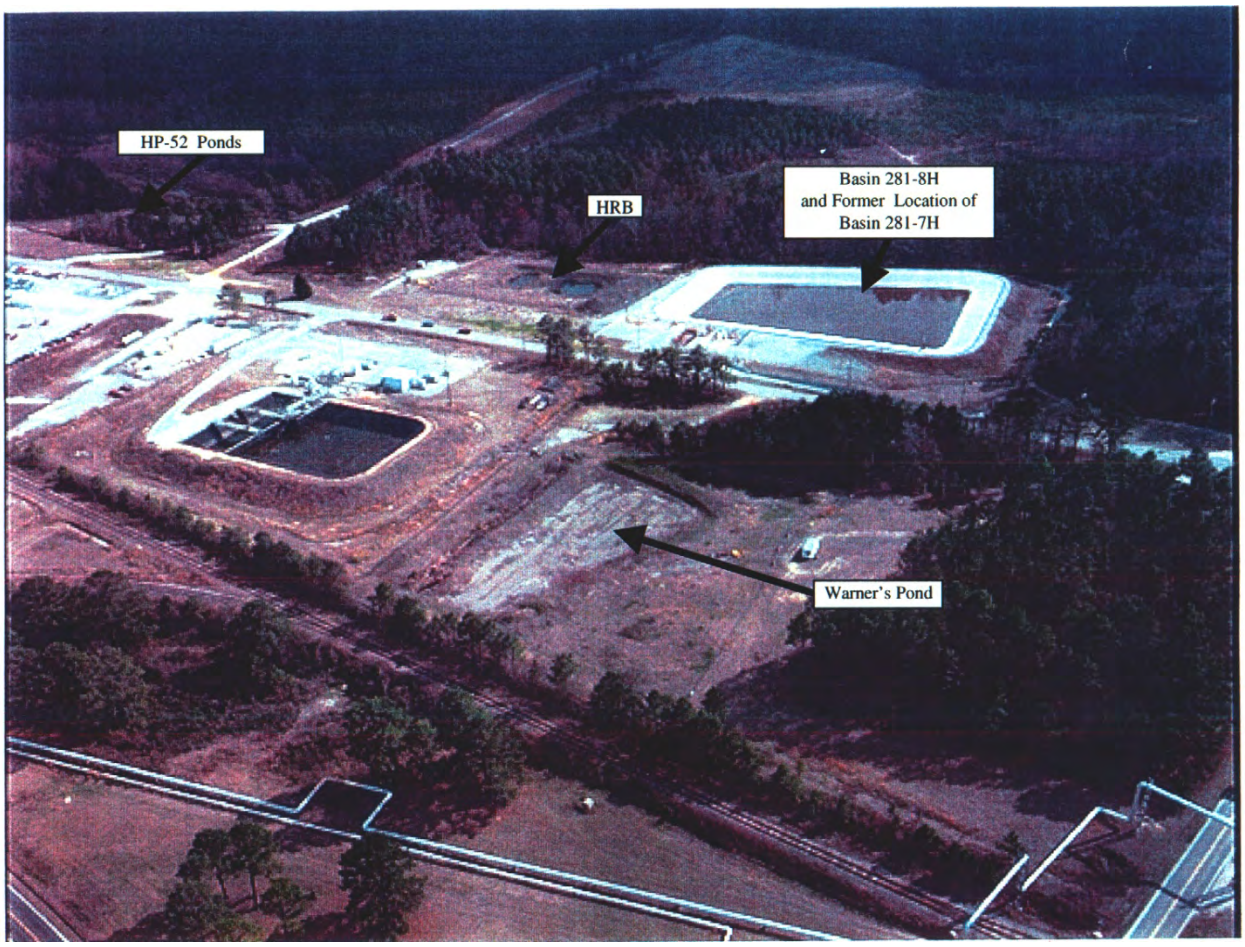


Figure W-3. Aerial Photograph of the GSACU OU subunits – HRB, Warner's Pond, and HP-52 Ponds – Prior to Remedial Actions (WSRC 2002)



Figure W-4. Aerial Photograph of the ORWBG Prior to Remedial Actions (WSRC 2001)



Figure W-5. Aerial Photograph of the GSACU OU, 2012

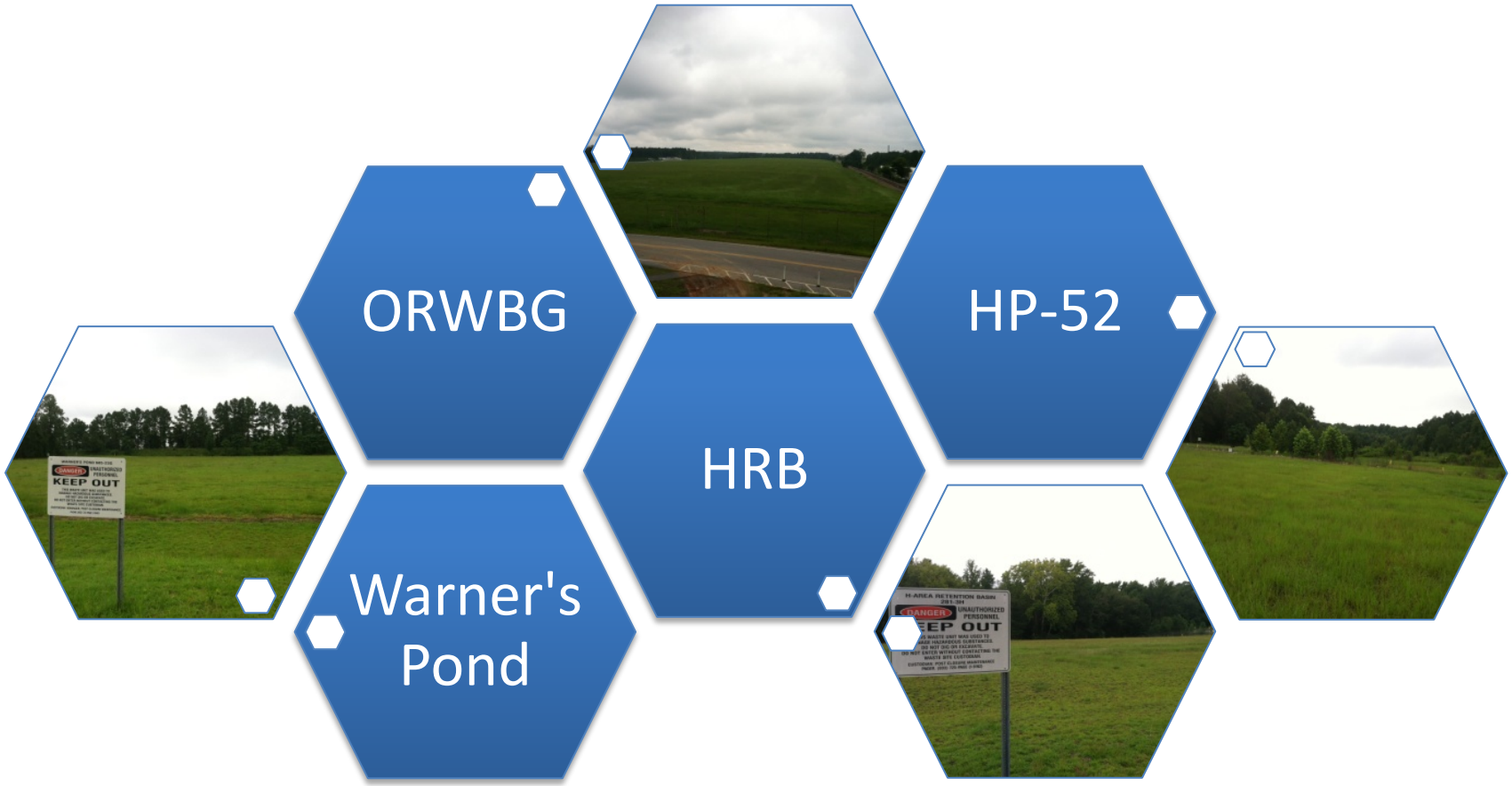


Figure W-6. 2012 Photographs of the GSACU OU subunits

Table W-1. Chronology of OU Events

Event	Date
Interim Record of Decision (ROD) Issuance – ORWBG	June 18, 1996
RFI/RI Field Start for HRB	October 1, 1997
Interim Remedial Action – ORWBG Start / Complete	July 23, 1996 / May 19, 1998
Interim ROD issuance – Old Solvent Tanks (OST)	September 14, 2001
Interim Remedial Action – OST start / complete	September 17, 2001/ March 13, 2003
RFI/RI Field Start for Warner's Pond	July 31, 2002
RFI/RI Field Start for HP-52 Ponds	August 2, 2002
Final ROD issuance - GSACU OU	September 26, 2002
Final Remedial Action – GSACU OU Start / Complete	August 11, 2003 / August 29, 2007
Previous Five-Year Reviews	February 4, 2009

Table W-2. Remedial Goals for the HRB, Warner's Pond, and HP-52 Ponds

COC	Type of COC	RG – Soil (pCi/g)	RG – Groundwater (pCi/ml)
Cesium-137	PTSM	104 (all subunits)	N/A
	HH/Eco[1]	0.55 (all subunits)	
Strontium-90	PTSM/CMCOC	1.5/0.65/1.12[2]	8
	HH	57.2 (HRB only)	

1 HH – human health risk, Eco – ecological risk

2 Individual RGs were identified for strontium-90 (PTSM) associated with the HRB basin bottom and sidewalls, the HRB sewer line/discharge area, and the Warner's Pond, respectively. There was no RG identified for strontium-90 for the HP-52 Ponds.

Table W-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$17,000	$15,500	$13,000	$20,300	$17,400	$89,000
Total ROD Estimated Direct O&M Costs	$47,000	$37,100	$37,100	$37,100	$37,100	$196,000

Table W-4. Recommendations and Follow-up Actions

Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
				Current	Future
Request change to the inspection frequency for the ORWBG from quarterly to annual via USDOE letter to the USEPA and SCDHEC to be sent within 45 days of final regulatory approval of the Fourth Five Year Remedy Review Report.	USDOE	USEPA/ SCDHEC	9/30/2014	N	N

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E)

I. SITE INFORMATION			
Site Name:	**General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E)**	**Date of Inspection:**	**08/22/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #32**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Cloudy 85°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Consolidation, excavation, disposal

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance*, ER-SOP-019, *Field Inspection Checklist for Old Radioactive Waste Burial Ground*, ER-IDS-019-027, *ACP Field Inspection Checklist for Warner's Pond*, ER-IDS-019-043, *Field Inspection Checklist for HP-52*, ER-IDS-019-044, and *Field Inspection Checklist for H-Area Retention Basin*, ER-IDS-019-042

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☒ Readily Available	☐ Up to Date	☐ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: Fencing is in good condition_____

B. Fencing

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition_____

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(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.) Field walkdown

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Field Deputy Project Director (Title) | 10/17/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(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: Survey markers were located and in good condition. Vegetation is mowed routinely.
VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent _____ Depth _____ Remarks:
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks:
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent _____ Depth _____ Remarks:
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent _____ Depth _____ Remarks:
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress Areal extent _____ Depth _____ Remarks:

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent _____

☐ Ponding ☐ Location shown on site map Areal extent _____

☐ Seeps ☐ Location shown on site map Areal extent _____

☐ Soft subgrade ☐ Location shown on site map Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☒ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☒ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment W-1. Five-Year Review Site Inspection Checklist – General Separations Area Consolidation Unit (GSACU) OU including Old Radioactive Waste Burial Ground (643-E) and Old Solvent Tanks (650-1E through 650-22E) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for GSACU OU by removing media contaminated at PTSM levels, consolidating residual contaminated materials within the ORWBG and placing a protective geosynthetic soil cover over them has met the remedial objectives of preventing physical exposure to contaminants and mitigating further migration of contaminants to the groundwater. The cover system is intact, long-term grasses has been fully established. Soil cover system remedy appears to be functioning as designed. Drainage channels are functioning adequately
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of quarterly (ORWBG) and annual (HRB, Warner's Pond and HP-52 Ponds) site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the integrity of the engineered cover, which in turn will maintain the effectiveness of the cover to mitigate leaching. There are no issues requiring corrective actions
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Optimization opportunities are provided in Table W-4 of the OU specific report

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GUNSITE 012 (NBN) OPERABLE UNIT

I. Introduction

This report is the first five-year review for the Gunsite 012 Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the Gunsite 012 OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the Gunsite 012 OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table X-1 lists the chronology of site events for the Gunsite 012 OU.

III. Background

The Gunsite 012 OU is a Resource Conservation Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with this OU are soil.

Physical Characteristics

The Gunsite 012 (Figure X-1) is located northeast of the geographical center of the SRS and about 4.8 km (3 mi) from the nearest site boundary. The Gunsite 012 OU is located within the Lower Three Runs watershed, approximately 270 m (300 yds) south of Pond B. The area is flat to gently rolling and approximately 84 m (280 ft) above mean sea level. A detailed discussion of the operational compliance history of Gunsite 012 OU was provided in the Record of Decision (ROD) (SRNS 2011a). Subsequent paragraphs and subsections in this document provide a summary of this information.

Gunsites were anti-aircraft gun emplacements that operated from 1955 to 1957 to provide physical protection for SRS against possible enemy attack. The Gunsite 012 was one of

five central gunsites that featured 90-mm anti-aircraft guns as well as extensive administrative support facilities, including barracks, mess halls, office buildings, and motor pools. Figure X-2 provides an aerial photograph of Gunsite 012 during operation.

The Gunsite 012 OU contains three RCRA/CERCLA subunits:

- Gunsite 012 Rubble Pile (NBN);
- Rubble Pile Across from Gunsite 012 (NBN); and
- Early Construction Operation Disposal Site (ECODS) G-3 (Adjacent to Gunsite 012) (NBN).

For RCRA/CERCLA investigation purposes, the Gunsite 012 OU was further partitioned into four soil subunits and one groundwater subunit. The Building Pad and the Parking Area Subunits are contained within the Gunsite 012 Rubble Pile subunit. The Gun Emplacement Area Subunit is located in the Rubble Pile Across from Gunsite 012 subunit. The ECODS G-3 subunit is contained within the ECODS G-3 subunit. Although the groundwater is not a unit listed in the FFA, the groundwater underlying the Gunsite 012 OU was included as part of the RCRA/CERCLA investigation process and identified as the Groundwater Subunit. Figure X-3 provides an illustration of the surface subunits.

The Gunsite 012 Rubble Pile is approximately 3.7 hectares (9 acres). The Building Pad consists of concrete slab foundations of former buildings, sidewalks, and driveways, and a concrete pad of an abandoned drinking well. The Parking Area consists of a former gravel parking lot that had been sprayed with an asphalt emulsion to suppress dust, and a disposal trench located within the trees to the northeast of the parking lot.

The Rubble Pile Across from Gunsite 012 is approximately 1.6 hectares (4 acres). The Gun Emplacement Area consists of concrete slab foundation for the former four circular gun emplacements and a building.

The ECODS G-3 is approximately 0.3 hectares (0.75 acres). ECODS G-3 is 60 m (200 ft) southwest of the Gunsite Rubble Pile and apparently contains construction waste from Gunsite 012. It currently is a wooded area.

The Groundwater subunit includes the groundwater underlying the Gunsite 012 OU. The water table at the Gunsite 012 is approximately 10.5 to 13.5 m (35 to 45 ft) below ground surface (bgs).

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River* (WSRC 1999) designates Gunsite 012 OU as being outside of a site industrial area. However, according to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for this OU is reasonably anticipated to be industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The buildings in the Building Pad subunit of the Gunsite 012 Rubble Pile were constructed in 1955 and dismantled in 1961. Asphalt floor tiles containing asbestos, adhesives and tar material were placed in a pile on the building pad. Floor tiles were also found in piles on the ground. An underground septic system consisted of vitrified piping and a 10,000 gallon septic tank which was abandoned in place. Seven 2000 gallon underground fuel storage tanks were removed most likely before 1990. Soil characterization conducted in 2007 determined that polycyclic aromatic hydrocarbons (PAHs) existed in the 0-0.3 m (0-1 ft) soil interval. Primarily, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenzo[a,h]anthracene, and indeno-[1,2,3-c,d]pyrene were identified with the Building Pad subunit. In addition to the PAH contamination, asbestos found in floor tiles were determined to pose a potential risk to human health. Results of the human health risk assessment (HHRA) identified a risk to the resident receptor of 2.7×10^{-4} for exposure to PAHs. No risk was identified for the industrial worker.

A gravel parking lot was constructed in 1955 in the Parking Area subunit of the Gunsite 012 Rubble Pile. The lot was periodically sprayed with an asphalt emulsion to suppress dust. From 1992 to 1997, the parking lot was used as a storage area for creosote-treated railroad crossties and utility poles. The railroad crossties and utility

poles were removed in January 1997. Based on the 2007 characterization events, PAHs were found in the 0-0.3-m (0-1-ft) soil interval in the gravel parking lot. However, it was determined that the low levels of PAHs were similar to PAH levels expected in any parking lot and therefore, no remedial response was needed. Additionally, antimony was determined to exist in the top 1.2 m (4 ft) of soil in the nearby disposal trench. The existence of antimony in the ditch appears to have originated from the scraps of metal and/or cans and buckets deposited within the disposal trench from past uses. Results of the HHRA identified a hazard greater than 1 (i.e., hazard quotient [HQ] = 2.7) to the resident receptor for exposure to antimony. There were no adverse health impacts identified for the industrial worker. The Rubble Pile Across from the Gunsite 012 contains the Gun Emplacement Area subunit. After the gun emplacements and building were removed, the building pad may have been used for limited chemical storage. The generator building's underground storage tank, which stored generator fuel, was removed prior to 1990. The 2007 characterization activities identified one PAH and trace amounts of petroleum analytes. However, all results were below action levels for industrial or unrestricted use.

Construction waste from the construction of Gunsite 012 apparently was disposed of in the ECODS G-3. Trace amounts of PAHs, petroleum analytes, solvents, pesticides, polychlorinated biphenyls (PCBs), and metals were identified in this subunit. All results were below action levels for industrial or unrestricted use. For the Groundwater subunit, 12 groundwater samples were collected in 2007 to support the conclusions of the contaminant migration analysis. No exceedances of the most likely contaminants were found and no additional sampling of the groundwater was performed. The contaminant migration analysis did not identify any problems for transport of soil contaminants to groundwater.

Initial Response

- At the Building Pad subunit, asbestos-containing asphalt floor tiles were determined to pose a potential risk to human health. A non-time critical removal (NTCR) action and a maintenance action were conducted during 2010. The NTCR action was specific for the removal of asbestos-containing floor tiles within the soil surrounding

the building pads (SRNS 2009). Additionally, a maintenance action was performed to remove the remaining floor tiles adhering to the building pads including the associated adhesive and tar material located on the building pads and expansion joints (SRNS 2010).

- Following the NTCR action and the maintenance action, remedial action was required for the remaining PAHs in the surface soil at the Building Pad subunit and the antimony in the Parking Area subunit surface soil that remained at levels that did not allow for unrestricted use.

Basis for Taking Action

The results of the Gunsite 012 evaluations are documented in the ROD for Gunsite 012 (SRNS 2011a) and are summarized below to support the selected remedy:

- There are no ecological COCs, contaminant migration COCs, or PTSM for any of the Gunsite 012 OU subunits;
- No human health COCs were identified for the Gun Emplacement Area, ECODS G-3, or the Groundwater subunits; and
- Human health COCs were identified at the Building Pad (i.e., PAHs in surface soil) and the Parking Area (i.e., antimony in surface soil) at levels that do not allow for unrestricted use.

The selected remedy for the Gunsite 012 OU leaves hazardous substances in place that pose a potential future risk and will require land use restrictions until the concentrations of hazardous substances in the soil and groundwater are at levels that allow for unrestricted use and exposure. If Land Use Controls (LUCs) are not implemented, actual or threatened releases of hazardous substances from the Building Pad and the Parking Area may present a current or potential threat to public health, welfare, or the environment.

Results of the groundwater sampling conducted in May 2007 as part of the RCRA/CERCLA investigation process determined that there were no exceedances in

groundwater. In addition, a contaminant migration analysis of the soil subunits did not identify any problems associated with the transport of soil contaminants to groundwater.

IV. Remedial Actions

Remedy Selection

As detailed in the ROD (SRNS 2011a), the remedial action objectives (RAOs) for Gunsite 012 OU are as follows:

Building Pad Subunit

- Prevent future residents from exposure to PAHs in surface soil at concentrations exceeding $1x10^{-6}$ risk.

Parking Area Subunit

- Prevent future residents from exposure to antimony in surface soil at concentrations exceeding hazard quotient (HQ)>1.

The remedial goals (RGs) for the human health refined constituents of concern (RCOCs) for the Building Pad and the Parking Area are shown in Table X-2 and Table X-3.

As stated in the ROD (SRNS 2011a), the selected remedial action for the ECODS G-3, the Gun Emplacement Area, and the Groundwater subunit is No Action. There is no waste to treat, no LUCs required, and no Applicable or Relevant and Appropriate Requirement (ARARs) for these RCRA/CERCLA subunits. Because there are no problems warranting action at these subunits, no action was taken. These subunits pose no risk to human health or the environment and warrant unrestricted land use.

As stated in the ROD (SRNS 2011a), the selected remedial action for the Building Pad and Parking Area is LUCs and include the following:

- Institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the SRS Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements prior to access being granted.

- Engineering controls including signage to prevent unauthorized entry and uses.
- Access controls to prevent exposure to trespassers, as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.l, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.

Remedial Implementation

Implementation of the Gunsite 012 OU remedial action included the following activities:

- Establishing LUCs for 3.6 hectares (8.85 acres).
- Installing warning signs at the LUC boundaries of the Building Pad and Parking Area subunits in October 2011.
- Implementing access controls at the SRS boundary to control and restrict public and trespasser access to Gunsite 012 OU.

Figure X-4 presents current (2012) photographs of this OU.

System Operations/Operation and Maintenance

There are no system operational requirements. Construction activities for the remedial action were recently completed. Thus, the following maintenance activities have not begun:

- Annual site inspections and site maintenance (warning signs and verification that no invasive activities have occurred); and
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit).

The ROD estimated operation and maintenance (O&M) cost associated with the selected remedy has a present worth cost of $388,000 discounted at 7% per year for 30 years. Since O&M cost were not incurred in fiscal year 2011, no comparison to the estimated costs can be made at this time.

V. Progress since Last Review

This is the first five-year review for the Gunsite 012 OU. There are no previous protectiveness statement concerning human health and the environment.

There are no recommendations or follow-up actions.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, 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 X-1; and
- Reviewed changes in standards and to-be-considered guidance;

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is expected to function as intended as demonstrated below:

- The selected remedy of land use controls (i.e., institutional controls and engineering controls) is expected to be effective in preventing future residents from exposure to PAHs and antimony. Annual inspections will verify and document the effectiveness of the land use controls. The Land Use Control Implementation Plan for Gunsite 012 OU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (SRNS 2011b). All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The ROD RGs were compared to the 2012 Regional Screening Levels. The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are

still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy. The selected remedy continues to be protective as the exposure pathways have been eliminated through implementation of the remedy.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for Gunsite 012 OU.

X. Protectiveness Statement(s)

The remedy at the Gunsite 012 OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with LUCs to prevent exposure to or ingestion of contaminated soil. All threats to contaminated soil at the Gunsite 012 OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the Gunsite 012 OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2009. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for Floor Tile Piles at Gunsite 012 Operable Unit (U)*, SRNS-RP-2009-01026, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Removal Action Report for Asbestos Removal at Gunsite 012 OU (NBN) (U)*, SRNS-RP-2010-01278, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011a. *Record of Decision, Remedial Alternative Selection for the Gunsite 012 OU (NBN) (U)*, SRNS-RP-2010-01232, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011b. *Land Use Control Implementation Plan for Gunsite 012 Operable Unit (NBN) (U)*, SRNS-RP-2011-00293, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

Various – *Inspection Data Sheets - Field Inspection Checklist for Gunsite 012*, ER-IDS-019-070, Inspection Period 2007 through 2011 (annually)

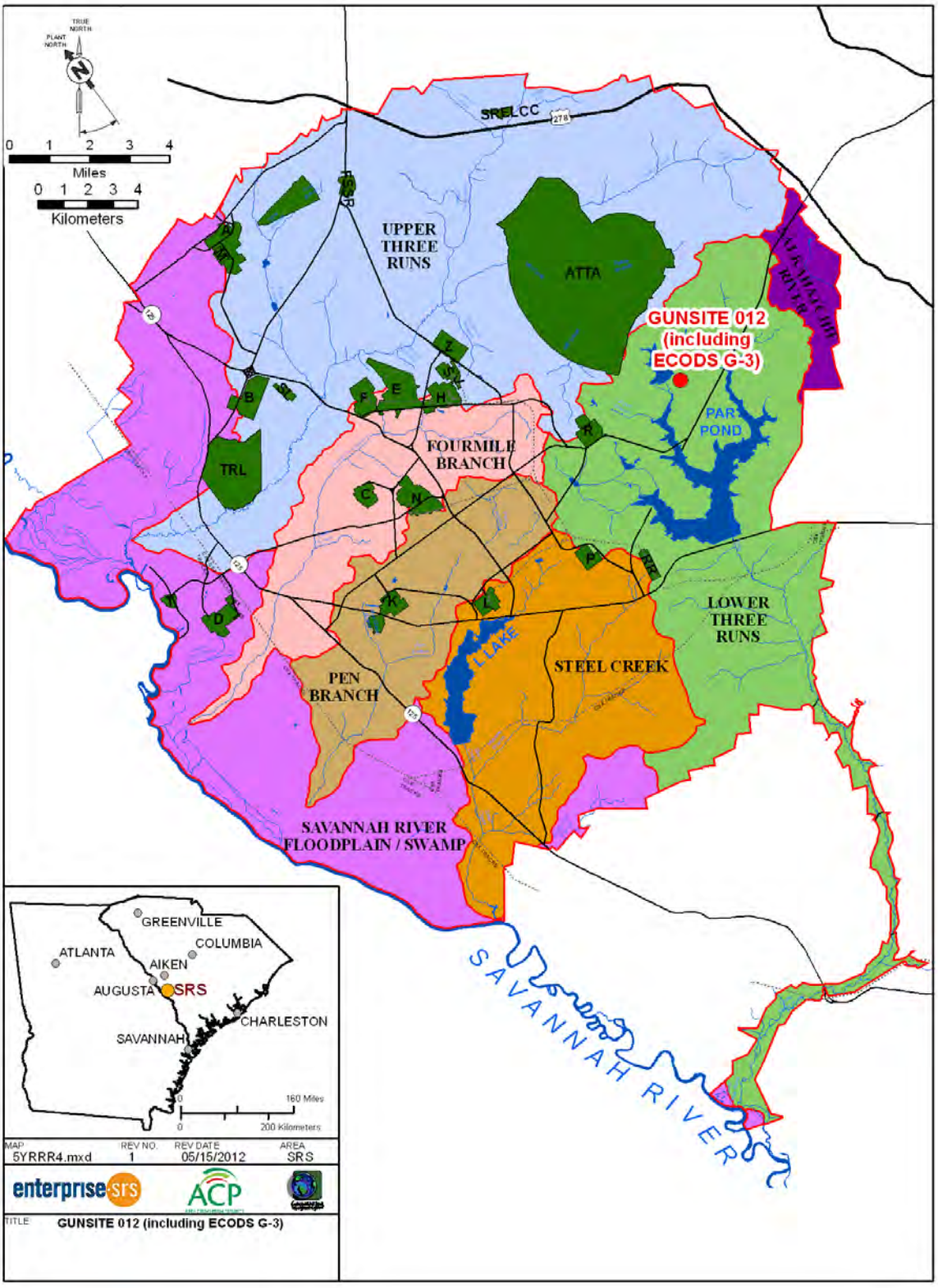


Figure X-1. Location of the Gunsite 012 OU at SRS



Figure X-2. Aerial Photograph of Gunsite 012 during Operation

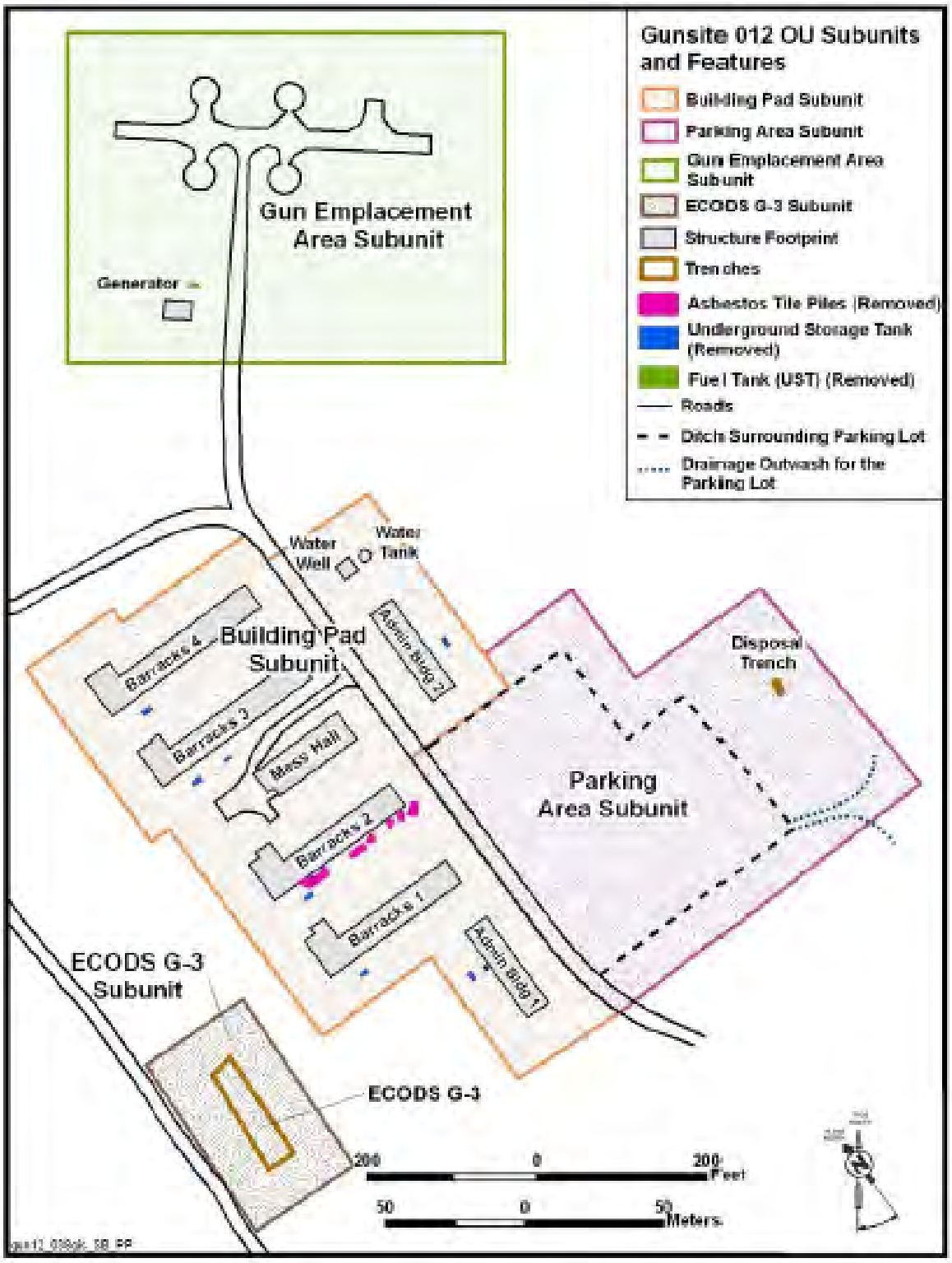


Figure X-3. Site Layout of Gunsite 012 Operable Unit



Figure X-4. Current Photos of Gunsite 012 Building Pad Subunit and Parking Area Subunit (2012)

Table X-1. Chronology of OU Events

Event	Date
RFI/RI Start/Complete	November 5, 2007 / August 20, 2009
Removal Action Start/Complete	June 16, 2010 / June 16, 2010
Record of Decision (ROD) Issuance	June 29, 2011
Remedial Action (RA) Start/Complete	October 5, 2011 / TBD
Previous Five-Year Review	None

Table X-2. Building Pad Subunit Remedial Goals for HH RCOCs

RCOC	Units	Future Resident Carcinogens (Soil)	Future Industrial Worker Carcinogens (Soil)
		Risk = $1x10^{-06}$	
Benzo[a]anthracene	mg/kg	0.15	NA
Benzo[a]pyrene	mg/kg	0.015	NA
Benzo[b]fluoranthene	mg/kg	0.15	NA
Benzo[k]fluoranthene	mg/kg	1.5	NA
Dibenzo[a,h]anthracene	mg/kg	0.015	NA
lndeno[1,2,3-c,d]pyrene	mg/kg	0.15	NA

Table X-3. Parking Area Subunit Remedial Goals for HH RCOCs

RCOC	Units	Future Resident Carcinogens (Soil)	Future Industrial Worker Carcinogens (Soil)
		Hazard Quotient = 1	
Antimony	mg/kg	31	NA

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Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN)

I. SITE INFORMATION			
Site Name:	**Gunsite 012 Operable Unit (NBN)**	**Date of Inspection:**	**05/24/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #78**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**80°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for Gunsite 012*, ER-IDS-019-070._____

_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(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.) Field Walkdown

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Candice Freeman (Name) Federal Project Director (Title) 10/16/12 (Date) 803-952-7085 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey wooden stakes were located. Several had been damaged due to control burn in the area.

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 X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(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:_____

._____

_____

_____

_____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident

Areal extent_____ Depth_____

Remarks:_____

_____

2. Cracks: ☐ Location shown on site map ☐ Cracking not evident

Lengths_____ Widths_____ Depths_____

Remarks:_____

_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent_____ Depth_____

Remarks:_____

_____

4. Holes: ☐ Location shown on site map ☐ Holes not evident

Areal extent_____ Depth_____

Remarks:_____

_____

5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress

Areal extent_____ Depth_____

Remarks:_____

_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

VII. COVER SYSTEMS ***(Continued)***

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☒ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:_____
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:_____
E. Gas Collection and Treatment ☐ Applicable ☒ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:_____
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

IX. **GROUNDWATER/SURFACE WATER REMEDIES** ***(Continued)***
C. Treatment System ☐ Applicable ☒ N/A
1. Treatment Train (Check components that apply)**:** ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters_____ ☐ Additive (e.g., chelation agent, flocculent)_____ ☐ Others_____ ☐ Good Condition ☐ Needs maintenance ☐ Sampling ports properly marked and function ☐ Sampling/maintenance log displayed and up-to-date ☐ Equipment properly identified ☐ Sampling ports properly marked and function ☐ Quantity of groundwater treatment annually_____ ☐ Quantity of surface water treatment annually_____ Remarks:_____
2. Electrical Enclosures and Panels *(properly rated and function)***:** ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Tanks, Vaults, Storage Vessels: ☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance Remarks:_____
4. Discharge Structure Appurtenances: ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
5. Treatment Building(s): ☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks:_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

IX. **GROUNDWATER/SURFACE WATER REMEDIES** ***(Continued)***
6. Monitoring Wells *(pump and treatment remedy)***:** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
D. Monitoring Data ☐ Applicable ☐ N/A
1. Monitoring Data: ☐ Is routinely submitted on time ☐ Is of acceptable quality
2. Monitoring Data: ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining
E. Monitored Natural Attenuation ☐ Applicable ☐ N/A
1. Monitoring Wells *(natural attenuation remedy)***:** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
X. OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Soil Vapor Extraction System ☐ Applicable ☒ N/A
1. Blowers, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances: ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment X-1. Five-Year Review Site Inspection Checklist – Gunsite 012 Operable Unit (NBN) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The Gunsite 012 OU consists of two subunits that warrant remediation: The remedy for the Building Pad and the Parking Area Subunits is institutional controls. Warning signs have been posted at either end of the subunits and administrative controls have been put in place to prevent unauthorized invasive activities at the subunits. The remedy, institutional controls, is functioning as designed as indicated by no evidence of invasive activities at the subunits.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining Gunsite 012 and the condition of its warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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H-AREA GROUNDWATER OPERABLE UNIT

I. Introduction

This is the fourth five-year review for the H-Area Groundwater Operable Unit (OU). This review was conducted from August 2012 through September 2012. The review for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) review requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document. Contaminants remaining at the H-Area Groundwater OU are at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the H-Area Groundwater OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table Y-1 lists the chronology of site events for the H-Area Groundwater OU.

III. Background

H-Area Groundwater OU, a media-specific OU, is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) for SRS. The media associated with the H-Area Groundwater OU is groundwater.

The H-Area Groundwater OU is the groundwater associated with the H-Area Hazardous Waste Management Facility (HWMF) OU, and the H-Area Retention Basins (HRBs), Warner's Pond, and the HP-52 Ponds.

Physical Characteristics

The H-Area Groundwater OU lies in the central portion of SRS; approximately 9.6 km (6 mi) from the nearest site boundary (see Figure Y-1). The groundwater contamination plume associated with the four earthen unlined H-Area HWMF basins is the H-Area

Groundwater OU and is observed in a zone which extends from the water table surface to approximately 15 m (50 ft) below ground surface (bgs) and covers an area of approximately 81.2 hectares (200 acres).

In July 2001, the U.S. Department of Energy (USDOE), the U.S. Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) agreed to modify the boundaries of the H-Area Groundwater OU to include groundwater impacted by the HRBs, Warner's Pond, and the HP-52 Ponds (WSRC 2002). A groundwater monitoring program was subsequently established to define the nature and extent of contamination in the Upper Three Runs and Gordon aquifers of the H-Area Groundwater OU.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the H-Area Groundwater OU as being within an industrial area. The future land use for the H-Area Groundwater OU is reasonably anticipated to remain industrial with the USDOE maintaining control of the land.

History of Contamination

The major sources of the H-Area Groundwater OU contamination were the H-Area HWMF, the HRBs, the HP-52 Ponds, and Warner's Pond.

The H-Area HWMF, shown in Figure Y-2, operated from 1955 until 1988. During that time, the facility received approximately 1.6 billion gallons of low-level waste effluents from H-Area chemical separation facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general-purpose evaporator overheads. The effluents were acidic (wastewater with nitric acid) and low-activity waste solution containing a wide variety of radionuclides and dissolved metals. Significant amounts of nitrate and caustic were received. Tritium was the primary radionuclide released to the basins.

From 1955 to 1972, the HRBs received non-hazardous radioactively contaminated wastewater from chemical separations facilities and from the H-Area Tank Farm. Warner's Pond was constructed in 1956 as an emergency holding pond to receive contaminated cooling water from the 221-H (H Canyon) building that flowed into an effluent stream. In 1967, during a transfer of high-level waste at the H-Area Tank Farm, some spilled material flowed into a nearby storm sewer and reached the HP-52 outfall. Two small holding ponds, referred to as the "HP-52 Cesium Ponds" or "HP-52 Ponds", were constructed to contain the contaminated water.

Initial Response

A groundwater monitoring network was installed in the 1950s. In 1986, the determination was made that the basins should be regulated under RCRA as hazardous waste disposal facilities, and closure plans were initiated. The basins were closed by dewatering, physically and chemically stabilizing the remaining sludge, and covering them with a protective multi-layer system to reduce rainwater infiltration. The basin closures were completed in 1991.

In 1992, SCDHEC issued to SRS a RCRA Part B Permit that specified ongoing groundwater monitoring requirements and a Corrective Action Plan to remediate the contaminated portions of the uppermost groundwater aquifer. Several contaminants exceeded regulatory limits and were targeted for remediation.

Basis for Taking Action

The maximum detected levels of several contaminants (e.g., tritium, mercury, and strontium-90) in the H-Area groundwater currently exceed the National Primary Drinking Water Standards and state standards (i.e., maximum contaminant levels [MCLs]). However, potential exposures to the general public are minimized by the distance from the OU to the site boundary, natural attenuation and radionuclide decay, institutional controls (i.e. land use controls [LUCs]), and dilution in receiving streams. The remediation of the H-Area Groundwater OU was designed to meet, as far as practicable, the Groundwater Protection Standards (GWPS) outlined in the 1992 SRS RCRA permit.

The contaminants requiring monitoring are shown in Table Y-2. These contaminants are identified in the current SRS RCRA Permit (SCDHEC 2003) and listed in the Interim Action Record of Decision (IROD) (WSRC 1995). These contaminants are monitored because they were detected at concentrations above the GWPS.

IV. Remedial Actions

Remedy Selection

An IROD for the H-Area Groundwater OU was issued in April 1995 (WSRC 2005). A Final ROD has not been issued. The final action for this media-specific OU will be documented by modifications to the RCRA permit.

The selected interim action under CERCLA is no further action beyond that required by the corrective action as identified in the SRS RCRA Permit. As described in the SRS RCRA Permit, the goal of remediation of the H-Area Groundwater Operable Unit is to lower contaminant concentrations in the groundwater associated with the H-Area HWMF to levels specified in the RCRA permit and to minimize the discharge of contaminants to the adjacent stream (WSRC 1995). The remedial action objectives (RAOs) of the interim remedial action are to address the potential ecological impacts at the seeplines along Fourmile Branch and to address the ambient water quality standards in Fourmile Branch by remediating this OU (WSRC 1995).

The SRS RCRA Permit set forth a phased approach to remediating the groundwater that required documented evaluations of the performance of the system to determine effectiveness toward meeting the RAOs. The Phase 1 remedy was a groundwater recovery and hydraulic control with treatment of mobile hazardous constituents and radionuclides (except tritium and nitrates) by treatment and injection of treated water into the shallow aquifer at the upgradient extent of the plume. The evaluation of this remedy (WSRC 2001) facilitated the following phased success measures to reach the RAOs that are in the current SRS RCRA Permit (SCDHEC 2003):

- Phase 1: Implement a groundwater extraction and injection system to capture and remediate those portions of the contaminant plume delineated by the 10,000 pCi/ml

tritium isoconcentration contour. Also capture the mercury plume emanating from Basin H-3.

- Phase 2a: Reduce mass flux of tritium discharging from the plume to Fourmile Branch by 70% and reduce the discharge of the remaining constituents as identified in Appendix ICB-A of the permit (SCDHEC 2003) to Fourmile Branch to levels that are less than the GWPS.

- Phase 2b: Reduce the discharge from the plume of all constituents identified in Appendix IVC-A of the permit (SCDHEC 2003) at the seepline to levels less than the GWPS.

- Phase 3: Remediate the entire contaminant plume to levels below the GWPS as listed in Appendix IVC-A of the permit (SCDHEC 2003) or evaluate the applicability of Alternate Concentration Limits or a Mixing Zone.

Remedy Implementation

Consistent with the phased approach of the permit, the implementation of the remedy was structured to prevent the plumes from further migration and discharge to Fourmile Branch, treat and/or attenuate the contaminant plumes at and approaching the OU boundary (Fourmile Branch), and finally to treat and/or attenuate all contaminants within the OU. Except for the initial treatment (pump-treat-reinjection), the permit identifies that development work would be needed to select and implement technologies to address the unique conditions presented at this OU. While the treatments that are and have been part of the remedy are presented chronologically in the following paragraphs, they work synergistically to address the permit requirements and RAOs.

Active Treatment with Pump - Treat - Reinjection

In 1997, SRS designed and built a pump-and-treat system using a water treatment unit (WTU) with a network of injection and extraction wells. The remediation system extracted groundwater downgradient of the seepage basins, passed it through a WTU to remove metals and radionuclides, and re-injected the treated water upgradient to maintain the recirculation loop. To reduce the migration of tritium to Fourmile Branch, the system

lengthened the tritium pathway in the extraction/reinjection loop. This was expected to provide more time for decay prior to discharge to Fourmile Branch. The length of the tritium pathway between injection and extraction was not sufficient to support decay and significant breakthrough (due to increased water volume and gradient), which prompted the termination of operations. Operation of the pump-and-treat system was suspended October 2003 upon receipt of conditional approval by SCDHEC.

Passive Treatment with Subsurface Barrier System

In 2004, two groundwater barriers were installed. One barrier was placed upgradient of Basin H-4 and a second barrier was placed downgradient of the basin for a total length of 948 m (3,160 ft) of low permeability wall. Vertically the wall was installed from just below ground surface to the base of the upper aquifer zone. Placement of the barrier walls altered groundwater levels near the walls (groundwater gradient), thus altering groundwater flow paths and increasing groundwater travel times to surface water and seeplines.

In June 2010, a base injection system, comprised of injection wells, pumping station, and chemical metering system, was constructed to inject an alkaline solution approximately at a pH of 10 into the aquifer to immobilize metals. Figure Y-3 shows the locations of the injectors that are placed downgradient of the barrier walls and upgradient of the seepline.

System Operations/Operation and Maintenance

The following system operational activities are ongoing:

- Since operation of the base injection system began in 2010, the pH in the target zone has stabilized. Periodic injections are ongoing to maintain pH in the target zone of the plume. Through the end of 2011, 9.9 million gallons of base solution have been injected (Table Y-3).

In 2011, enhancements were made to the cover system over the H-Area HWMF basins. Specifically, the drainage system, consisting of concrete-lined swales, was re-graded and new concrete was installed. Also, modifications to tie the drainage layer from the cap to the swales were completed.

Costs associated with the selected remedy for H-Area Groundwater OU include O&M costs of WTU, base injection, and institutional controls. O&M costs at the WTU were about $1M per month. RCRA documentation does not require estimated project costs to be prepared. Therefore, none are included in this remedy review.

V. Progress since Last Review

The previous protectiveness statement concluded that the interim remedial actions at the H-Area Groundwater OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being maintained by the barrier walls and base injection treatment system which have been functioning properly based on groundwater monitoring data.

There were no recommendations or follow-up actions from the last five-year review.

The following actions have been implemented:

- Base injection operations began and are continuing

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action. Figure Y-4 provides current photographs of the remedial actions;
- Reviewed all process and performance monitoring data provided by the annual groundwater monitoring and corrective action reports and provided a technical assessment of whether the treatment systems are functioning as intended by the IROD and whether the shutdown criteria has been achieved;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment Y-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls;

- Ensured that all actions required under the RCRA Permit were implemented; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

The H-Area Groundwater OU and underlying geology have been impacted by the volumes of acidic waste discharged to the basins. The carrier fluid for the process waste to the seepage basins (groundwater contaminant source) was low pH acid that leached to the subsurface over a 30-plus year period creating a groundwater plume of low pH that has impacted the geochemistry of the subsurface soils, leaching natural metals and minerals, and minimizing the retardation of contaminants. As recognized by SRS, the pH must be addressed to have success in reaching the RAOs and RCRA Permit requirements. Because of the properties of the individual metal and radionuclide contaminants, one remedy will not address all the contaminants. The only viable approach to tritium, a main contaminant at this site, is to decrease the rate of release from sources and slow the migration rates through the water table to the receptors. Thus, the remedial approach implemented at SRS attempts to address these facets. This technical review was conducted to assess progress in addressing the RAOs as per the IROD (WSRC 1995).

Ecological Studies

Ecological studies associated with the H-Area Groundwater OU are conducted as part of the FMB Integrator Operable Unit (IOU). These studies include ecological benchmark comparisons that compare ecological screening values to sediment, sediment/soil, and surface water media constituent concentrations. The ESVs are derived from ecologically relevant criteria and standards such as National Ambient Water Quality Criteria. Review of the 4th periodic report for the Fourmile Branch IOU indicates that in terms of community level effects there is no evidence that metals discharged from H Area have degraded fish or macroinvertebrate communities in Fourmile Branch (SRNS 2012b). Aluminum, barium, and mercury may pose a potential threat to wildlife. Aluminum and barium showed a potential threat to wildlife upgradient of SRS operations. Only mercury is a potential issue in lower and middle Fourmile Branch, but there is no evidence that

this is associated with discharges from SRS operational areas (i.e., F-Area, H-Area) (SRNS 2012b).

Groundwater and Surface Water Data

This data review encompassed a review of concentration data, contaminant plume maps (WSRC 2008, SRNS 2009a, SRNS 2010, SRNS 2011, SRNS 2012a), and time trend data for sampling locations within the H-Area Groundwater OU.

As a condition of the RCRA permit for the H-Area HWMF groundwater, SRS annually calculates and reports the tritium flux to Fourmile Branch. As shown in Table Y-4, tritium flux discharges have been reduced by > 70 %.

A review of the surface water data from stations FM-2U, FM-H1, FM-H2, FM-2, FM-2a, FM-2D, FM-2B, FM-31, FMC-002H and FMC-002HD for the period encompassing the 2nd, 3rd and 4th Remedy Review was conducted at evaluate the impact of the H-Area Groundwater OU on Fourmile Branch. Table Y-5 presents the contaminants that at any time during the three review periods were detected above the GWPS or MCL. The base injection has been in operation for less than 2 years. A full evaluation of the impact of the base injection operations on the discharge to surface water would be premature at this time due to the short timeframe in which the system has been working.

A review of the seepline data for the period encompassing the 2nd, 3rd, and 4th Remedy Review was conducted to assess the effect of the H-Areas Groundwater OU treatment systems on the seeplines. Table Y-6 provides a summary of constituents from the seepline sampling locations that have exceeded the GWPS or MCL at any time during the period beginning in 2001 (initial sampling) and ending April 2012. Review of the seepline data indicates decreasing concentrations over time for all constituents except nitrate-nitrite as nitrogen and radium-228. Further review of the radium-228 data from initial well sampling through early 2012 indicates that of the 338 records there are two detected values greater than the standard of 5 pCi/L. These detections occurred in 2001 and 2010. The overall data trend is flat with the average concentration being 2.1 pCi/L. Further review of the nitrate-nitrite as nitrogen data indicate the wells with time trends

above the standard of 10 mg/L are located within the nitrate-nitrite as nitrogen plume that emanates from the region on the northwest edge of Basin H-4 (SRNS 2012a).

While showing decreasing concentrations over time, there are several contaminants that remain above their standards. These contaminants are associated with existing plumes and are located downgradient of these plumes.

In summary, though standards have not been reached at the seeplines for all permitted constituents, the general trend is decreasing concentrations. Due to the short operating time of the base injection, the full impact of that treatment system on the contaminants at the seepline cannot be fully evaluated. The data to date provides supporting evidence that the remediation strategy deployed for the H-Area Groundwater OU is having a positive impact on the seeplines and associated wetlands. Of the three constituents identified in the ecological studies as potential threats to wildlife, only mercury was detected above standard with concentrations decreasing to below the GWPS during this five-year review cycle.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 31, 2012 by phone and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The H-Area Groundwater OU was inspected by SRNS and USDOE personnel on May 31, 2012 and October 17, 2012. No issues were identified for the H-Area Groundwater OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements (ARARs), risk assumptions, and the results of site inspections indicate that the remedy is

functioning as intended by the IROD. The IROD identifies no further action beyond that required by the SRS RCRA Permit, but stipulates the corrective action will address the potential ecological impacts at the seeplines along Fourmile Branch and will also serve to address the ambient water quality standards in Fourmile Branch by remediating this OU. The implemented treatment strategy is addressing the goal of the remediation, as described in the SRS RCRA Permit: lower contaminant concentrations in the groundwater associated with the H-Area HWMF to levels specified in the RCRA permit and to minimize the discharge of contaminants to the adjacent stream. Ecological assessment of Fourmile Branch indicates no impact from the H-Area HWMF. However, aluminum, barium, and mercury are potential threats to wildlife in Fourmile Branch in the area impacted by H-Area operations. As part of the Fourmile Branch IOU program, studies of ecological impacts to the branch will be ongoing. Based on the results of the ecological studies to date, the RAOs of the IROD are being met. The groundwater requirements of the RCRA permit, which the IROD identified must also be satisfied, have not been met. However, the treatment approach is making positive progress towards those requirements. The effective implementation of institutional controls has prevented exposure to, or ingestion of, contaminated groundwater.

According to the data reviewed, the site inspections, and the interviews, the remedy is functioning as intended by the IROD. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

There are several opportunities for system optimization associated with this OU. The groundwater monitoring network has evolved since it was initiated in the 1950s. This evolution while supporting specific objectives has resulted in some instances in wells producing redundant data due to proximity. Several wells producing duplicative data have been identified for removal from the sampling network. The temporal changes in the contaminant plumes is of a sufficiently long time that it is recommended sampling frequencies be revised from semiannual to annual for the full suite of GWPS constituents. However, the quarterly sampling of indicator parameters will be retained to provide warning if conditions change that would warrant a return to semiannual sampling. Bis(2-ethylhexyl)phthalate (DEHP) is recommended for removal from the permitted

constituents due to its sporadic detection, both temporally and spatially, from 2000 through March 2012 (SRNS 2012c).

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 standards or to-be-considered guidance identified in the IROD that call into questions the protectiveness of the remedy.

Changes in Standards and To Be Considered

The action specific ARARs have been met with the shutting down and dismantling of the groundwater pump-and-treat system. The chemical specific ARARs and location specific ARARs associated with groundwater remediation must still be met and have been evaluated.

The GWPS set forth in the SRS RCRA Permit (SCDHEC 2003) for the constituents that were identified as present above those standards were compared against MCLs, where available. The comparison found six constituents where the GWPS differed from the MCL (Table Y-7). The GWPS is more protective than the MCL for carbon-14, cyanide, cobalt-60, and technetium-99; thus SRS is adhering to a more stringent standard. The groundwater data for the H-Area wells that are monitored as per the RCRA Part B permit were evaluated for the period Jan 2000 through August 2012 for arsenic and (DEHP). Two thousand two hundred eighty-four DEHP records were reviewed. Twenty six detected results from 22 wells occurred during the period 2000 through 2011 with an average value of 9.4 µg/L and a maximum value of 23.8 µg/L. Fifteen records from twelve wells were above the GWPS of 10 µg/L and seventeen records from fourteen wells were above the MCL of 6 µg/L. The data provide no evidence of a DEHP groundwater issue. Two thousand three hundred seventeen arsenic records were reviewed. There were 73 detected results from 39 wells during the period 2000 through 2008 with an average value of 7.4 µg/L. Zero records were above the GWPS of 50 µg/L and twelve records from two wells were above the MCL of 10 µg/L with a maximum value of 43.1 µg/L and an average value of 19 µg/L. Eleven of twelve records were from

one well, a point of compliance well, located at the downgradient edge of Basin H-1. The data indicate the likelihood of a localized presence of arsenic. All wells associated with the H-Area Groundwater OU are monitored semiannually for arsenic.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. 1,4-dioxane is a potential contaminant at this unit as it is found at sites where chlorinated solvents are present. Two hundred sixty-three 1,4-dioxane records from 31 wells for the period 2000 through March 2012 were reviewed from the OU. There were six detects that were all from one well. This well is within the boundaries of the tetrachloroethylene (PCE) plume.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

There have been no changes in MCLs (versus GWPS) that would impact the remedy. Because this OU is operated under the RCRA permit, no baseline risk assessment is required; therefore changes in toxicity data and risk methods are not relevant. The remedy is progressing as expected.

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

Recommendations and follow-up actions concerning H-Area Groundwater OU are listed in Table Y-8.

X. Protectiveness Statement(s)

The remedy at the H-Area Groundwater OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by the subsurface barrier walls and base injection, groundwater monitoring, and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the H-Area Groundwater OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program. Protectiveness of the remedial action will be verified by continued groundwater monitoring.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 2003. *South Carolina Hazardous and Mixed Waste Permit, Permit Number SC1 890 008 989 2003 RCRA Permit Renewal for the Savannah River Site, issued September 30, 2003, Module IV – Groundwater Requirements, Section C, H-Area Hazardous Waste Management Facility*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC

SRNS, 2009a. *2008 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U)*, Volume I, SRNS-RP-2009-00272, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009b. *H Area Base Injection for Metals Treatment Temporary Authorization Plan (U)*, SRNS-TR-2009-00222, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *2009 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U)*, Volume I, SRNS-RP-2010-00172, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *2010 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U) Volume I*, SRNS-RP-2011-00150, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012a. *2011 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U) Volume I*, SRNS-RP-2012-00045, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012b. *Periodic Report 4 for the Fourmile Branch Integrator Operable Unit (IOU) (U)*, SRNS-RP-2011-01359, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2012c. *EC&ACP Groundwater Monitoring Optimization Report: A Comprehensive, Technical Approach for the Evaluation and Optimization of Groundwater Monitoring and Reporting (U)*, SRNS-RP-2012-0196, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1995. *Interim Action Record of Decision Remedial Alternative Selection for H-Area Groundwater Operable Unit (U),* WSRC-RP-94-1163, 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, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2002. *RFI/RI Work Plan for the H-Area Groundwater Operable Unit (U*), WSRC-RP-2000-4144, Revision 1.2, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC.

WSRC, 2008. *2007 Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility, and the Mixed Waste Management Facility (U)*, Volume I, WSRC-RP-2008-4021, Washington Savannah River Company, Savannah River Site, Aiken, SC

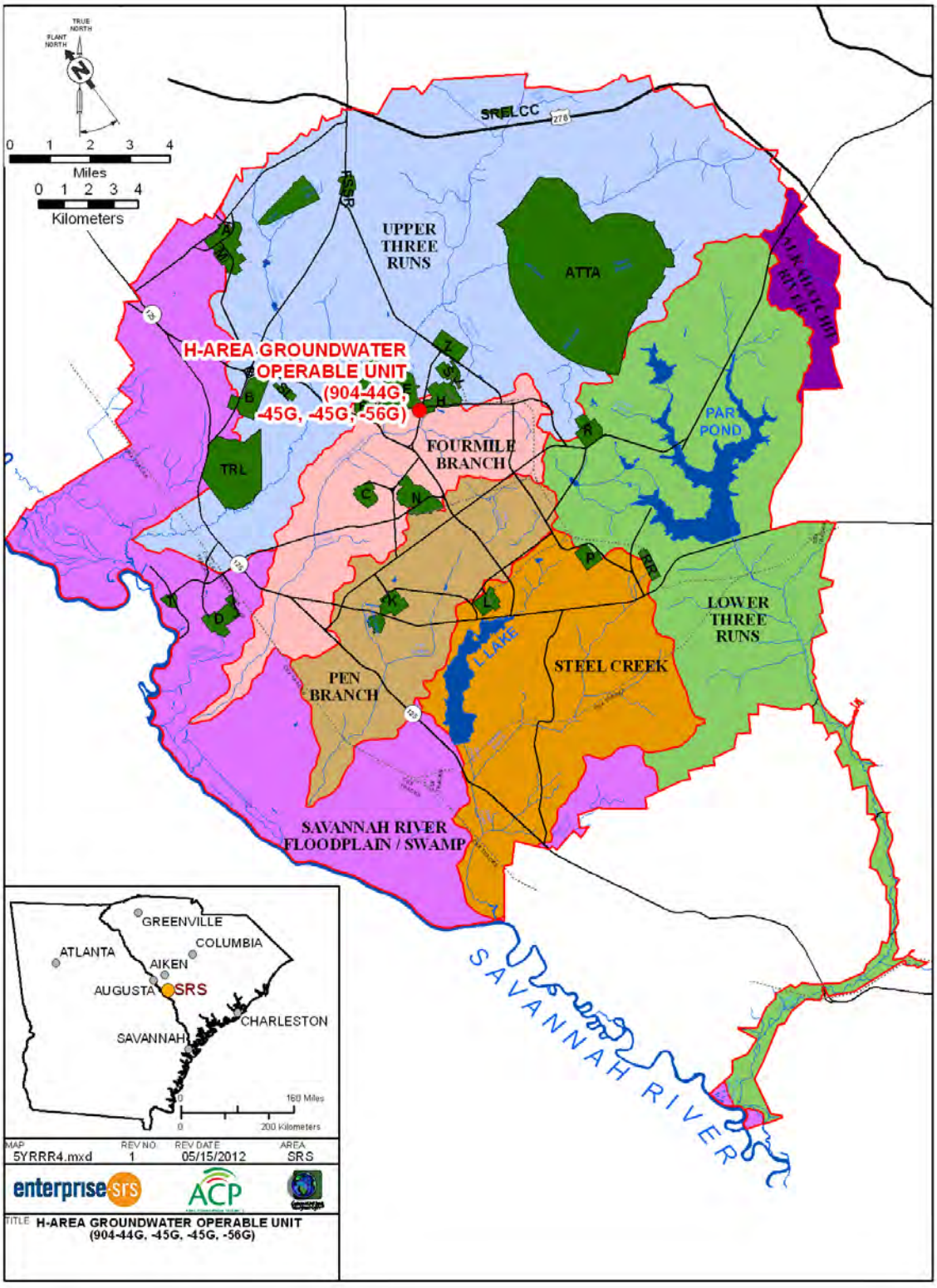


Figure Y-1. Location of the H-Area Groundwater OU at the SRS, Aiken, SC

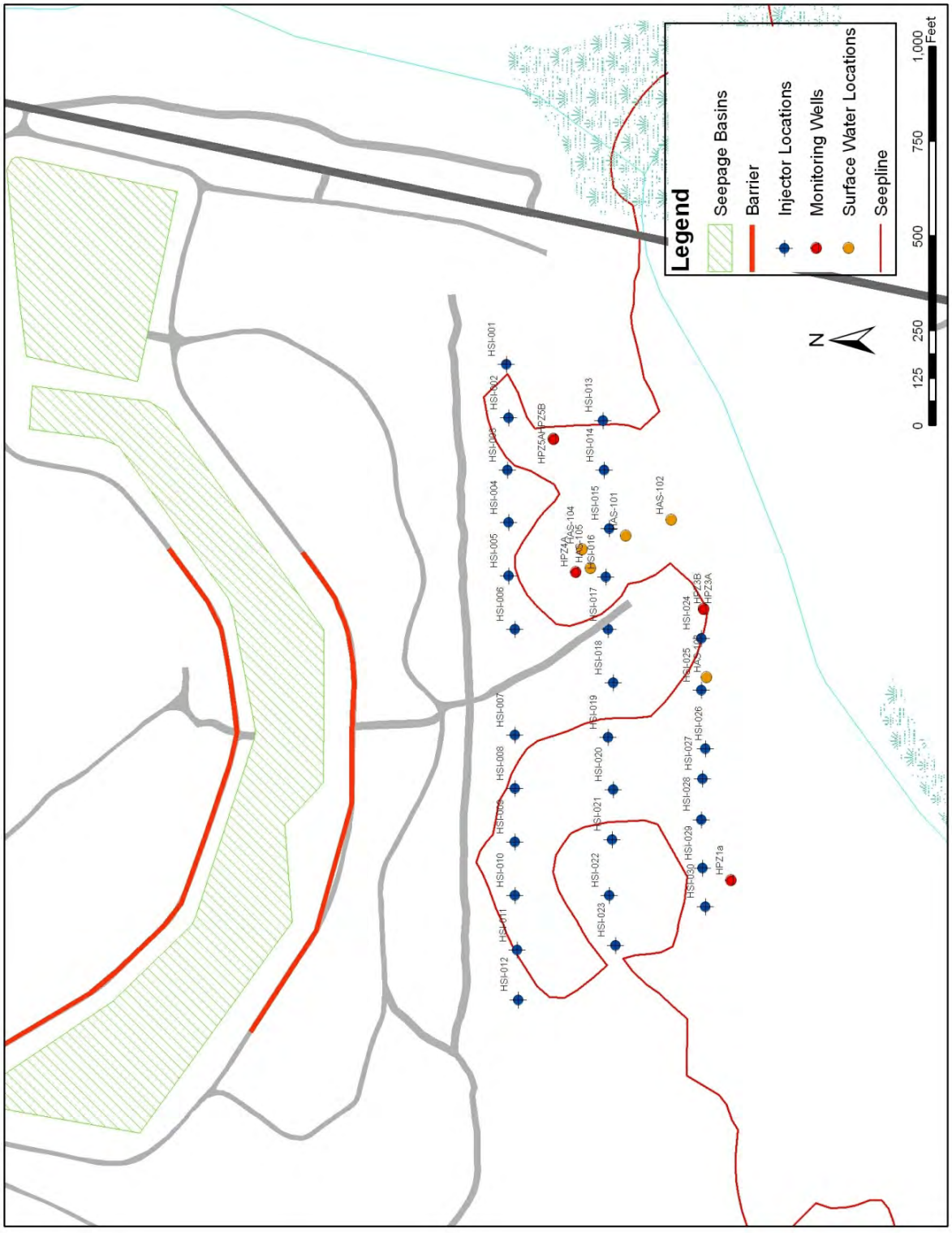


Figure Y-2. Treatment Systems for the H-Area Groundwater OU



Figure Y-3. H-Area HWMF Basins Prior to Closure (Jan 1989)



Figure Y-4. Current Photo of H-Area Groundwater (2012) (Inset is the basin injection operating system)

Table Y-1. Chronology of OU Events

Event	Date
RCRA Closure Plan Approved	1989
Corrective Action Start	1989
RCRA Closure Certified	1991
Interim Action Record of Decision (IROD) Issuance	April 13, 1995
Previous Five-Year Reviews	June 30, 1997, February 12, 2004, February 4, 2009

Table Y-2. H-Area Groundwater OU / HWMF Monitored Hazardous Constituents per the SRS RCRA Permit (SCDHEC 2003)

Inorganics
Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Cyanide, Lead, Mercury, Nitrate-Nitrite as Nitrogen, Selenium, Silver, Thallium, Tin, Vanadium, Zinc
Organics
Benzene, bis(2-Ethylhexyl)phthalate, Methylene chloride (Dichloromethane), Tetrachloroethylene (PCE), Trichloroethylene (TCE), Trichlorofluoromethane,
Radionuclides
Gross alpha, Gross (nonvolatile) beta, Total radium, Americium-241, Carbon-14, Cobalt-60, Curium-242, Curium-243/244, Curium-246, Iodine-129, Nickel-63, Plutonium-238, Plutonium-239/240, Radium-226, Radium-228, Strontium-90, Technetium-99, Thorium-228, Thorium-230, Tritium, Uranium-233/234, Uranium-234,Uranium-235, Uranium-238

Table Y-3. H-Area HWMF Base Injection Volumes Injected

Year	Total Volume (million gallons)
2010[a]	1.8[b]
2011	8.1[c]

a - Operation of system began in September 2010
b - SRNS 2011
c - SRNS 2012a

Table Y-4. Summary of Calculated Tritium Flux to Fourmile Branch associated with the H-Area Groundwater OU (SRNS 2012a)

Year	Calculated Tritium Flux (Ci/yr)	% Tritium Reduction from Baseline Year of 2000
2000	240	NA
2003	221	8
2004	147	39
2005	114	52
2006	116	52
2007	81	66
2008	90	62
2009	67	72
2010	50	79
2011	56	77

Table Y-5. Summary of Constituents from the H-Area GW OU Surface Waters of Fourmile Branch Detected Above Standards

Constituent	Unit	GWPS /MCL[1]	Maximum Concentration [# of Samples]		
			2nd Remedy Review (1997-2001)	3rd Remedy Review (2002-2006)	4th Remedy Review (2007-2011)
Antimony	µg/L	6	10 [49]	2.7 [93]	0.21 [65]
Arsenic	µg/L	10	6 [55]	3.12 [105]	27.1 [65]
Beryllium	µg/L	4	5 [52]	0.22 [93]	0.23 [65]
Cadmium	µg/L	5	5 [64]	0.65 [117]	1.15 [46]
Carbon-14	pCi/L	5	11.2 [66]	162 [142]	1140 [88]
Cobalt	µg/L	3	6.27 [52]	15.7 [93]	5.69 [65]
Gross alpha	pCi/L	15	46.8 [68]	7.06 [174]	128 [207]
Iodine-129	pCi/L	1	All ND [59]	4.69 [70]	9 [206]
Non-volatile Beta	pCi/L	50	192 [68]	142 [174]	268 [207]
Total radium	pCi/L	5	13.5 [64]	4.16 [94]	7.44 [82]
Radium-226	pCi/L	5	12 [65]	2.68 [134]	5.55 [85]
Radium-228	pCi/L	5	3.22 [66]	6.05 [113]	8.4 [69]
Strontium-90	pCi/L	8	9.54 [67]	7.96 [57]	18.1 [135]
Thallium	µg/L	2	10 [43]	7.95 [93]	2.52 [65]
Tin	µg/L	2.6	10 [57]	8.37 [87]	0.62 [65]
Tritium	pCi/L	20,000	312,000 [66]	4,810,000 [455]	2,760,000 [585]
Vanadium	µg/L	4	10.8 [52]	4.09 [93]	30.9 [65]

ND = Non detect

Table Y-6. Summary of Constituents from the H-Area Groundwater OU Seepline Detected Above Standards

Constituent	Unit	GWPS/ MCL[1]	Maximum Concentration [# of Samples]		
			2nd Remedy Review (1997-2001)	3rd Remedy Review (2002-2006)	4th Remedy Review (2007-2011)
Arsenic	µg/L	10	ND [8]	59.8 [117]	20.6 (J) [48]
Beryllium	µg/L	4	1.55 (J) [8]	9.87 [177]	0.63 [101]
Carbon-14	pCi/L	50	221 [8]	798.4 [197]	268 [195]
Chromium	µg/L	100	73.5 [8]	659 [172]	40.9 [48]
Cobalt	µg/L	3	9.8 [8]	36.2 [181]	4.4 [132]
Methylene Chloride	µg/L	5	8.31 [9]	16 [65]	ND [38]
Gross Alpha	pCi/L	15	48.5 [7]	188 [199]	40.1 [236]
Iodine-129	pCi/L	1	39.6 [9]	50.7 [180]	22.1 [241]
Lead	µg/L	15	1920 [8]	460 [173]	9.01 [48]
Mercury	µg/L	2	ND [8]	2.33 [180]	1.1 [231]
Nickel	µg/L	100	29.7 [8]	267 [184]	62 [68]
Nickel-63	pCi/L	50	ND [8]	63.3 [70]	21.4 [70]
Nitrate-Nitrite as N	mg/L	10	8.45 [8]	60.2 [207]	80.2 [234]
Non-Volatile Beta	pCi/L	50	86.1 [7]	302 [199]	107 [236]
Total Radium	pCi/L	5	8.04 [7]	133 [167]	7.51 [102]
Radium-226	pCi/L	5	13.3 [7]	11.3 [198]	1.98 [133]
Radium-228	pCi/L	5	18.1 [7]	3.2 [198]	6.74 [133]
Technetium-99	pCi/L	50	34.7 [7]	1080 [202]	196 [162]
Tin	µg/L	2.6	1340 [8]	49.8 [118]	ND
Tritium	pCi/L	20,000	5,900,000 [9]	5,470,000 [204]	2,930,000 [235]
Uranium-233/234	pCi/L	15	5.76 [7]	16.8 [199]	0.87 [135]
Uranium-238	pCi/L	15	2.77 [7]	20.5 [199]	0.87 [135]
Vanadium	µg/L	4	81.1 [8]	733 [146]	10.5 [48]

Table Y-7. Comparison of Permitted GWPS for the H-Area Groundwater OU versus MCLs

Contaminant	Unit	GWPS	MCL
Arsenic	µg/L	50	10
Bis(2-Ethylhexyl)phthalate (DEHP)	µg/L	10	6
Cyanide	µg/L	20	200
Carbon-14	pCi/L	50	2000
Cobalt-60	pCi/L	50	100
Technetium-99	pCi/L	50	900

Table Y-8. H-Area Groundwater Recommendations and Follow-up Actions

Issue	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Optimization of sampling to correlate with rate of change of contaminant concentrations	Reduce sampling for full suite in selected wells from semiannual to annual	USDOE	SCDHEC	4/2013	N	N
Optimization of analyte list	Delete DEHP from monitoring program	USDOE	SCDHEC	4/2013	N	N
Optimization of wells sampled	Remove wells from monitoring program to eliminate redundancy in data	USDOE	SCDHEC	4/2013	N	N

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit

I. SITE INFORMATION			
Site Name:	**H-Area Groundwater Operable Unit**	**Date of Inspection:**	**05/31/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #9**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**83°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☒ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☒ Vertical Barriers
- ☒ Other

Base Injection

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/31/2012 (Date)

Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. **Local Regulatory Authorities and Response Agencies** (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: _____

_____

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Other Permits	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: RCRA Part B Permit

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater 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.) Field Walk Down

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/17/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater 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:_____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☒ Applicable ☐ N/A

1. Settlement: ☐ Location shown on site map ☒ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring: Potentiometric Head ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks: Since installation of the walls, potentiometric heads have been rising on the upstream side and declining on the downstream side and have not reached equilibrium yet.

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☒ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: The groundwater extraction system has been removed from service.

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☒ Good Condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☒ Filters
☐ Additive (e.g., chelation agent, flocculent)
☐ Others
☒ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☒ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually
☐ Quantity of surface water treatment annually
Remarks: The groundwater extraction system has been removed from service.

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☒ Good Condition ☐ Needs maintenance
Remarks:

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☒ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:

4. Discharge Structure Appurtenances:

☒ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:

5. Treatment Building(s):

☐ N/A ☒ Good Condition (especially roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Groundwater Injection Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: The baseline injection system is operated as needed to maintain desired groundwater parameters.

2. Injection System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment Y-1. Five-Year Review Site Inspection Checklist – H-Area Groundwater Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The groundwater extraction/treat/reinjection remedial system functioned as designed. The installation of the barrier walls with base injection is installed and operating as designed. The remedy will facilitate achieving the RAOs and RGs for this OU.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M programs are well established and functioning to ensure that remedial systems remain in effective service. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. See Table Y-8 of this OU-specific review.

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H-AREA HAZARDOUS WASTE MANAGEMENT FACILITY (904-44G, 904-45G, 904-46G, AND 904-56G) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the H-Area Hazardous Waste Management Facility (904-44G, -45G, -46G, and -56G) (H-Area HWMF) Operable Unit (OU). This review was conducted from August 2012 through September 2012. Contaminants have been left in place at the H-Area HWMF OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the H-Area HWMF OU is protective of human health and the environment. The report documents the results of the review. The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document.

II. OU Chronology

Table Z-1 lists the chronology of site events for the H-Area HWMF.

III. Background

The H-Area HWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for SRS. The media associated with the H-Area HWMF OU is soil.

The groundwater is being addressed by the H-Area Groundwater OU.

Physical Characteristics

The H-Area HWMF is located in the central portion of SRS, approximately 9.6 km (6 mi) from the nearest site boundary (Figure Z-1). The H-Area HWMF consists of four unlined basins, H-1 (904-44G), H-2 (904-45G), H-3 (904-46G) and H-4 (904-56G) and the associated H-Area Inactive Process Sewer Line (HIPSL) (Figure Z-2).

The dimensions and volumetric capacity of the basins were as follows:

- Basin H-1 – 27 m x72 m x 2.7 m (90 ft x 240 ft x 9 ft), 1.1 million gallons;
- Basin H-2 – 33 m x138 m x 2.7 m (110 ft x 460 ft x 9 ft), 2.8 million gallons;
- Basin H-3 – 105 m x144 m x 5.1 m (350 ft x 480 ft x 17 ft), 9.4 million gallons; and
- Basin H-4 – 39-129 m x720 m x 2.4 m (130-430 ft x 2400 ft x 8 ft), 22.6 million gallons.

At the time of closure, the H-Area HWMF (904-44G, 904-45G, and 904-56G) had a combined maximum operating capacity of 26.5-million gallons of wastewater. Figure Z-3 shows the basins prior to the start of closure.

The HIPSL that was used to convey wastewater to the H-Area HWMF is outside the scope of the H-Area HWMF Record of Decision (ROD). The HIPSL RCRA closure action was completed in conjunction with the General Separations Area Consolidated Unit (GSACU) OU remedial action.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the Savannah River Site (WSRC 1999) designates the H-Area HWMF OU as being within an industrial area. The future land use for the H-Area HWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The H-Area HWMF operated from 1955 until November 1988. In 1962, Basin H-4 replaced Basin H-3. During that time, the H-Area HWMF received waste effluents from H-Area chemical separation facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads.

Significant amounts of nitrate and caustic were received in the basins. Radioactive releases were greater than 99 percent tritium. A 1984 soil coring study showed that

approximately 90 percent of the radionuclides and metals were concentrated within the top 0.3 m (1 ft) of basin soil (WSRC 2001).

Initial Response

Preventative actions at H-Area HWMF OU were conducted pursuant to the requirements of RCRA per Settlement Agreement 87-27-SW.

Closure of the four basins began in 1989 and was completed in May 1991. The four basins were closed by dewatering; physically and chemically stabilizing the remaining sludge with a layer of granite, limestone, and blast furnace slag; and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.

The H-Area HWMF was certified closed in July 1991 and was accepted by the South Carolina Department of Health and Environmental Control (SCDHEC) in October 1991 as being in compliance with RCRA requirements (SRNS 2009).

Basis for Taking Action

The constituents of concern at the H-Area HWMF are arsenic, barium, cadmium, copper, lead, mercury, nickel, vanadium, zinc, tetrachloroethylene, gross alpha, gross beta, tritium, nitrate, carbon-14, cobalt-60, iodine-129, radium-226, radium-227, strontium-90, technetium-99, and uranium-233/234. No remedial goals were established in the ROD for soils (WSRC 2003).

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the H-Area HWMF within the RCRA closure process in 1988. Closure of the H-Area HWMF began in 1989 and was completed in July 1991. Preventative activities at the H-Area HWMF became subject to CERCLA when SRS was placed on the National Priorities List (NPL) in December 1989. As documented in the ROD, the RCRA closure was selected as the final action under CERCLA. Therefore, no further action under CERCLA was necessary for the H-Area HWMF (WSRC 1993).

The remedial action objectives (RAOs) for the H-Area HWMF OU were to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The H-Area HWMF RCRA preventative action of stabilization and placement of all contaminated materials under a low-permeability cap satisfied both RAOs.

Remedy Implementation

Implementation of the selected final action remedy (i.e., the RCRA preventative action) included the following activities:

- Dewatering the basins to eliminate free liquids and to solidify the remaining waste and residues;
- Stabilizing the remaining waste using 0.9-1.8 m (3-6 ft) of granite aggregate, 0.3 m (1 ft) of limestone and blast furnace slag to provide a load bearing capacity sufficient to support the cover system; and
- Placing a 9-hectare (22.1-acre) low permeability cover system consisting of a layer of back fill, a 0.6-m (2-ft) layer of low-permeability compacted kaolin clay, a 22.5-cm (9-in) drainage layer of sand, a geotextile fabric filter, topped with 0.6 m (2 ft) of topsoil to support a vegetative cover.

In 2011, enhancements to the cover system over the basins were completed. Specifically, the drainage system, consisting of concrete lined swales, was re-graded and new concrete installed. Also, modifications to tie the drainage layer from the cap to the swales were completed. Figures Z-4 and Z-5 provide current photographs of the H-Area HWMF.

Systems Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Post-closure groundwater monitoring is required as a condition of the RCRA Hazardous Waste Permit to verify that no unacceptable exposure to potential hazards posed by conditions at the OU occur in the future.

- Monthly site inspections will occur for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any necessary repairs will be made as part of the maintenance program. Annual elevation surveys are conducted to monitor the long-term settlement of the cap.
- Institutional controls are being enforced to preclude unauthorized access or intrusive activities through the SRS Site/Use Site Clearance program and SRS site security.

Costs associated with the selected remedy for H-Area HWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost data comparison is not provided in this remedy review.

V. Progress since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at H-Area HWMF are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls in place while USDOE controls the OU.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the remedial action is being maintained as per the land use controls;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment Z-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Ensured that all actions required under the RCRA Permit were implemented (i.e., annual inspections, maintenance to the soil covers, groundwater monitoring).

Data Review

A review of the monthly site inspection reports was conducted for the period 2007 through 2012. The monthly site inspections, site maintenance (i.e., repair of erosion damage, mowing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) currently implemented continue to maintain the effectiveness of response actions. The most prevalent findings in the inspection reports were active ant mounds, detached signage and blocked drainage grates and outlets. The first two of these findings are addressed on the spot and the third is typically completed within a several week period. There was one finding of a crack in the drainage head wall associated with Basin H-4 (904-56G) identified during the August 2011 inspection. The design for the drainage head wall replacement is complete. Construction is scheduled to be complete by the end of 2014. Review of the annual subsidence monitoring reports for the period 2007 through 2011 indicate the monument elevations are within the allowable tolerance. Inspection and maintenance data do not indicate a history of remedy problems or potential remedy failure.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The HHWMF OU was inspected by SRNS and USDOE personnel on June 13, 2012 and October 17, 2012. No issues were identified for the HHWMF OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection. A minor item noted during the inspection of the HHWMF OU, documented with response (SRNS 2013), had no impact on the protectiveness of the remedy.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD. The stabilization and placement of a multi-layer low permeability cover system has achieved the RAOs to prevent physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater. The effective implementation of institutional controls has prevented exposure to, and ingestion of, contaminated groundwater.

O&M of the cover system has, on the whole, been effective based on the review of inspection reports as documented in Section VI. Land use controls 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); warning signs and use restrictions via the SRS Site Use/Site Clearance Program. No activities were observed that would have violated the institutional controls.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

As the remedial work has been completed, the applicable standards set forth in the ROD (WSRC 1993) and RCRA closure plan (WSRC 2000) associated with soils and basin sediments have been met. All standards and To-Be-Considered values associated with groundwater are discussed in the review of the H-Area Groundwater OU.

There have been no changes in exposure pathways, land use or contaminant characteristics. While no chemical specific soil remedial goals were set forth in the ROD (WSRC 1993), the remedy has eliminated the exposure pathway associated with soils.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations for follow-up actions for the H-Area HWMF OU.

X. Protectiveness Statement(s)

The remedy at the H-Area HWMF OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled. All threats to contaminated soil at the H-Area HWMF OU have been addressed through stabilization and placement of all contaminated materials under a low-permeability cap and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the H-Area HWMF OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2009. *2000 RCRA Part B Permit Renewal Application - H-Area Hazardous Waste Management Facility*, WSRC-IM-98-30, Volume V, Revision 1, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1993. Final Record of Decision Remedial Alternative Selection for H-Area Hazardous Waste Management Facility (U), WSRC-RP-93-1043, Revision 1, Westinghouse Savannah River Company, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2000. *H-Area HWMF Closure Plan (U)*, WSRC-RP-98-4024, March 2000, Westinghouse Savannah River Company, Aiken, SC

WSRC, 2001. *H-Area Corrective Action Phase 1 Evaluation,* WSRC-RP-2001-4015, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - Post-Closure Inspection H-Area Hazardous Waste Management Facilities 904-45G, 904-46G, 904-56G, ER-SOP-009, Inspection period 2007 through 2011 (monthly)

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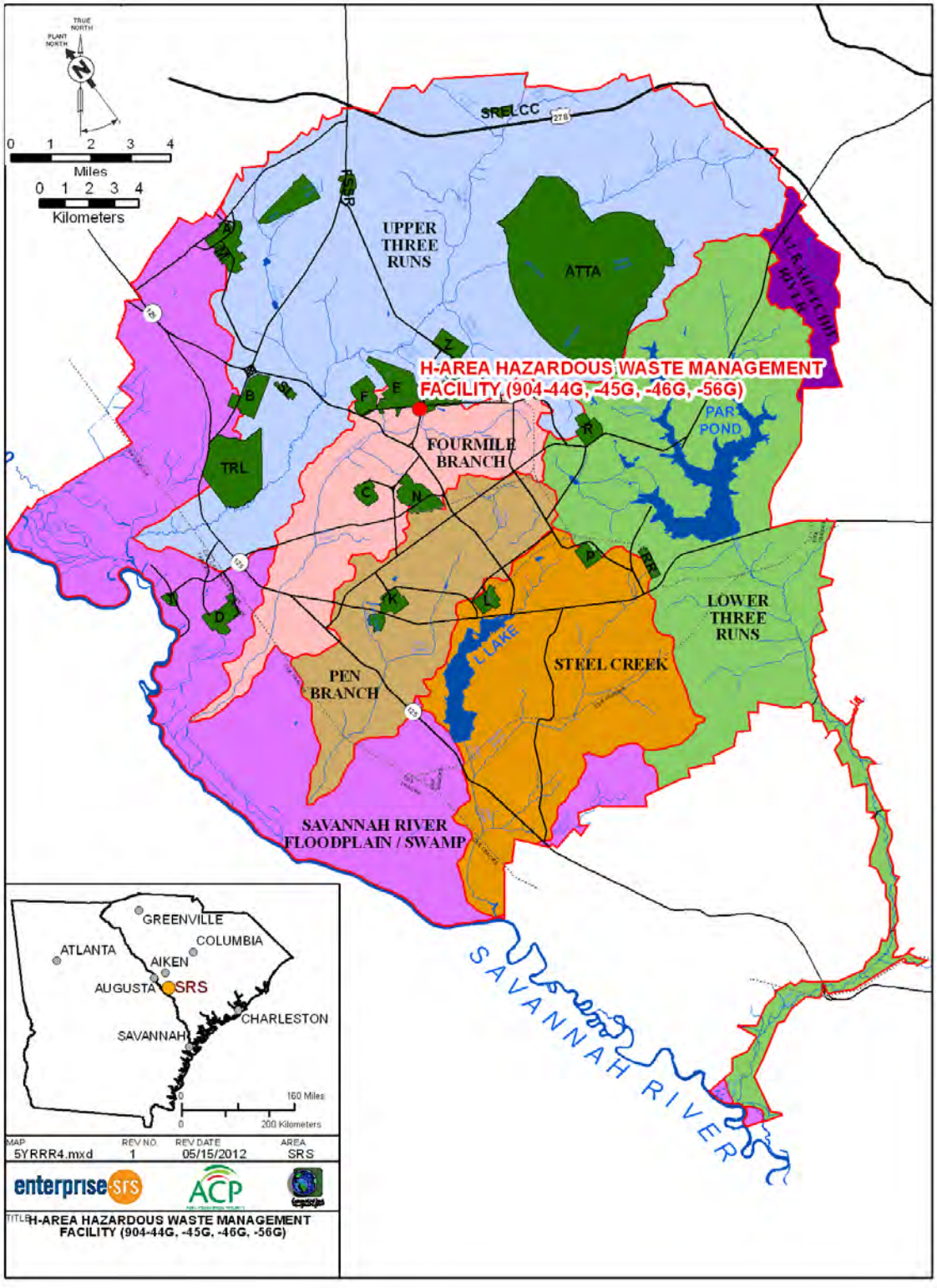


Figure Z-1. Location of the H-Area Hazardous Waste Management Facility

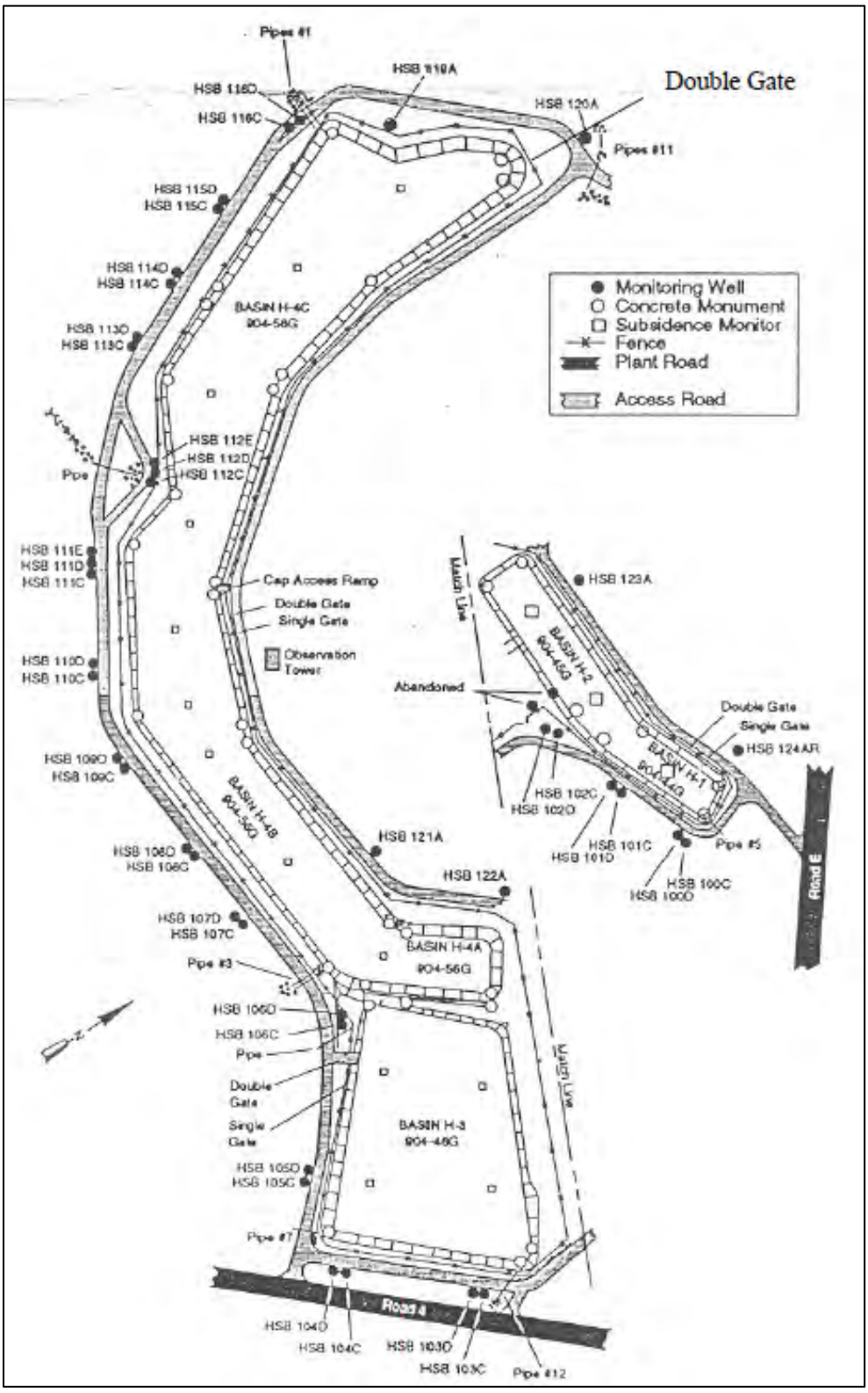


Figure Z-2. Site Layout for H-Area Hazardous Waste Management Facility



Figure Z-3. H-Area HWMF Basins Prior to Closure (Jan 1989)



Figure Z-4. Current Aerial Photograph of the HHWMF (2010)



Figure Z-5. Current On-Unit Photographs of the Cover System of the H-Area Hazardous Waste Management Facility

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Table Z-1. Chronology of OU Events

Event	Date
RCRA Closure Plan Approved	1989
Corrective Action Start	1989
RCRA Closure Certified	October 1991
Final Record of Decision (ROD) Issuance	September 10, 1993
Previous Five-Year Reviews	June 30, 1997 / February 12, 2004 / February 4, 2009

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Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU

1. SITE INFORMATION			
Site Name:	**H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU**	**Date of Inspection:**	**06/13/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #7**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**87°F, sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Stabilization and Excavation

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

2. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. **Local Regulatory Authorities and Response Agencies** (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

3. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. **O&M Documents:**

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *H-Area Seepage Basins Post Closure Inspection*, ER-SOP-009 _____

_____

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Other Permits	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: RCRA Part B Permit

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

IV. O&M COSTS

1 O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2 O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From: _____ (Date) To: _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3 Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. Access and Institutional Controls ☒ Applicable ☐ N/A

A Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: Fencing is in good condition

B Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walk Down

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/17/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:_____
B. Other Site Conditions
Remarks:
VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent Depth Remarks:
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent ☐ Ponding ☐ Location shown on site map Areal extent ☐ Seeps ☐ Location shown on site map Areal extent ☐ Soft subgrade ☐ Location shown on site map Areal extent Remarks:
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent Remarks:
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
1. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay Remarks:
2. Bench Breached: ☐ Location shown on site map ☐ N/A or okay Remarks:
3. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay Remarks:

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

5. Settlement Monuments: ☒ Located ☒ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks:_____

_____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☒ N/A

Remarks:_____

_____

2. Outlet Rock Inspected: ☒ Functioning ☐ N/A

Remarks:_____

_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:

Areal extent_____ Depth_____ ☐ N/A

☐ Siltation not evident

Remarks:_____

_____

2. Erosion:

Areal extent_____ Depth_____ ☐ N/A

☐ Erosion not evident

Remarks:_____

_____

3. Outlet Works: ☐ Functioning ☐ N/A

Remarks:_____

_____

4. Dam: ☐ Functioning ☐ N/A

Remarks:_____

_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement_____ Vertical displacement_____

Rotational displacement_____

Remarks:_____

_____

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident

Areal extent_____ Depth_____

Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☒ N/A

☐ Vegetation does not impede flow

Areal extent_____ Type_____

Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent_____ Depth_____

Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A

Remarks: The drainage ditches at basin H4 have been relined with concrete. A culvert has a crack which is being analyzed for repair to ensure effective transport of surface water runoff away from the contaminant source. _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident

Areal extent_____ Depth_____

Remarks:_____

2. Performance Monitoring:

Type of Monitoring_____ ☐ Performance not monitored

Frequency_____ ☐ Evidence of breaching Head Differential_____

Remarks:_____

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

IX. **GROUNDWATER/SURFACE WATER REMEDIES** ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment Z-1. Five-Year Review Site Inspection Checklist – H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) OU *(continued)*

XI. OVERALL OBSERVATIONS
1. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The closure of the three basins (904-44G, -45G, -46G) by dewatering, physically and chemically stabilizing the remaining waste, and placing a low permeability cap over them has met the remedial objectives of preventing physical exposure to contaminants and mitigating further migration of contaminants to the groundwater. The selected remedy for this waste unit of excavating, grouting manholes and pipe sections in place, and installing an engineered cover over selected sections of the remaining vitrified clay pipe is meeting the remedial objectives.
2. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Operating and Maintenance programs are well established and functioning to ensure that remedial systems remain effective service. When inspections identify any necessary maintenance repairs, repairs will be performed accordingly to maintain current and long-term protectiveness
3. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
4. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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United States Department of Energy

Savannah River Site

Fourth Five-Year Remedy Review Report for the Savannah River Site Aiken, South Carolina

SRNS-RP-2012-00011

Revision 1.1

Volume II

November 2013

Prepared by:
Savannah River Nuclear Solutions, LLC
Savannah River Site
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and
Savannah River Nuclear Solutions, LLC
Aiken, South Carolina

HEAVY EQUIPMENT WASH BASIN AND CENTRAL SHOPS BURNING/RUBBLE PIT (631-5G) OPERABLE UNIT

I. Introduction

This report is the first five-year review for the Heavy Equipment Wash Basin (HEWB) and Central Shops Burning/Rubble Pit (631-5G) (CSBRP-5G) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the HEWB/CSBRP-5G OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the HEWB/CSBRP-5G OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table AA-1 lists the chronology of site events for the HEWB/CSBRP-5G OU.

III. Background

The HEWB/CSBRP-5G OU is listed as a Resource Conservation and Recovery Act (RCRA) 304(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). The media addressed by the HEWB/CSBRP-5G OU Record of Decision (ROD) is soil. The groundwater beneath the HEWB/CSBRP-5G OU will be addressed as part of the Central Shops Groundwater OU.

The HEWB/CSBRP-5G OU consists of three soil subunits: 1) CSBRP (631-5G); 2) HEWB; and 3) HEWB Overflow Discharge Area. Figure AA-1 shows the location of the HEWB/CSBRP-5G OU at SRS. Figure AA-2 shows the site layout for HEWB/CSBRP-5G OU.

Physical Characteristics

The HEWB/CSBRP-5G OU is located in the central part of SRS, within the Fourmile Branch Watershed, approximately 9.6 km (6 mi) from the nearest (western) site boundary. The HEWB is roughly 9 to 18 m (30 to 60 ft) with an earthen berm 1.2- to

1.5-m (4- to 5-ft) high and an area of 0.02 ha (0.04 ac). It accommodates a volume capacity of 108 m3 (3,800 ft3) of standing water at full capacity (Figure AA-4).

The CSBRP-5G was approximately 0.15 ha (0.37 ac) and estimated to contain 3,409 m^3 (120,400 ft^3) of trash by volume. The CSBRP (631-5G) was originally grouped with the other inactive neighboring burning rubble pits (631-1G and 631-3G). However, in 1998 it was combined with HEWB to allow investigation of a suspected groundwater plume beneath the pit. The plume was thought to originate near the HEWB and to contain volatile organic compounds (VOCs) such as trichloroethylene (TCE). Waste disposal ceased in 1973 when the pit reached capacity and was covered with 0.6 to 0.9 m (2 to 3 ft) of soil and brought to grade. Surface grade is approximately 84 m (276 ft) above mean sea level (msl).

The HEWB Overflow Discharge Area is in relatively flat open woodland within the floodplain of an intermittent stream. The Overflow Discharge Area was installed under the berm at the northern end of the HEWB to receive discharges from the HEWB.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan (LUCAP) for the SRS (WSRC 1999) designates the HEWB/CSBRP-5G OU as being within an industrial area. The future land use for the HEWB/CSBRP-5G OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

From 1950 until the early 1970s, the HEWB received Heavy Equipment Wash Area (HEWA) effluent wash water together with sanitary wastewater from Central Shops. HEWA was a facility set up in the maintenance area to clean equipment prior to maintenance. Historically, during day shifts the HEWB received approximately 10 gallons per minute (gal/min) of wastewater five days a week. The wastewater contained traces of oil, grease, and detergents, plus significant levels of solids that were allowed to settle in the basin. According to the wastewater permit, about one-half of the

resulting wash water was lost through infiltration/evaporation. After construction of the Central Shops Sanitary Wastewater Treatment plant in the early 1970s, the wash water from the HEWA was no longer directed to the HEWB. Since 1981, the HEWB has not received water from Central Shops and the associated facilities. The HEWB only collects stormwater at the present time.

The HEWB Overflow Discharge Area historically received permitted discharges from the HEWB via a high overflow discharge culvert installed under the berm at the northern end of the HEWB. Portions of the releases either infiltrated the soil surface or traveled surficially to the intermittent stream. This same floodplain served as a conduit for occasional excess stormwater flow.

The CSBRP-5G pit received waste materials including asbestos, used batteries and empty paint cans along with ash, paper, and glass at various times from 1951 until 1973. Waste was also burned periodically at CSBRP-5G from 1951 until 1973 when a layer of soil was placed over the ashes. The pit continued to receive rubble such as paper, empty paint cans, lumber, and empty galvanized steel barrel until 1973.

Initial Response

After operations ceased, the HEWB and the HEWB Overflow Discharge Area were abandoned in place. When the CSBRP-5G reached capacity in 1973 waste disposal ceased and was covered with 0.6 to 0.9 m (2 to 3 ft) of soil and brought to grade.

Basis for Taking Action

Characterization data was collected and evaluated in the 2003 RCRA Facility Investigation/ Remedial Investigation Report with Baseline Risk Assessment (RFI/RI/BRA) to identify refined constituents of concern (RCOCs) which are constituents warranting remedial action. There were no RCOCs identified for the industrial worker scenario. There were no RCOCs identified for the CSBRP-5G or the Overflow Discharge Area based on unrestricted (residential) land use. There were six RCOCs identified for the HEWB based on unrestricted (residential) land use including benzo[a]pyrene, alpha chlordane, gamma chlordane, heptachlor epoxide, p,p'-DDD, and p,p'-DDT. The contamination is isolated to the surface soil in the HEWB.

The hypothetical risk to the future resident for exposure to surface soil contamination in the HEWB was 2.7×10^{-5}. This presents a condition that warrants institutional controls (i.e., land use controls [LUCs]) to prevent unrestricted land use as documented in the ROD for the HEWB/CSBRP-5G and consistent with the LUCAP for the SRS.

Based on the unit characterization data and risk assessment results, the risks associated with the CSBRP-5G and HEWB Overflow Discharge Areas subunits are negligible. No RCOCs for human health or ecological receptors were identified at the two subunits. No Action was the selected response for these two subunits and they remain in their present conditions with no restrictions or LUCs. The HEWB/CSBRP-5G OU does not contain contaminated soil that could act as a source of future contamination to the groundwater through leaching. Therefore, this OU is not a "source control" unit.

IV. Remedial Actions

Remedy Selection

Six RCOCs are present at concentrations representing a combined risk greater than $1x10^{-6}$ at the HEWB subunit and residential exposure must be prevented. Therefore, the following RAO was identified for the HEWB subunit:

- Prevent residential exposure to contaminated soil at the HEWB subunit (WSRC 2004).

The human health RCOCs and RGs for the HEWB subunit are listed in Table AA-2.

The selected remedy for the HEWB/CSBRP OU is institutional controls (i.e., LUCs) which include access controls (SRS barrier fence), access control signs posted around the HEWB subunit, periodic inspections, and deed restrictions. Remedy Implementation

Implementation of the HEWB OU remedial action included the following activities:

- Establishing LUCs for the HEWB subunit for 0.11 ha (0.26 ac);
- Installing warning signs at the boundaries of the HEWB subunit;
- Implementing access controls at the SRS boundary to control and restrict public and trespasser access to HEWB subunit.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (repair of access road and warning signs) for HEWB subunit only. No inspections or maintenance are required for CSBRP-5G or the Overflow Discharge Area.
- Site controls and land use restrictions via the SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the HEWB/CSBRP-5G OU. Institutional controls will be maintained until the identified RCOCs no longer pose a threat under the residential (unrestricted) land use scenario.

The operation and maintenance (O&M) cost associated with the selected remedy for the HEWB/CSBRP-5G OU includes the annual inspections and site maintenance, institutional controls and five-year remedy reviews. The ROD estimated O&M cost has a present worth of $82,480 discounted at 3.9% per year for 30 years. The actual O&M cost since the remedial action was completed in FY03 until FY11 is $395,300. The actual O&M costs (Table AA-3) are as expected.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedial actions at HEWB/CSBRP-5G OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The final remedial actions were not evaluated in the previous five-year review because the ROD had just been issued. The final remedial actions of institutional controls have now been implemented and have been functioning properly.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Reference XII, Documents Reviewed;

- Confirmed the implementation of the remedial action;
- Evaluated whether the RCOCs still pose a threat under the residential (unrestricted) land use scenario to determine if institutional controls are still required;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment AA-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls,;
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 31, 2012 at the HEWB OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The HEWB OU was inspected by SRNS on May 31, 2012 and DOE SR personnel on October 16, 2012. No issues were identified for the HEWB OU during these inspection and interviews.

On January 15, 2013 a site inspection was conducted by US EPA and SCDHEC personnel, accompanied by DOE SR and SRNS personnel. No problems regarding the remedy of this OU as implemented were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The selected remedy of institutional controls is effective in preventing residential exposure to RCOCs.
- Annual site inspections have been performed and indicate that no land disturbance has occurred and access road and signs are intact. For this five-year review, the unit was inspected to confirm that the warning signs were posted at the HEWB subunit and inspection records were reviewed to confirm annual inspections have been conducted for accuracy and legibility of identification and warning signs, for visible subsidence or erosion of the waste unit, for proper vegetation growth, for mowing, etc.

- All other routine maintenance activities (i.e., mowing, etc.) and corrective actions have been implemented and documented.

The above remedial activities are meeting the RGs established for the HEWB/CSBRP-5G OU, as discussed in Section II, by eliminating or controlling all routes of exposure to human 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 remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

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. There are no opportunities for optimization.

VIII. Issues

There are no issues related to current site operations, conditions, or activities that currently prevent the remedy for HEWB/CSBRP-5G OU from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for this OU.

X. Protectiveness Statement(s)

The remedy at the HEWB/CSBRP-5G OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with LUCs to prevent exposure to or ingestion of contaminated soil. All threats to contaminated soil at the HEWB/CSBRP-5G OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the HEWB/

CSBRP-5G OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for January 2019.

XII. Document Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2001. *RCRA Facility Investigation/Remedial Investigation Work Plan for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) Operable Unit (U)*, WSRC-RP-98-4187, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) Operable Unit (U)*, WSRC-RP-2002-4088, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Record of Decision Remedial Alternative Selection for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit Operable Unit (631-5G) (U),* WSRC-RP-2003-4185, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005a. *Corrective Measures Implementation Report/Final Remediation Report for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit Operable Unit (631-5G) (U)*, WSRC-RP-2005-4006, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005b. *Land Use Control Implementation Plan for the Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit Operable Unit (631-5G) (U)*, WSRC-RP-2005-4015, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various – *Inspection Data Sheets - Field Inspection Checklist – Heavy Equipment Wash Basin (U)*, ER-IDS-019-034, Inspection period 2007 through 2011 (annually)

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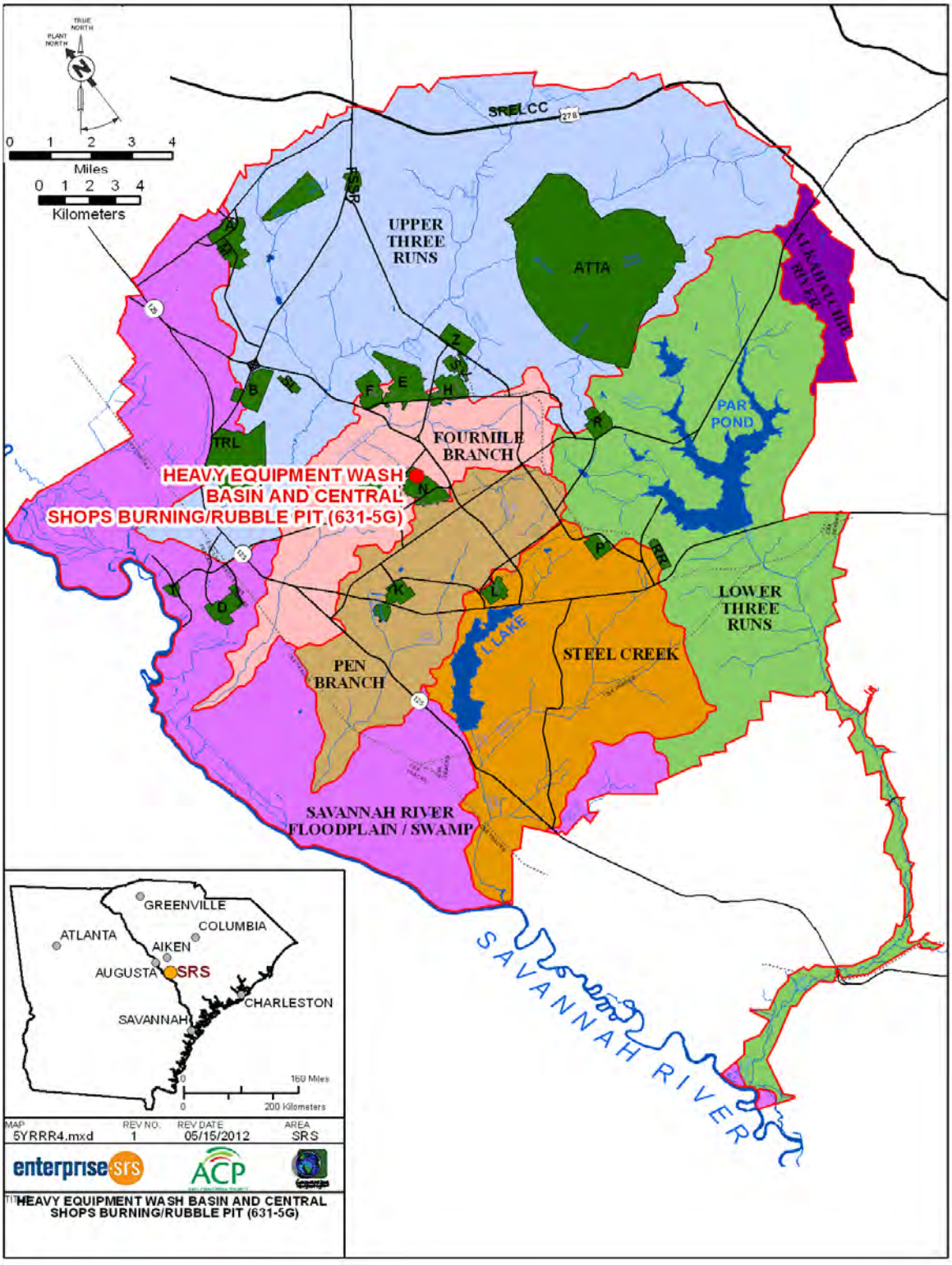


Figure AA-1. Location of the Heavy Equipment Wash Basin and Central Shops Burning Rubble Pit Operable Unit

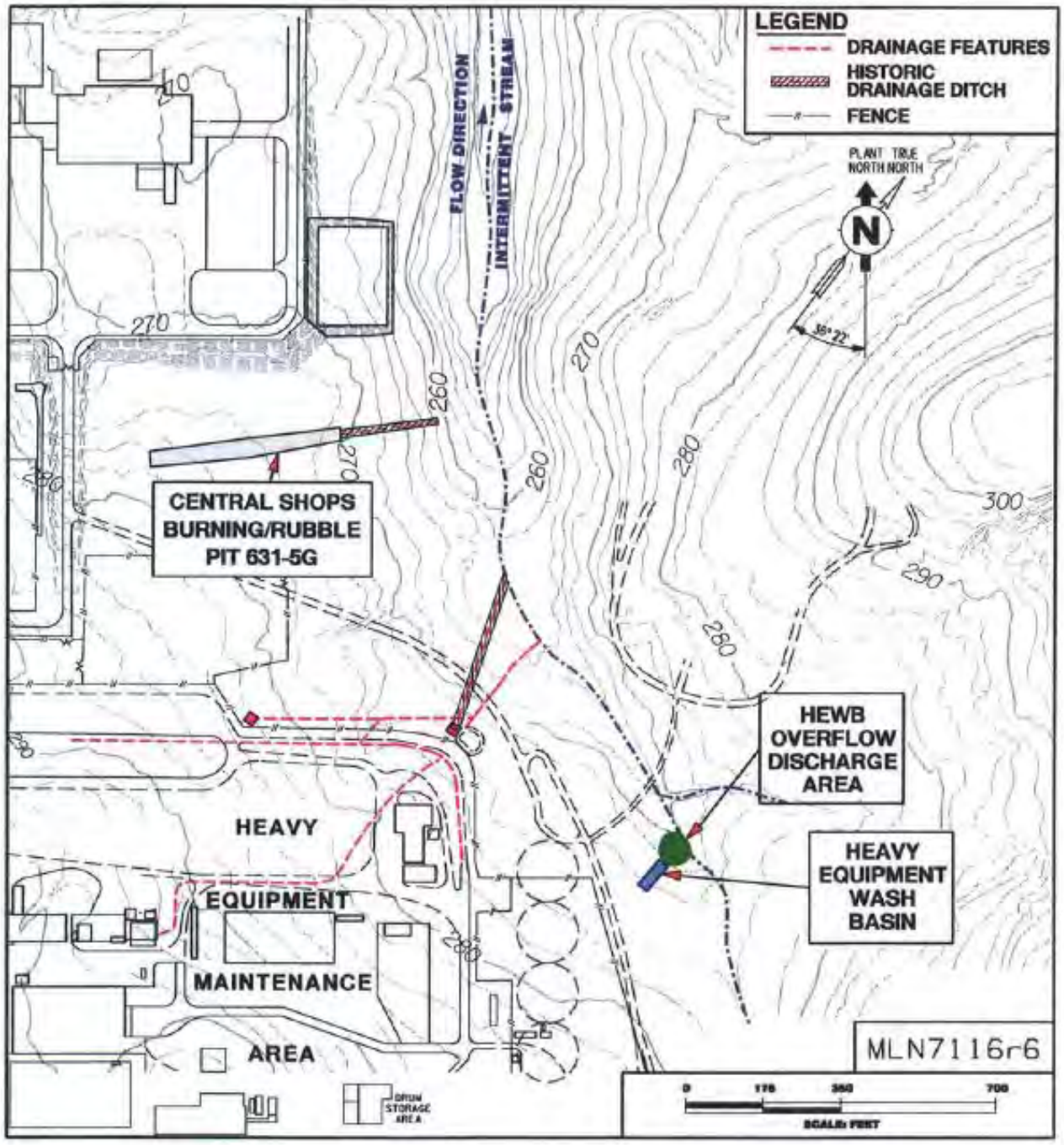


Figure AA-2 Layout of the Heavy Equipment Wash Basin and Central Shops Burning Rubble Pit Operable Unit



Figure AA-3. Aerial Photo of the HEWB/CSBRP-5G OU in Operation in 1951



Figure AA-4. Current Photos of the CSBRP-5G



Figure AA-5. Current Photos of the HEWB Boundary Sign (top) and Basin (bottom)

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Table AA-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	September 1998 / October 3, 2001
Record of Decision (ROD) issuance	January 7, 2005
Remedial Action start/complete	February 22, 2005 / March 22, 2005
Previous Five-Year Review	February 4, 2009

Table AA-2. Refined COCs and RGs for HEWB Subunit Soil

Subunit	RCOC	RGO
HEWB	Benzo[a]pyrene	0.0519 mg/kg
	alpha-Chlordane	1.28 mg/kg
	gamma-Chlordane	1.28 mg/kg
	Heptachlor epoxide	0.0542 mg/kg
	p,p'-DDD	2.04 mg/kg
	p,p'-DDT	1.44 mg/kg

Table AA-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$6,600	$7,400	$3,800	$3,800	$3,200	$24,800
Total ROD Estimated Direct O&M Costs*	$17,000	$2,000	$2,000	$2,000	$2,000	$25,000

* The ROD (WSRC 2004) Table A-1 provides the annual estimated Direct O&M Costs. The unit cost for annual inspection and maintenance is $2000 each year and the five-year statutory review of $15,000 is included every 5 years.

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Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G)

I. SITE INFORMATION			
Site Name:	**Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G)**	**Date of Inspection:**	**05/31/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #13**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**83°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 5/31/2012 (Date)

Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for the Heavy Equipment Wash Basin*, ER-IDS-019-034._____

_____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(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: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Candice Freeman (Name) | Federal Project Director (Title) | 10/16/12 (Date) | 803-952-7085 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey markers 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 AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(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:_____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A
Remarks:

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident
Areal extent Depth
Remarks:

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent
☐ Ponding ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent
Remarks:

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☒ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment AA-1. Five-Year Review Site Inspection Checklist – Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is institutional controls until soils containing RCOCs no longer pose a threat under the residential (unrestricted) land use scenario. Selected remedies for the HEWB/CSBRP-5G OU are functioning as intended. There are no issues requiring corrective actions.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage and warning signs) and site controls (SRS Site Use and Site Clearance Programs which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the OU, the condition of the grass and vegetative cover and warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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K-AREA BINGHAM PUMP OUTAGE PIT (643-1G) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the K-Area Bingham Pump Outage Pit (643-1G) (KBPOP) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants and waste have been left in place at the KBPOP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the KBPOP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table BB-1 lists the chronology of site events for the KBPOP OU.

III. Background

KBPOP OU is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the KBPOP OU is soil.

Physical Characteristics

The KBPOP (643-1G) OU is located near the K-Reactor Area in the west-central portion of SRS (Figures BB-1 and BB-2). It is approximately 6.4 km (4 mi) east of the SRS boundary. The pit was formed by excavating trenches to an average depth of 3.9 m (13 ft), disposing of 2.7 m (9 ft) of debris, and then returning the unit to grade. The unit is approximately 120 m (400 ft) in length and 18 m (60 ft) in width.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996) residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* designates the KBPOP OU as being within an industrial

area (WSRC 1999). The future land use for the KBPOP OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The KBPOP was a burial pit that received waste debris generated by major modifications to primary and secondary reactor cooling systems in 1957 and 1958, including waste from the Bingham pumps primary system. The waste consisted of miscellaneous construction debris (pipes, cables, ladders, etc.). There were no pumps buried or liquid waste disposed of in the pit. Low-level radioactive debris generated by the repairs (less than 25 mR/hr with no detected alpha activity) was buried in the pit.

Initial Response

After the pit was filled to capacity in 1958, the debris was covered by 1.2-m (4-ft) of backfill. The cover material was placed at a time preceding the preparation of the formal CERCLA documentation and investigation.

Basis for Taking Action

The potential for unrestricted excavation and human exposure to buried debris with fixed radioactive contamination is the basis for taking action at the KBPOP OU**.** As a result of the data analysis and risk assessment presented in the Remedial Investigation/Baseline Risk Assessment (RI/BRA) for the KBPOP OU, cesium -137 was the only contaminant of concern (COC) for this OU. The maximum concentration detected in the surface soils at the KBPOP OU was 0.295 pCi/g. Because the cesium-137 concentrations were less than typical background concentrations due to global fallout, institutional controls were considered to be sufficient for remedial action.

Based on characterization and risk assessment information, the KBPOP OU does not impact the watershed. The results from the KBPOP OU sample analyses indicate that minor concentrations/activities of constituents in the soil have migrated from the pit into

the surrounding soil horizons; however, horizontal migration is limited to the boundaries of the pit, and vertical migration is limited to the upper clayey zones.

The geotechnical and geologic data indicate that a less permeable zone is present underneath the pit that will inhibit less mobile constituents from migrating vertically and potentially impacting the groundwater. Groundwater sampling results support that the KBPOP OU has not impacted the groundwater and that the metal constituents detected are naturally occurring.

A total of six groundwater samples were collected from the water table aquifer in the vicinity of the KBPOP. These include two background samples (KH1 and KH4), an additional upgradient sample (KH3), and three down- or side-gradient samples (KH2, KH5, and KH6) (Figure 2). Based on the conclusion of the KBPOP RI/BRA Report, there are no groundwater COCs and no soil contaminant migration COCs. Therefore, no groundwater remedial actions were required.

Table BB-2 presents the refined COCs (RCOCs) and remedial goals (RGs) for the future industrial worker based on a risk of $1x10^{-6}$.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 1998), the remedial action objectives (RAOs) for the KBPOP OU soils are as follows:

- Reduce risks to human health via external exposure to radiological constituents (i.e., cesium-137) in the soil; and
- Achieve RGs established for unit soil.

There were no RAOs required for ecological receptors or contaminant migration COCs.

As stated in the ROD, the selected remedial action at the KBPOP OU is as follows:

- Land Use Controls (LUCs) (access and deed restrictions/notifications) for soil; and

- No remedial action for groundwater was identified in the ROD because the RI/BRA concluded that KBPOP is not impacting groundwater.

Remedy Implementation

The implementation of the selected remedy included the following:

- Establishment of LUCs for 0.24 hectares (0.59 acres);
- Posting of warning signs at appropriate locations in sufficient numbers to be seen from any approach; and
- Establishment of a maintenance program for the 0.24-hectare (0.59-acre) native soil cover.

Figure BB-3 is a current photo (2012) of the KBPOP OU.

Systems Operations/Operation and Maintenance

There are no system operation requirements for KBPOP OU.

The following maintenance activities are being performed to maintain the soil cover as long as the waste remains a threat to human health or environment:

- Visual inspections are being performed semiannually for evidence of damage to the soil cover due to erosion or intrusion by burrowing animals. The inspection also addresses upkeep of the vegetative cover and the warning signs.
- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.
- LUCs (i.e., institutional controls) are being enforced to preclude unauthorized access or intrusive activities through the SRS Site/Use Site Clearance program and SRS site security.

Costs associated with the selected remedy for the KBPOP OU includes operation and maintenance (O&M) costs of LUCs. The ROD estimated O&M costs associated with the selected remedy are $320,000. This is a present worth cost, including 30 years of maintenance activities based on a 5% discount rate. After characterization and effectiveness of the remedy was evaluated, the actual O&M cost for the KBPOP was assessed. The total actual O&M costs from project support and other post construction expense to fiscal year 2011 is $149,000. Table BB-3 compares the actual O&M costs over the last five years to the estimated costs from the ROD. The O&M costs are reasonable as compared to other SRS waste unit O&M costs related to site inspections.

V. Progress Since Last Review

The previous protectiveness statement from the last Five-Year Review concluded that because the remedial actions at KBPOP OU are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through 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 documents listed in Section XII, Documents Reviewed;
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklists provided in Attachment BB-1 with the purpose of assessing the protectiveness of the remedy and functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the KBPOP OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The KBPOP OU was inspected by SRNS and USDOE SR personnel on August 1, 2012. No issues were identified for the KBPOP OU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No problems regarding the remedy of this OU as implemented were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The selected remedy KBPOP OU of maintaining the native soil cover and LUCs is effective in preventing human exposure to cesium-137 in the soil. The Land Use Control Implementation Plan for KBPOP OU is included in the Final Remediation Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 1998a). The site maintenance (i.e., repair of erosion damage, mowing, and warning signs) and site controls (SRS Site Use/Site Clearance Programs) currently implemented continue to maintain the integrity of the native soil cover. The semiannual site inspections do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk. Inspection forms between 2006 and 2012 indicate the frequent presence of active ant hill mounds, occasional growth of pine trees, or the presence of fallen pine branches from nearby trees, and one instance of a damaged sign. In each instance, a maintenance order was placed and the conditions were treated/repaired.
- There have been no changes in the physical conditions of the KBPOP OU that would affect the protectiveness of the remedy.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

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. As an opportunity for optimization, semi-annual inspections should be reduced to annual inspections, as discussed in Section IX, Recommendations and Follow-up Actions, and Table BB-4.

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

Table BB-4 presents the recommendations for the KBPOP OU.

X. Protectiveness Statement(s)

The remedy at the KBPOP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with LUCs to prevent exposure to or ingestion of contaminated soil. All threats to contaminated soil at the KBPOP OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the KBPOP OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 1997a. *Feasibility Study for the K-Area Bingham Pump Outage Pit (643-1G) Operable Unit*, WSRC-RP-96-831, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997b. *Remedial Investigation Report with Baseline Risk Assessment for the K-Area Bingham Pump Outage Pit (643-1G) (U)*, WSRC-RP-95-1555, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC 1998a. *Final Remediation Report for the K-Area Bingham Pump Outage Pit (643-1G) (U)*, WSRC-RP-98-4003, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998b. *Record of Decision Remedial Alternative Selection for the K-Area Bingham Pump Outage Pit (643-1G) (U)*, WSRC-RP-97-178, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999a. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2000. *Federal Facility Agreement Annual Progress Report for Fiscal Year 2000 (U)*, WSRC-RP-2000-4300, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006. *Background Soils Statistical Summary Report for the Savannah River Site*, ERD-EN-2005-0223, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist K-Area Bingham Pump Outage Pit (643-1G) (U)*, ER-IDS-019-004, Inspection period 2007 through 2011 (semiannually)

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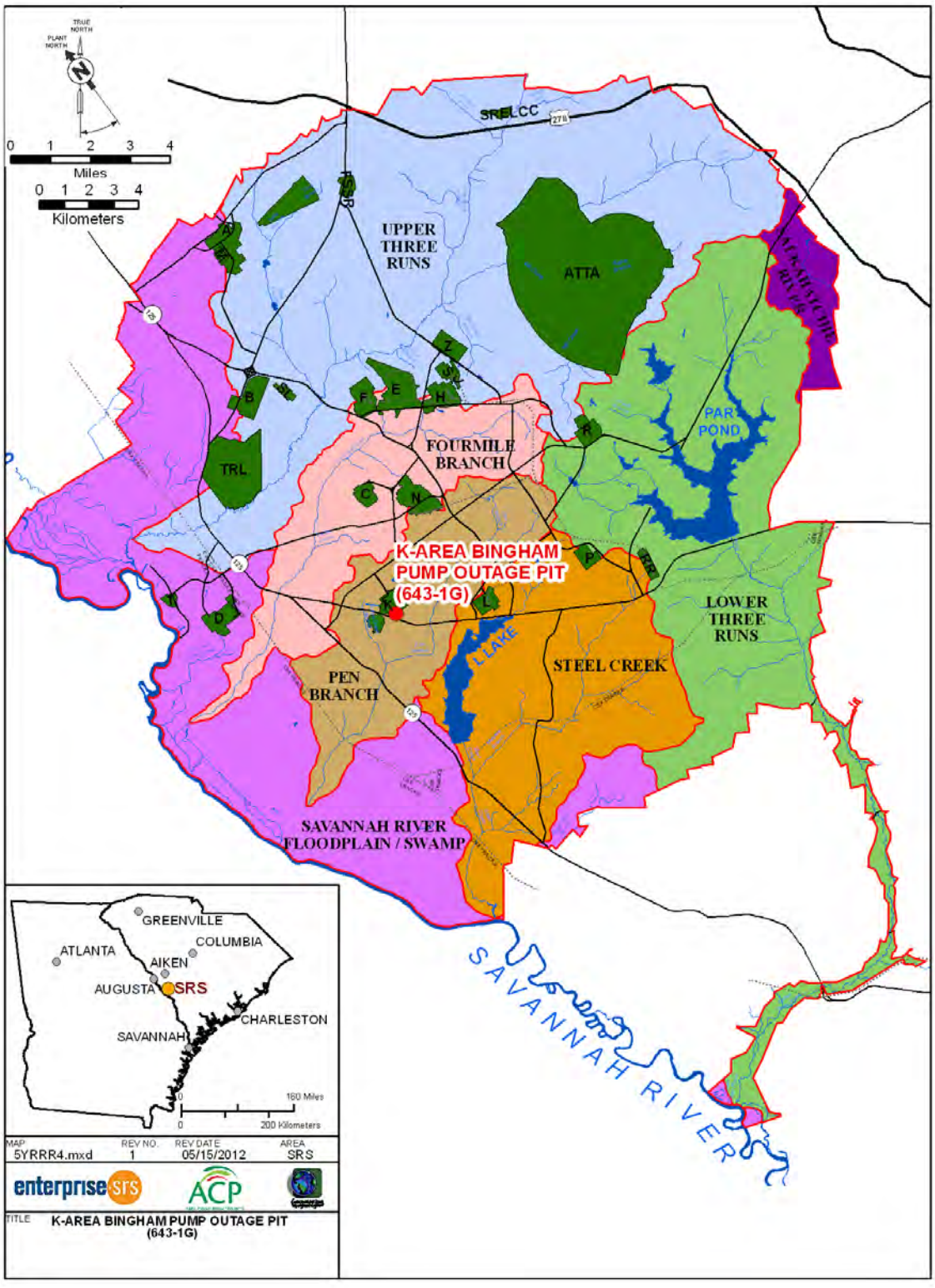


Figure BB-1. Location of the K-Area Bingham Pump Outage Pit (643-1G) OU at SRS

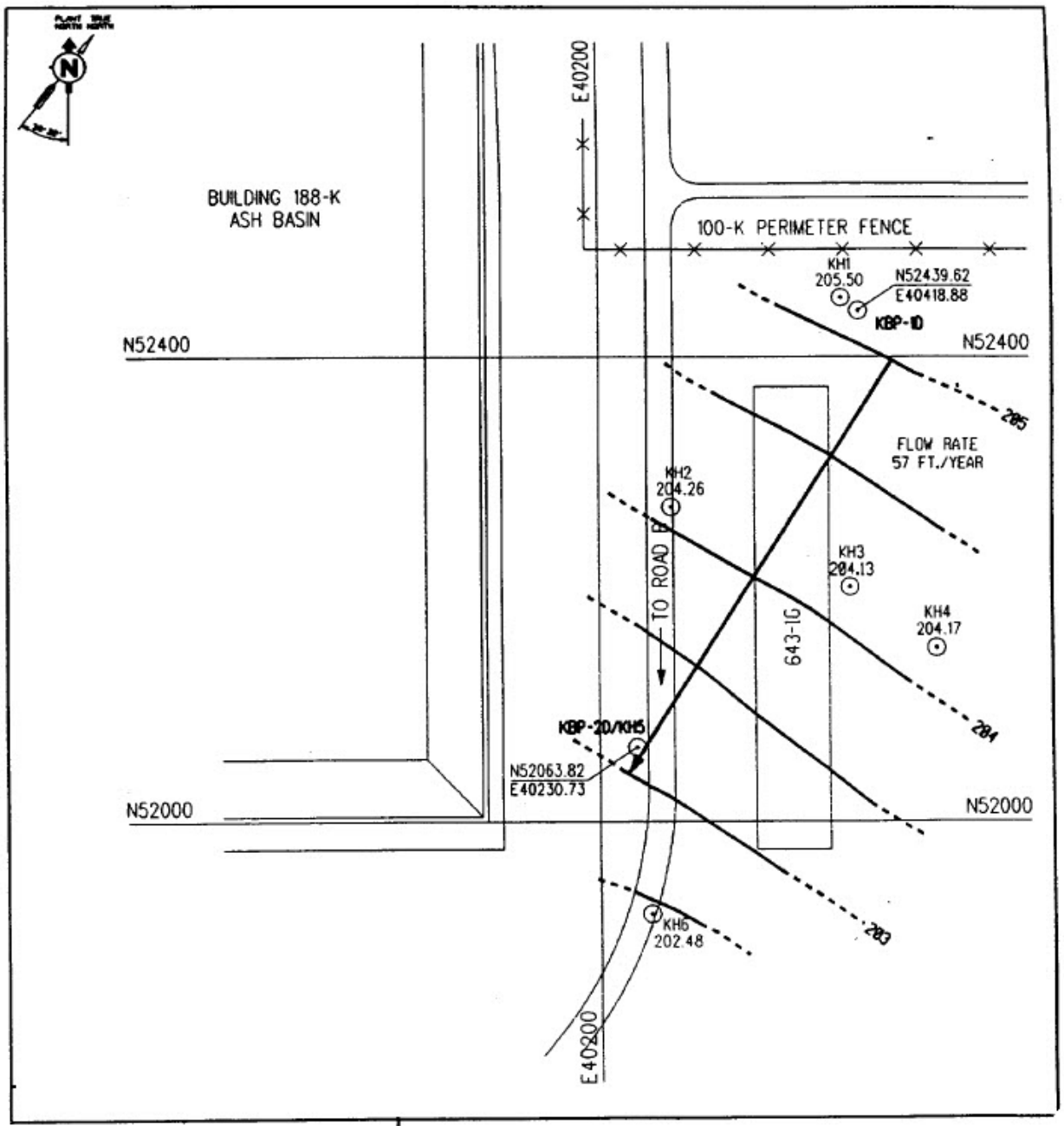


Figure BB-2. Location of Groundwater Samples at K-Area Bingham Pump Outage Pit (643-1G) Operable Unit



Figure BB-3. Layout of the K-Area Bingham Pump Outage Pit (643-1G) Operable Unit

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Table BB-1. Chronology of OU Events

Event	Date
Removal Action (Disposal Operation)	1957 - 1958
Remedial Investigation (RI) start / complete	January 1995 / June 19, 1997
Record of Decision (ROD) issuance	April 14, 1998
Previous Five-Year Reviews	February 12, 2004, February 4, 2009

Table BB-2. RCOC and RG for the Industrial Worker Scenario

RCOC	Medium	RG**	Max Detect in Surface Soil (0-0.3m [0-1 ft])	SRS Background*
Cesium-137	Soil	0.106 ρCi/g	0.295 pCi/g	0.339 pCi/g

*ERD-EN-2005-0223, Rev. 1 – Table B-1, 95% for 0.03 m (0-1 ft) soils
**Based on a target cancer risk of 1 x 10^{-6} for a future industrial worker

Table BB-3. Comparison of Actual vs. Estimated O&M

	FY07	FY08	FY09	FY10	FY11	5-Year Total
O&M Actual	$6,500	$7,300	$3,800	$3,700	$3,200	$24,500
Total ROD Estimated Direct O&M Costs*	$102,600	$2,600	$2,600	$2,600	$2,600	$113,000

*Source of estimate: The ROD (WSRC 1998b) provides a present worth of $40,000 for 30 years of site maintenance. Using a standard present worth formula, this present worth estimate was calculated to be equal to an annual cost of $2,600 based on 30 years of site maintenance and a 5% discount rate. Similarly the present worth for 6 five-year ROD reviews was given as $280,000 in the ROD (WSRC 1998b). A present worth analysis was used to convert this estimated total present worth cost into six unit costs of $100,000 for each of the five-year ROD reviews.

Table BB-4. Recommendations and Follow-up Actions for KBPOP OU

Issues	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Optimization of Inspection	Request change to the inspection frequency from semi-annual to annual via USDOE letter to the USEPA and SCDHEC within 45 days of final regulatory approval of the Fourth Five-Year Remedy Review Report. .	USDOE	USEPA/ SCDHEC	September 2014	N	N

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G)

I. SITE INFORMATION			
Site Name:	**K-Area Bingham Pump Outage Pits (643-1G)**	**Date of Inspection:**	**08/01/2012**
Location and Region	**SRS, USEPA Region 4**	**CERCLIS #:**	**#20**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Foggy 91°F**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for K-Area Bingham Pump Outage Pits*, ER-IDS-019-004. _____

_____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks:_____

B. Fencing

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs are in good condition._____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(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: semi-annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/09/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(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: _____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks: _____

2. Cracks: ☐ Location shown on site map ☐ Cracking not evident

Lengths _____ Widths _____ Depths _____

Remarks: _____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent _____ Depth _____

Remarks: _____

4. Holes: ☐ Location shown on site map ☐ Holes not evident

Areal extent _____ Depth _____

Remarks: _____

5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress

Areal extent _____ Depth _____

Remarks: _____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

C. Benches ☐ 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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks:_____

_____

2. Gas Monitoring Probes:

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks:_____

_____

3. Monitoring Wells:

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks:_____

_____

4. Leachate Extraction Wells:

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks:_____

_____

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A

Remarks:_____

_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ☐ Needs maintenance

Remarks:_____

_____

2. Gas Collection Wells, Manifolds, and Piping:

☐ Good condition ☐ Needs maintenance

Remarks:_____

_____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment BB-1. Five-Year Review Site Inspection Checklist – K-Area Bingham Pump Outage Pits (643-1G) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedial action for this unit is institutional controls. The institutional controls are in place and being implemented to provide access control and prevent exposures as intended by the decision documents.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of semi-annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining KBPOP and the condition of its warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. A request to reduce the inspection frequency from semi-annual to annual has been recommended as an opportunity for optimization.

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K-AREA BURNING/RUBBLE PIT (131-K) AND RUBBLE PILE (631-20G) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the K-Area Burning/Rubble Pit (131-K) (KBRP) / Rubble Pile (631-20G) (KRP) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants and waste have been left in place at the KBRP/KRP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the KBPOP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table CC-1 lists the chronology of site events for the KBRP/KRP OU.

III. Background

The KBRP/KRP OU is a Resource Conservation Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The KBRP/KRP OU consists of two soil waste units and groundwater beneath the OU.

Physical Characteristics

The KBRP/KRP OU is located approximately 9.4 km (5.9 mi) east of the nearest site boundary and 0.6 km (0.4 mi) east of the K-Reactor Area (Figure CC-1). Figure CC-2 shows the site layout of the KBRP/KRP OU. The KBRP was constructed in 1955-1956 as a shallow, unlined excavation measuring approximately 9 m (30 ft) wide, 72 m (240 ft) long, and approximately 2.4 m (8 ft) deep, for waste burning and burial.

The KRP, constructed sometime between 1956 and 1961, consists of a general disposal area, semicircular in shape, measuring approximately 90 m (300 ft) long and 15 to 40.5 m

(50 to 135 ft) wide. Individual rubble piles within the area were 1.2 to 1.8 m (4 to 6 ft) high. Total estimated waste volume is 2,142 m^3 (2,800 yd^3).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a) designates KBRP/KRP OU as being within an industrial area. The future land use for KBRP/KRP OU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

KBRP was constructed for the disposal of combustible wastes. During operation, organic liquids of unknown use and origin, waste oils, paper, plastics, and rubber were disposed of in the pit and burned periodically. Disposal records, including composition, origin, and use of materials disposed, were not kept for this unit during its period of operation. The use of the KBRP for disposal of combustible wastes was discontinued in 1973. Only inert rubble was placed in the pit until it was backfilled with soil to grade level in 1981. The primary contaminants detected in soil were polycyclic aromatic hydrocarbons (PAHs) formed by incomplete burning of organic materials.

The KRP was constructed as a general disposal area. KRP is composed primarily of soil matter, with some broken asphalt, broken concrete pieces, and gravel-sized coal. The coal and asphalt exist in a wide range of particle sizes and are dispersed in a highly heterogeneous manner throughout the individual rubble piles. Disposal records were not kept for this unit during its period of operation. The primary contaminants detected in soil at the KRP were PAHs and metals.

A volatile organic carbon (VOC) groundwater plume originated beneath the KBRP/KRP and has migrated southwestwardly from the KBRP/KRP OU. Tetrachloroethylene (PCE) and trichloroethylene (TCE) exceed maximum contaminant levels (MCLs) however, the VOC plume is not located near a surface water discharge. No source material is present

in the KBRP/KRP soils. There are no contaminant migration constituents of concern (CM COCs) for the KBRP/KRP soils that pose a risk to groundwater.

Figures CC-3 and CC-4 present photographs of KBRP/KRP OU before remediation (1974) and in current conditions (2012), respectively.

Initial Response

The KBRP was backfilled with soil to grade level in 1981 when the disposal capacity was reached.

Basis for Taking Action

The potential exposure to or ingestion of contaminated soil and groundwater poses a potential increased risk of cancer to human receptors and is the basis for taking action at the KBRP/KRP OU.

The RCRA Facility Investigation/Remedial Investigation (RFI/RI) collected soil samples within the KBRP and from soil within the KRP individual rubble piles and native soils beneath the piles (WSRC 1998). During unit screening, ground penetrating radar (GPR) surveys were performed to define the pit and pile boundaries to locate any buried objects in order to avoid drilling into buried material. No restriction to drilling was encountered.

Final human-health constituents of concern (COCs) were identified for the KBRP/KRP OU based on the results of the baseline risk assessment. PAHs are the predominant COCs in both KBRP and KRP soil. Arsenic was also identified as a COC for the KRP.

Groundwater immediately downgradient of KBRP was found to have PCE and TCE concentrations above MCLs. Groundwater and soil data indicate that the KBRP is no longer a source for groundwater contamination. This is based on the historical trends of analytical data in the adjacent monitoring wells and the results of the soil investigation. No CM COCs were identified for the surface units. The soil and groundwater COCs are listed in Table CC-2.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD), the remedial action objectives (RAOs) for the unit are as follows:

- Protect future industrial workers from unacceptable exposures to PAHs in soil at the KBRP/KRP and arsenic in soil at the KRP;
- Protect future industrial workers from unacceptable exposures to PCE and TCE in groundwater; and
- Prevent further degradation of groundwater and return it to levels below MCL to allow beneficial uses.

As stated in the ROD, the selected remedial actions for the unit are as follows:

- Soil cover over the KBRP/KRP;
- Institutional controls (i.e., LUCs); and
- Monitored natural attenuation (MNA) for the water table aquifer groundwater.

Because the source of groundwater contamination is depleted and no CM COCs were identified, no source control actions were required for the unit.

Remedy Implementation

The implementation of the selected remedy included the following activities:

- Consolidated 7,650 m^3 (10,000 yd^3) of contaminated soil (KRP soil from individual rubble piles), which was outside the planned cover area, into the KBRP. The soil removal area was expanded to include other rubble piles composed of gravel-size coal, rocks, and dirt that were discovered near the soil removal area. Confirmatory sampling verified no COCs remained in the soil removal area (WSRC 2002).
- Installed a 0.6 m (2-ft) thick minimum common fill soil cover over KBRP/KRP per South Carolina Regulation 61-107, 11, Part IV, Subtitle G using conventional and

commercially available earth-moving equipment. The soil cover system covers 0.3 hectares (0.8 acres) per the Post Construction Report (PCR) (WSRC 2002).

- Implemented LUCs for 0.47 hectares (1.15 acres) and posted warning signs at the perimeter of KBRP/KRP.
- Installed groundwater monitoring wells and established a long-term groundwater monitoring program for MNA to ensure maximum mixing zone concentration limits are not exceeded per the groundwater mixing zone application (GMZA) (WSRC 1999). The following changes listed below have been made to the monitoring network and sampling since the development of the GMZA. Changes have been documented within the various annual groundwater reports.
- Additional CPT data collected in 2002 indicated that the compliance boundary well KRP 7 would likely exceed the MCLs for PCE and TCE, and was not suitable as a compliance boundary well. The KRP cluster (KRP 14D and KRP 14C) was proposed and accepted as new compliance boundary wells installed further downgradient of KRP 7.
- Later in 2002, PCE and TCE exceeded MCLs in one well (KRP 14D), a compliance boundary well. Since the number of exceedances was small; the USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) directed SRS to do a moderate corrective action plan. The plan included continued quarterly sampling in the Mixing Zone network and the installation of the KRP 15 well cluster (WSRC 2003).
- In 2004, it was again reported that well KRP 14D exceeded the MCL for TCE. The core team agreed that it would not be feasible to pursue the contamination beyond KRP 14 because the plume was migrating toward the congested subsurface of the K-Reactor facility and could merge with the additional uncharacterized plumes associated with K Area. Per USEPA, SCDHEC and USDOE agreement, the KRP 14 cluster (KRP 14D and KRP 14C) were removed from the monitoring network. It was further agreed that the GMZA would not be modified, no additional modeling was

needed, and no additional monitoring wells needed to be installed. Well KRP 7 was designated as the new compliance boundary well.

- In 2006, the USEPA, SCDHEC and USDOE agreed that due to steady or declining concentration trends, and compliance boundary wells being considerably below MCLs, the sampling frequency at KBRP/KRP was reduced to semiannually from quarterly. It was also approved to reduce the analytical list from all of the Method 8260 analytes to only PCE, TCE, and their daughter products (vinyl chloride, 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene).

System Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs);
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit); and
- Sampling of the GMZA monitoring wells. MNA monitoring program verifies the natural decrease of contaminant concentrations in the groundwater to levels below MCLs for PCE and TCE. Sampling will continue until MCLs have been attained, the MNA has achieved its RAOs, and the remedial action is complete. The results were reported via annual EMRs since 2003. Starting in 2008, the monitoring results for KBRP/KRP OU were combined with the LBRP/LRP OU and PBRP OU monitoring reports into a single abbreviated annual groundwater data summary, with full detailed reports every five years (WSRC 2008). The first five-year detailed report was submitted in June 2012 (SRNS 2012). The MNA remedy was expected to reduce groundwater concentrations to below MCLs by 2005 due to the processes of advection and dispersion (WSRC 1999c). However, contamination still exists above MCLs, but core concentrations continue to decline and a GMZ is still reasonable for monitoring.

The operation and maintenance (O&M) costs associated with the selected remedy for KBRP/KRP include the soil cover, groundwater mixing zone monitoring, and institutional controls. The ROD estimated a present worth cost of $345,390, which was discounted at 5% for 30 years of maintenance activities. The actual (O&M) cost since the remedial action was completed in FY04 until FY11 is $570,000. The actual O&M costs (Table CC-3) are higher than expected because groundwater monitoring and reporting have continued longer than expected and therefore, are higher than the ROD estimate.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedy of a soil cover over the KBRP/ KRP with institutional controls and MNA for the groundwater at the KBRP/KRP is protective of human health and the environment.

Since the previous review in 2007, an agreement with the USEPA, SCDHEC, and USDOE was reached in 2008 to combine the reports for KBRP/KRP, LBRP/LRP, and PBRP into an annual groundwater monitoring data summary letter with a detailed groundwater report every fifth year beginning June 30, 2012 (WSRC 2008).

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;
- Reviewed the groundwater monitoring data (Table CC-4);
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment CC-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and

- Reviewed changes in standards and to-be-considered guidance.

Data Review

Annual groundwater reports or data summaries have been submitted for the KBRP/KRP OU since 2003 and were thoroughly reviewed for this Five-Year Remedy Review. The latest 2012 report includes time-series plots of PCE and TCE at each station, a plume map, and a comprehensive review of the monitoring activities and monitoring results (SRNS 2012).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the KBRP/KRP OU, and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The KBRP/KRP OU was inspected by SRNS and USDOE personnel on August 1, 2012. No issues were identified for the KBRP/KRP OU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The soil cover continues to protect present and future industrial workers from unacceptable exposures to PAHs in soil at the KBRP/KRP, and arsenic in soil at the KRP;
- LUCs (including institutional controls) are continuing to prevent human exposure to contaminated soils and groundwater; and
- The MNA program and monitoring well network provides sufficient data to assess the progress of natural attenuation within the groundwater. MNA is preventing further

degradation of groundwater and is returning it to levels below MCLs. Core plume contaminant levels, as seen in well KRP 9, have been decreasing over the past four years (Figure CC-5). Groundwater contamination has persisted longer than originally expected due to reductions in dispersion and groundwater recharge, as well as possible increases in the sorption of contaminants. The VOC plume has not increased in areal size or migrated below the uppermost aquifer zone. Based on the annual monitoring reporting, the requirements of the Mixing Zone are being satisfied. All groundwater monitoring results are well below mixing zone contaminant levels (MZCLs) as shown in Table CC-4.

The above remedial activities are meeting the RAOs established for the KBRP/KRP OU as discussed in Section IV, by eliminating or controlling all routes of exposure to possible industrial workers. The Land Use Control Implementation Plan for KBRP/KRP OU is located in Appendix D of the PCR and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2002).

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. The MCLs for PCE and TCE have remained the same since the remedies were implemented. There have been no changes in standards or physical conditions of the KBRP/KRP OU that would affect the protectiveness of the remedy.

Due to the presence of chlorinated solvents at the site, there is a potential that 1,4-dioxane may also exist because it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. The presence of 1,4-dioxane is not likely to change the protectiveness of the remedial action that includes LUCs (at a minimum) which consequently renders the exposure pathway to human receptors incomplete. An evaluation of the effectiveness of the remedy is premature until such time that a formal MCL is established.

SRS has performed a historical review of groundwater data at the KBRP/KRP OU. 1,4-Dioxane has only been analyzed twice throughout its history. Both samples were collected in 2006 and were non-detect. The 4Q2013 sampling at KBRP/KRP OU will include the analysis of 1,4-dioxane. The 1,4-dioxane results will be reported and discussed in the subsequent annual Groundwater Monitoring Data Summary that will be submitted in June 2014, as well as summarized in the next Five-Year Remedy Review. Based on the results, the USEPA, SCDHEC and USDOE will decide whether 1,4-dioxane should be permanently added to the list of monitored constituents.

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

Issues related to the KBRP/KRP OU are presented in Table CC-5.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions for the KBRP/KRP OU are presented in Table CC-6.

X. Protectiveness Statement(s)

The remedy at KBRP/KRP OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to contaminated soil at the KBRP/KRP OU have been addressed through implementation of the soil cover, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative

controls that maintain the KBRP/KRP OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2012. *K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G)(KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-3L, and 131-2L)(LBRP), and P-Area Burning/Rubble Pit (131-P)(PBRP) Operable Units (OUs) Detailed Combined Groundwater Monitoring Report (U)*, SRNS-RP-2012-00200, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1998. *RCRA Facility Investigation/Remedial Investigation Report with the Baseline Risk Assessment for the K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-97-442, Revision 1.2, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken SC

WSRC, 1999a. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1999b. *Groundwater Mixing Zone Application for the K-Area Burning/Rubble Pit and Rubble Pile*, WSRC-RP-98-4084, Revision 1.1, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken, SC

WSRC, 1999c. *Groundwater Flow and Solute Transport Modeling Report for the K-Area Burning/Rubble Pit and Rubble Pile*, WSRC-RP-98-5052, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000. *Record of Decision Remedial Alternative Selection for the K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-97-862, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2002. *Post-Construction Report (PCR) for the K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit (U)*, WSRC-RP-2002-4095, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Comparison of Groundwater Monitoring Data with Modeling Predictions for the K-Area Burning/Rubble Pit and Rubble Pile Groundwater Contamination and Plan for Corrective Action (U)*, WSRC-RP-2002-4185, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Proposal to Standardize Sampling and Reporting Requirements of Groundwater Data for P, L, and K Area Burning/Rubble Pit Operable Units*, ACP-08-133, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist K-Area Burning Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) (U)*, ER-IDS-019-015, Inspection period 2007 through 2011 (semiannually)

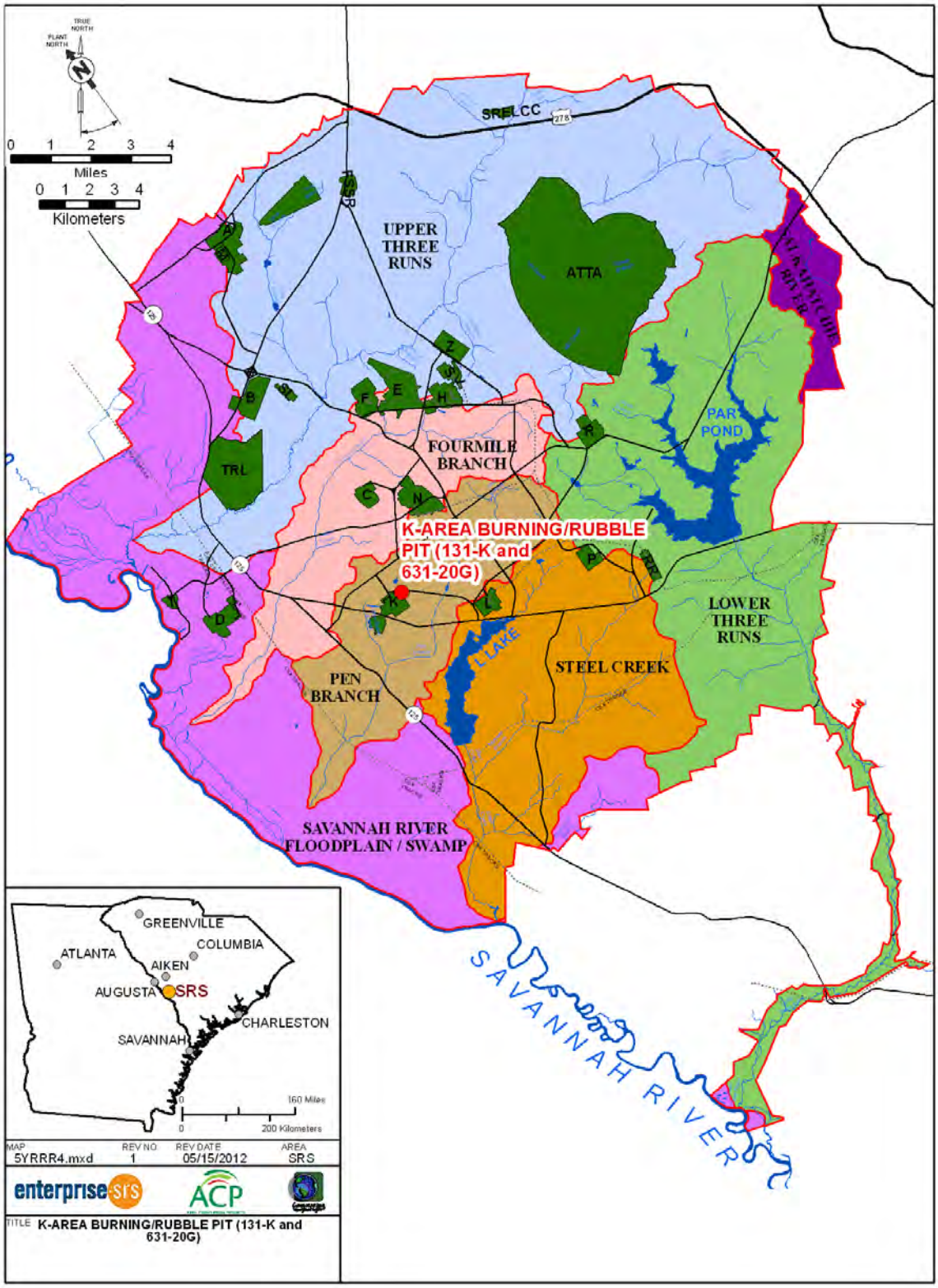


Figure CC-1. Location of the K-Area Burning/Rubble Pit (131-K) OU at Savannah River Site

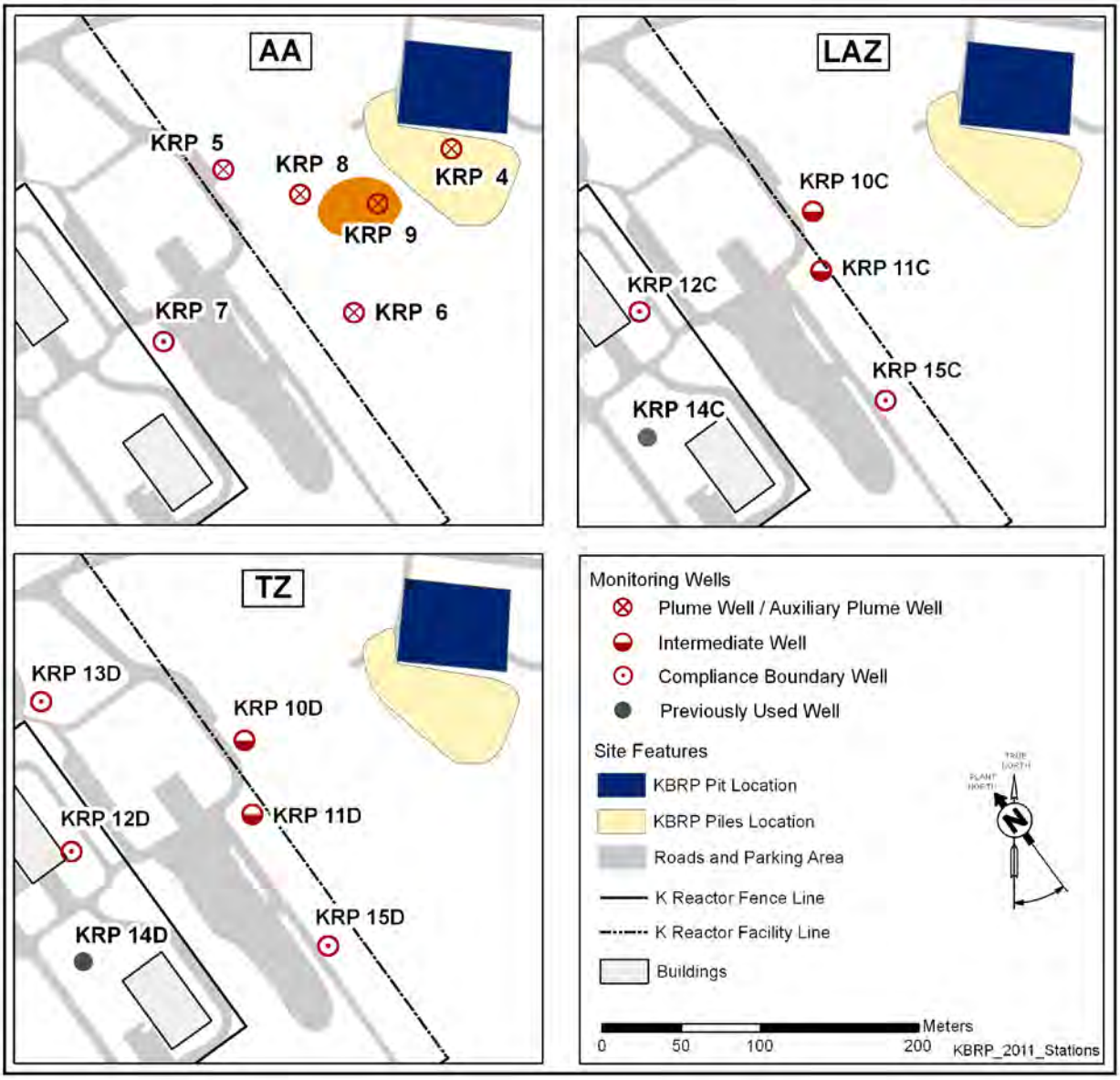


Figure CC-2. Site Layout of KBRP and Well Locations



Figure CC-3. Photo of KBRP/KRP Before Remediation Activities



Figure CC-4. Current Photo of the KBRP/KRP (2012)

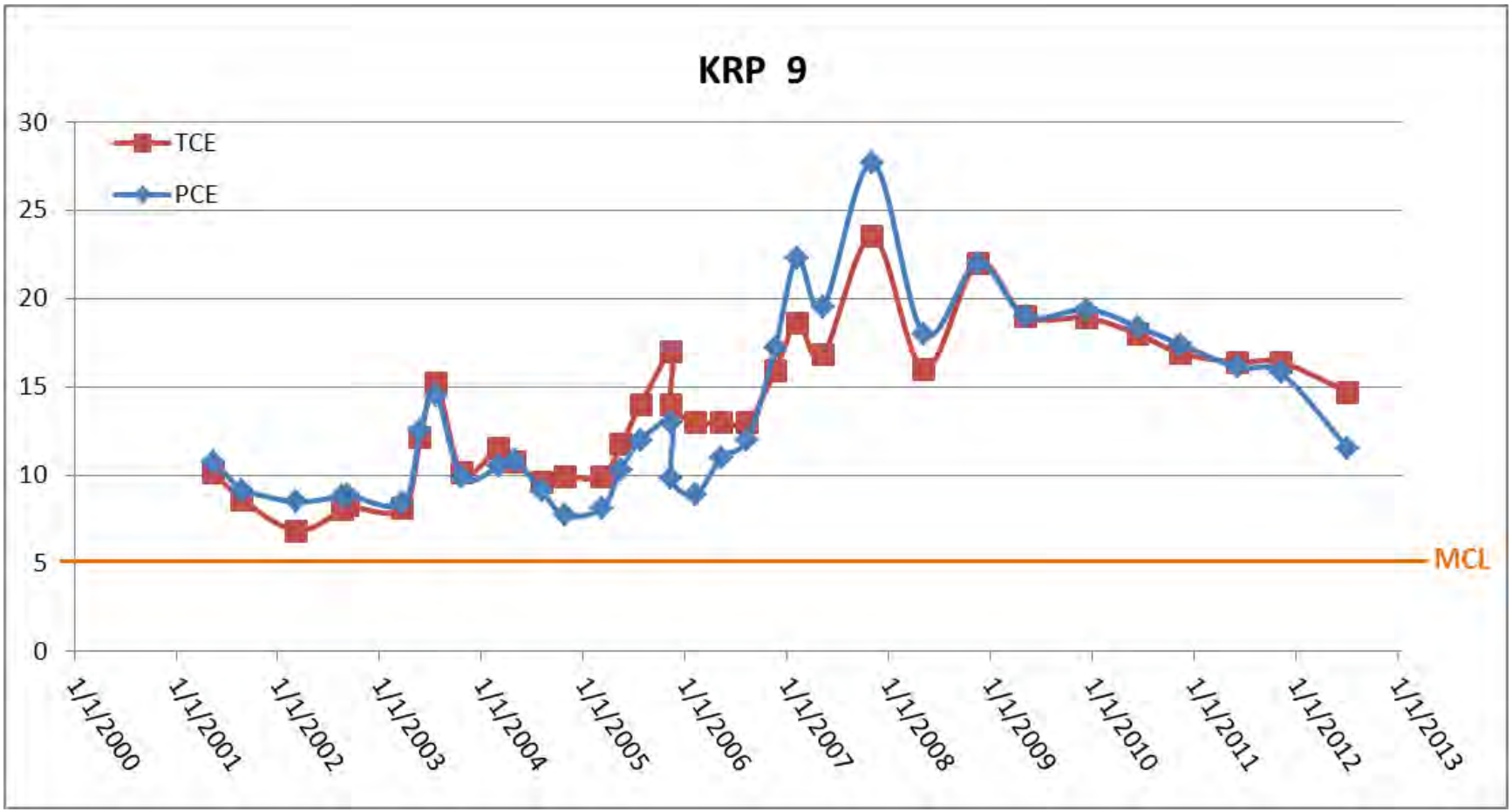


Figure CC-5. PCE and TCE Time-Trend Plot at Well KRP 9

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Table CC-1. Chronology of Events

Event	Date
RFI/RI start/complete	1996/December 1998
Record of Decision (ROD) issuance	August 20, 2001
Remedial Action (RA) start/complete	October 8, 2001/March 27, 2002
Previous Five-Year Reviews	February 12, 2004, February 4, 2009

Table CC-2. Constituents of Concern, Risks to Future Industrial Workers, and Remedial Goals for KBRP and KRP OU

Medium	COCs	Basis/Receptor	Baseline Risk	Remedial Goals (for 10^{-6} or HQ=0.1)
KBRP Soil	Benzo[a]anthracene	Future Industrial Worker	$3.70 \times 10^{-5*}$	6.24 mg/kg[a]
	Benzo[a]pyrene		$3.70 \times 10^{-4*}$	0.624 mg/kg[a]
	Benzo[b]fluoranthene		$5.00 \times 10^{-5*}$	6.24 mg/kg[a]
	Benzo[k]fluoranthene		$2.50 \times 10^{-6*}$	62.4 mg/kg[a]
	Dibenzo[a,h]anthracene		$5.40 \times 10^{-5*}$	0.624 mg/kg[a]
	Indeno[1,2,3-c,d]pyrene		$2.14 \times 10^{-5*}$	6.24 mg/kg[a]
KRP Soil	Benzo[a]anthracene	Future Industrial Worker	$1.81 \times 10^{-5*}$	6.24 mg/kg[a]
	Benzo[a]pyrene		$1.45 \times 10^{-4*}$	0.624 mg/kg[a]
	Benzo[b]fluoranthene		$2.30 \times 10^{-5*}$	6.24 mg/kg[a]
	Indeno[1,2,3-c,d]pyrene		$8.70 \times 10^{-6*}$	6.24 mg/kg[a]
	Arsenic		$3.35 \times 10^{-5*}$	7.96 mg/kg[c]
KBRP and KRP OU Water Table Aquifer	Tetrachloroethylene (PCE)	Future Industrial Worker and Exceedance of MCL	$1.6 \times 10^{-6**}$	5.0 µg/L[b]
	Trichloroethylene (TCE)		$1.10 \times 10^{-7**}$	5.0 µg/L[b]

Chrysene, fluoranthene, and pyrene are residential COCs, and exist at the KBRP/KRP OU at concentrations less than future industrial worker exposure concentrations.

* Combines ingestion, inhalation, and dermal contact based on potential exposure to soil in the 0- to 1-foot interval.

** Risk based on potential exposure (ingestion) of groundwater.

a The remedial goal is based on the 1x10-6 target cancer risk to the hypothetical, future, industrial worker.

b The remedial goal is based on the Water Quality Protection of Human Health as established by South Carolina Regulation 61-68 of the Pollution Control Act.

c The remedial goal is based on two times the mean concentration of arsenic in background soil at the KBRP and KRP.

HQ = hazard quotient

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

Table CC-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	42,400	47,900	45,700	41,500	42,900	220,500
Total ROD Estimated Direct O&M Costs	16,212	2,900	2,900	2,900	2,900	27,812

Table CC-4. Groundwater Monitoring Results Compared to MZCLs and MCLs

STATION ID	PCE		TCE	
	2Q12 Result	MZCL*/MCL	2Q12 Result	MZCL*/MCL
KRP 4	ND	43*/5	ND	61*/5
KRP 5	ND	43*/5	ND	61*/5
KRP 6	ND	43*/5	ND	61*/5
KRP 7	ND	5	ND	5
KRP 8	4.92	43*/5	3.94	61*/5
KRP 9	11.5	43*/5	14.7	61*/5
KRP 10C	ND	5	ND	5
KRP 10D	ND	5	ND	5
KRP 11C	ND	5	ND	5
KRP 11D	ND	5	ND	5
KRP 12C	ND	5	ND	5
KRP 12D	ND	5	ND	5
KRP 13D	ND	5	ND	5
KRP 15C	ND	5	ND	5
KRP 15D	ND	5	ND	5

MZCL*=Mixing Zone Contaminant Level; MCL= Maximum Contaminant Level; ND= Non-detect

Table CC-5. Issues Identified for KBRP/KRP OU

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1,4-Dioxane has been identified as being a potential contaminant at KBRP/KRP OU based on its possible association with other solvents that are present at KBRP/KRP OU. However, there is a lack of groundwater data to dismiss 1,4-dioxane as being present at levels which would be harmful to human health or the environment.	N	N

Table CC-6. Recommendations and Follow-up Actions for KBRP/KRP OU

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date*	Affects Protectiveness? (Y/N)	
					Current	Future
1,4-Dioxane has not been monitored recently in the KBRP/KRP OU wells.	1,4-Dioxane will be monitored in all of the KBRP/KRP OU wells during the 4Q13 sampling event. The data results will be presented in the subsequent annual Groundwater Monitoring Data Summary letter that will be submitted in June 2014, as well as in the next Five-Year Review. Based on the results, the Core Team will decide whether or not 1,4-dioxane will need to be permanently added to the list of monitored constituents.	USDOE	SCDHEC/ USEPA	June 2014	N	N

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit

I. SITE INFORMATION			
Site Name:	**K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit**	**Date of Inspection:**	**08/01/2012**
Location and Region	**SRS, USEPA Region 4**	**CERCLIS #:**	**#40**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Foggy 90°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other MNA

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for K-Area Burning Rubble Pit (131-K) and Rubble Piles (631-20G)*, ER-IDS-019-015._____

_____

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs and monuments were in good condition. _____

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/09/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks: Vegetation is mowed routinely.

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A
Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident
Areal extent Depth
Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent
☐ Ponding ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent
Remarks:

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☒ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☒ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:** ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☒ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Remarks: _____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident

Areal extent _____ Depth _____

Remarks: _____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A

☐ Vegetation does not impede flow

Areal extent _____ Type _____

Remarks: _____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent _____ Depth _____

Remarks: _____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks: _____

2. Performance Monitoring:

Type of Monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching Head Differential _____

Remarks: _____

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

Attachment CC-1. Five-Year Review Site Inspection Checklist – K-Area Burning/Rubble Pit (131-K) and K-Area Rubble Pile (631-20G) Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is installation of a soil cover over KBRP and KRP with institutional controls and Monitored Natural Attenuation for the water table aquifer groundwater. The remedy seems to be fully established and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Institutional controls will maintain future industrial use through implementation of a LUCIP and include: (1) physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.); (2) administration controls that maintain this site for industrial use only (SRS is a secured government facility with land use restrictions); and (3) warning signs and land use controls (SRS Site Use/Site Clearance Program).
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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K-AREA REACTOR SEEPAGE BASIN OPERABLE UNIT

I. Introduction

This report is the second five-year review for the K-Area Reactor Seepage Basin (904-65G) (KRSB) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the KRSB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the KRSB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table DD-1 lists the chronology of site events for the KRSB OU.

III. Background

KRSB OU is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS). The media associated with this OU is soil.

Physical Characteristics

The KRSB OU is located in the south-central portion of the Savannah River Site (SRS) in K-Area (Figure DD-1). The OU is adjacent to a major electrical transmission line right-of-way and is approximately 120 m (400 ft) west of the K-Reactor (105-K). The basin dimensions are approximately 40.5 m x 21 m (135 ft x 70 ft) with an average depth of 2.1 m (7 ft) below ground surface (bgs).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a) designates KRSB OU as being within

an industrial area. The future land use for KRSB OU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The KRSB was constructed in 1957 to receive low-level radioactive wastewater from disassembly basin purges from K-Reactor (105-K). Figure DD-2 shows the site layout of the KRSB OU. From 1957 until 1969, the KRSB received low-level radioactive purge water from the K-Area Disassembly Basin via a 180-m (600-ft) long, 7.5-cm (3-in) diameter polyethylene pipe buried approximately 0.6 to 1.2 m (2 to 4 ft) bgs. After the basin was taken out of service, the basin was left open and was not backfilled to grade.

Initial Response

During the primary source investigation at the KRSB in 1996, a break in the pipeline that supplied wastewater to the basin during its operation was detected. Contaminated soil above and below this line break was excavated and disposed. The ends of the pipe where the break was observed were capped. No other initial response actions were taken. The characterization of the basin and pipeline proceeded.

Basis for Taking Action

The potential for human exposure to radiologically contaminated soils in the KRSB resulting in a future industrial worker risk of greater than $1x10^{-6}$ and the potential for soil contaminants to leach into the groundwater was the basis for taking action at the KRSB.

In 1995, characterization activities were conducted under the *Phase II Remedial Investigation Work Plan for the K-Area Reactor Seepage Basin* (WSRC 1994). A Remedial Investigation Report and Baseline Risk Assessment (RI/BRA) (WSRC 1998) was prepared and approved in 1998. These studies indicate that the seepage basin, process sewer line, and soil adjacent to the process sewer line present a potential hazard to future industrial workers and residents, and that remediation of the KRSB OU was warranted. Five radionuclides were identified as human health constituents of concern (COCs) in the 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 COCs (CMCOCs) as these contaminants will leach to groundwater and exceed 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 DD-2.

Tritium, gross alpha, and total radium were detected in groundwater near the KRSB OU at concentrations above maximum contaminant levels (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 $1x10^{-3}$.

In lieu of Proposed Plan and ROD documents, an Explanation of Significant Difference (ESD) document was submitted and was approved in September 2002 (WSRC 2002). 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 $1x10^{-6}$ for carcinogens and a hazard quotient of 1 for noncarcinogens or background (where background levels of COCs exceed $1x10^{-6}$).
- 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 membrane 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 to prevent disturbance of the cover system and prohibit residential or agricultural use of the area.

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 $1x10^{-5}$ cm/sec 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).

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., the warning signs, fence).

- 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).

The operation and maintenance (O&M) costs associated with the selected remedy for KRSB OU include O&M costs of the soil cover and institutional controls and has an estimated present worth of $458,813, discounted at 3.9% per year for 30 years of maintenance activities. The actual O&M cost since the completion of the soil cover in 2003 until FY2011 is $155,200. Table DD-3 compares the actual O&M costs over the last five years to the estimated costs from the ROD.

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. There were no recommendations or follow-up actions from the last 5-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 DD-1; and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the KRSB OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The KRSB OU was inspected by SRNS and USDOE personnel on August 1, 2012. No issues were identified for the KRSB OU during this inspection and interviews.

On January 16, 2013, a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. During the site inspection, it was noted that there is no current groundwater monitoring associated with the KRSB OU to monitor for residual CMCOCs. Additional information was requested to explain why groundwater monitoring was not required.

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. The document included calculations demonstrating that the low-permeability cover would prevent impact to groundwater for at least 1,000 years. As part of the remedy implementation, the four existing wells adjacent to the basin (KRSB-1, -2, -3, and -4A) were abandoned, as documented in the KRSB Post-Construction Report/Final Remediation Report (WSRC 2002).

The groundwater associated with K-Area OU will be addressed in accordance with the Federal Facility Agreement (FFA). A core team meeting will be scheduled to discuss current groundwater conditions at K-Area and discuss what activities should be undertaken prior to the current FFA field start of 2034.

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 (PCR) 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 CMCOCs (strontium-90 and carbon-14) and mitigating infiltration through the contaminated media. Results from the cores collected after grouting are reported in the PCR 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. Inspection records from the last five years indicate only one instance (in 2009) where some minor damage due to erosion was noted. A work order to repair this damage was issued and implemented. Anthills have been

noted on most inspection reports, and are treated upon discovery. No other evidence of burrowing animals was noted during inspections.

- A review of the PCR 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.

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. 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.

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 land use controls. Land use controls 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 co-mingled 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

The next five-year review is scheduled for no later than January 2019.

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, March 2013, 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 2007 through 2011 (annually)

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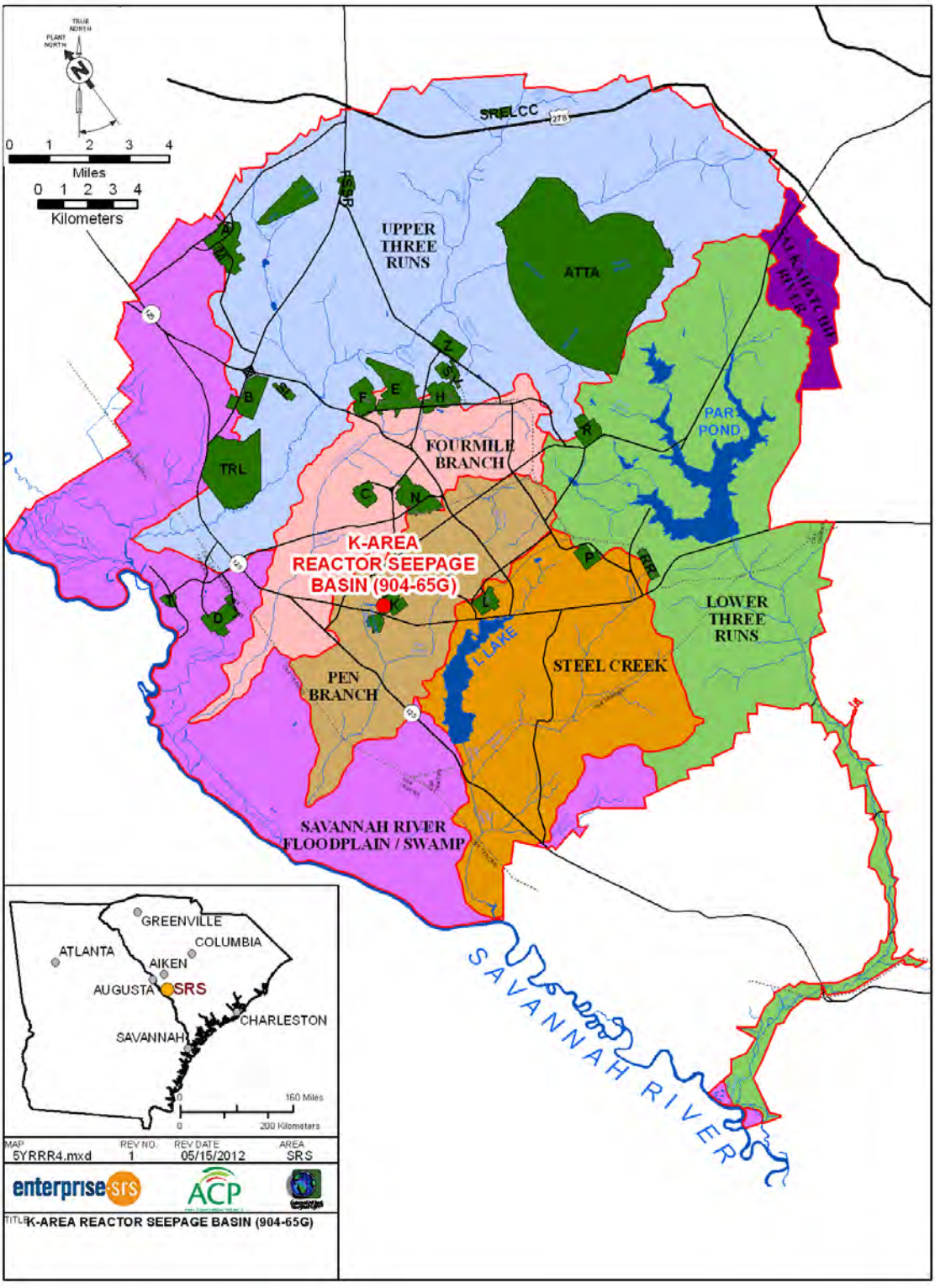


Figure DD-1. Map of SRS Showing the Location of K-Area Reactor Seepage Basin OU at SRS

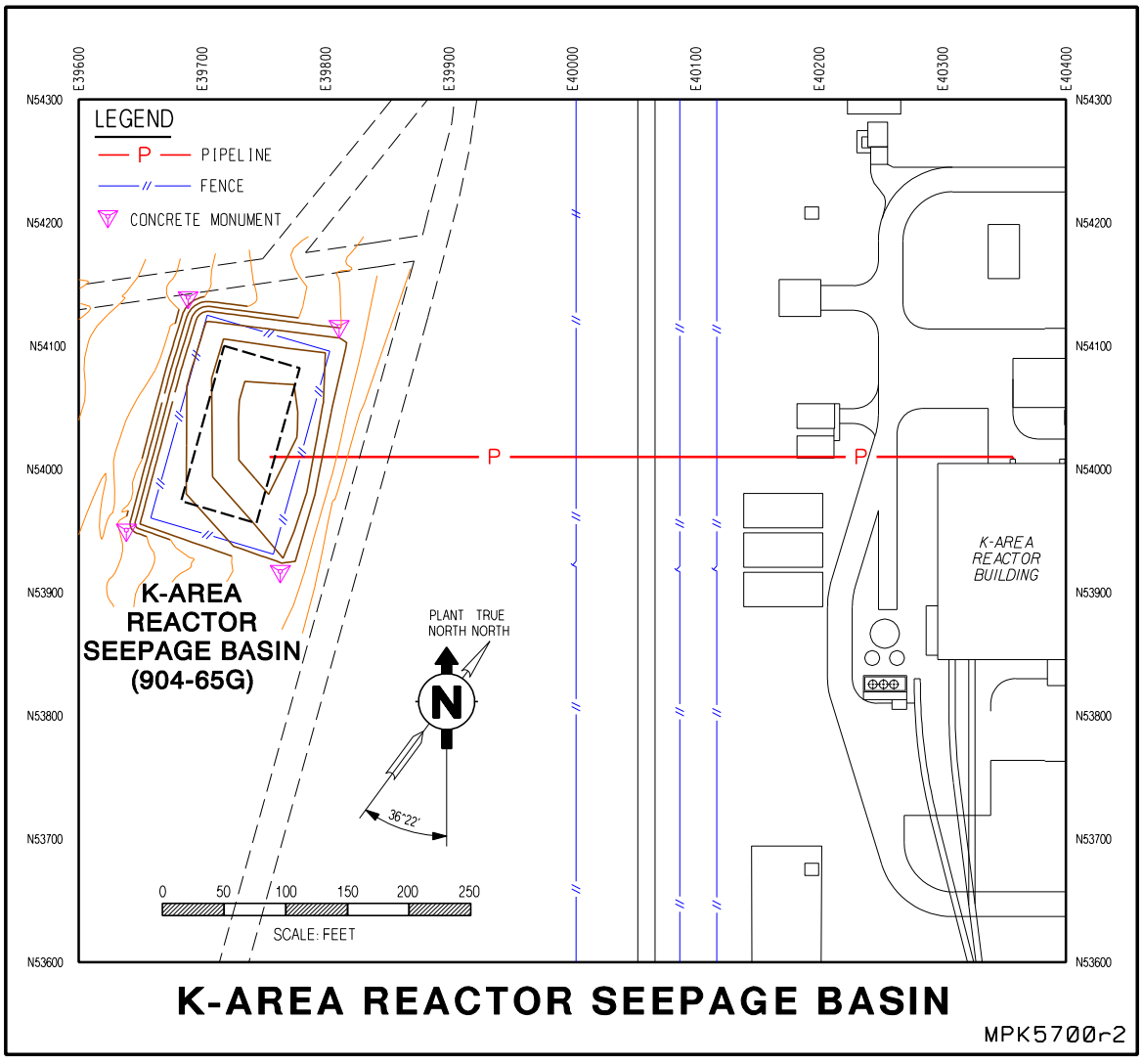


Figure DD-2. Site Layout for K-Area Reactor Seepage Basin



Figure DD-3. Before and During Remedial Action



Figure DD-4. Current Photo After Remedial Action

Table DD-1. Chronology of OU Events

Event	Date
RI Start/Finish	July 1995/May 27, 1998
Plug-in ROD	November 29, 1999
Explanation of Significant Difference (ESD)	September 16, 2002
Remedial Action (RA) Start/Complete	September 29, 2000/ September 3, 2002
Previous Five-year Review	February 4, 2009

Table DD-2. COCs and Remedial Goals in KRSB OU Soils

COC	Type of COC	Remedial Goals ρCi/g
Americium-241	HH*	6.5
Carbon-14	CM	0.31
Cesium-137	HH	0.105
Cobalt-60	HH	0.0224
Plutonium-239/240	HH	8.25
Strontium-90	HH, CM	28.5 (CM RGO)

HH Human Health, *Industrial Worker 1.0E-06 Risk (Table 7-7 from WSRC-RP-96-871)
CM Contaminant Migration (Table 7-2 from WSRC-RP-96-871)

Table DD-3. Comparison of Actual vs. Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	Total for last 5 years
O&M Actual	$6,600	$7,500	$3,900	$3,900	$3,300	$25,200
Total ROD Estimated Direct O&M Costs*	$30,300	$15,300	$15,300	$15,300	$15,300	$91,500

*Source of estimate: Table 8, page 64 of the ROD (WSRC 199b) provides an estimated present worth for direct O&M costs of $458,813. Because this estimate was not itemized, an assumption of the distribution of this present worth value was made for purposes of this five-year ROD review, based on estimating practices at the time of ROD preparation. It is estimated that a $72,000 portion of the present worth is for annual inspections and maintenance and a $71,000 portion of the present worth is for every fifth year ROD Review for 500 years. Using standard present worth calculations and a discount rate of 3.9%, annual costs for inspections and maintenance are estimated to be $15,300 and unit costs for five year ROD reviews are estimated to be $15,000.

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Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit

I. SITE INFORMATION			
Site Name:	**K-Area Reactor Seepage Basin (904-65G) Operable Unit**	**Date of Inspection:**	**08/01/2012**
Location and Region	**SRS, USEPA Region 4**	**CERCLIS #**	**#55**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Foggy 91°F**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other In-Situ Stabilization

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for K-Reactor Seepage Basin*, ER-IDS-019-012._____

_____

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs were in good condition. _____

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) 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: annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/09/2012 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) 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:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks: Vegetation is mowed routinely.

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A	
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A	
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____	
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____	
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A	
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____	

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment DD-1. Five-Year Review Site Inspection Checklist – K-Area Reactor Seepage Basin (904-65G) Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is institutional controls, in situ stabilization treatment, and a soil cover system. The remedy is functioning as designed because in situ stabilization will treat the PTSM and a soil cover with institutional controls will provide access controls.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The implemented remedy includes consolidation of PTSM material in the unit in-situ stabilization of PTSM, a low permeability soil cover system, institutional controls, and grouting pipelines. The remedies are functioning as designed since the in-situ stabilization treats the PTSM and the soil cover and institutional controls provides access controls.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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L- AND P-AREA BINGHAM PUMP OUTAGE PITS (L AND P BPOPS) (643-2G, 643-3G, AND 643-4G) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G) (L and P BPOPs) Operable Unit (OU). Contaminants have been left in place at the L and P BPOP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the L and P BPOP OU is protective of human health and the environment. The review was conducted from August 2012 through September 2012. This report documents the results of the review.

II. OU Chronology

Table EE-1 lists the chronology of site events for the L and P BPOPs OU.

III. Background

The L and P BPOPs OU is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the L and P BPOP OU is soil.

Physical Characteristics

The L and P BPOPs are located near the L- and P-Reactor Areas, respectively, at SRS (Figure EE-1). The L BPOP consists of two pits (643-2G and 643-3G) aligned end-to-end with approximately 37.5 m (125 ft) between them; one pit is 82.5 x 6.6 m (275 x 22 ft) and the other pit is 113 x 6 m (377 x 20 ft) (Figure EE-2). The P BPOP consists of one pit (643-4G) with dimensions of 141.6 x 7.8 m (472 x 26 ft). The mean depth of each pit is approximately 3.9 m (13 ft) (Figure EE-3). Figure EE-4 and EE-5 show current (2012) photographs of L and P BPOPs, respectively.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999b) designates the L and P BPOPs OU as being close to but outside of an industrial area. The future land use for the L and P BPOPs OU is reasonably anticipated to be industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The L and P BPOPs were burial pits that received waste debris generated by major modifications to primary and secondary reactor cooling systems in 1957 and 1958, including waste from the Bingham pumps primary system. The waste consisted of miscellaneous construction materials such as pipes, cables, ladders, and concrete. No known pumps or liquid wastes were buried in the L and P BPOPs. Radioactive contamination associated with the debris was less than 25 milliRoentgens per hour with no detected alpha activity. The debris was classified as Low Level Threat Waste.

Initial Response

The L and P BPOPs were formed by excavating trenches to an average depth of 3.9 m (13 ft), disposing of 2.7 m (9 ft) of debris, and then returning the pits to grade by covering the debris with 1.2 m (4 ft) of backfill. This cover material was placed in 1958 at a time preceding the preparation of the formal CERCLA documentation and investigation.

Basis for Taking Action

The potential for unrestricted excavation and human exposure to buried debris with fixed radioactive contamination is the basis for taking action at the L and P BPOPs. No human health refined constituents of concern (RCOCs) were identified in the soil at any depth at L BPOP for any land use/receptor scenario. No human health RCOCs were identified in the surface soil at P BPOP for any land use/receptor scenario. Polyaromatic hydrocarbons (PAHs) including: benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluor-

anthene, and dibenzo[a,h]anthracene, and polychlorinated biphenyls (PCBs) (i.e., Aroclor 1254 and Aroclor 1260) were retained as RCOCs in subsurface soil at P BPOP for the hypothetical on-unit resident scenario. Benzo[a]pyrene was identified as the only RCOC in the subsurface soil for the future industrial worker scenario and is confined to a small area around intra-pit boring P-46 with a maximum concentration of 1430 µg/kg. No ecological RCOCs or contaminant migration COCs (CMCOCs) were identified for either L BPOP or P BPOP.

Table EE-2 presents the RCOCs and remedial goals (RGs) for the future industrial worker and residential adult receptors based on a risk of $1x10^{-6}$.

Groundwater is included as a subunit for the L and P BPOPs OU. However, no CMCOCs were identified as potential sources of groundwater contamination, and no COCs were identified in the groundwater. Therefore, groundwater monitoring and reporting is not required for the L and P BPOPs OU.

IV. Remedial Actions

Remedy Selection

As stated in the ROD, the remedial action objectives (RAOs) for the L and P BPOPs OU soils are as follows:

- Reduce the potential for exposure to buried waste at each unit and exposure to PAHs and PCBs in subsurface soil at the P BPOP.

As stated in the ROD, the remedial action at the L and P BPOPs OU is as follows:

- Land Use Controls (LUCs) (access and deed restrictions/notifications) for soil to prohibit residential use and unauthorized excavation of the waste; and
- No action for groundwater

Remedy Implementation

The implementation of the selected remedy for the L and P BPOPs included the following:

- Established LUCs for 0.3 hectares (0.73 acres) for LBPOP and 0.17 hectares (0.41 acres) for PBPOP as documented in the survey plats provided in the Final Remediation Report (FRR) (WSRC 2000) and the Land Use Control Assurance Plan (WSRC 1999b);
- Posted warning signs at the units at appropriate locations in sufficient numbers to be seen from any approach to prohibit unauthorized excavation and disturbance of the cover system;
- Established a maintenance program for the 0.13-hectare (0.31-acre) L BPOP native soil cover and the 0.11-hectare (0.28-acre) P BPOP native soil cover;
- Existing SRS access controls (including security gates and guards) prohibit residential use; and
- Existing SRS Site Use/Site Clearance Program controls work in the areas of the OUs and prevents unauthorized disturbance of the L and P BPOPs while under ownership of the government.

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are being performed to maintain the soil cover as long as the waste remains a threat to human health or environment:

- Visual inspections are being performed semi-annually for evidence of damage to the Final soil cover due to erosion or intrusion by burrowing animals. The inspection also addresses upkeep of the vegetative cover and the warning signs.
- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.
- LUCs (i.e., institutional controls) are being enforced to preclude unauthorized access or intrusive activities through the SRS Site Use/Site Clearance program and SRS site security.

Costs associated with the selected remedy for the L and P BPOPs OU includes operation and maintenance (O&M) costs of land use controls. The ROD estimated O&M costs associated with the selected remedy is $141,500, which was discounted at 5% per year. This is a present worth cost, including 30 years of maintenance activities. After characterization and effectiveness of the remedy was evaluated, the actual O&M cost for the L and P BPOP was assessed. The total actual O&M cost from project support and other post construction expense to fiscal year 2011 is $275,600. Table EE-3 compares the actual O&M costs over the last five years to the estimated costs from the ROD. The O&M costs are reasonable as compared to other SRS waste unit O&M costs related to site inspections.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at L and P BPOPs OU are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through land use controls. There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed documents listed in Section XII, Documents Reviewed;
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklists provided in Attachments EE-1 (L BPOP) and EE-2 (P BPOP) with the purpose of assessing the protectiveness of the remedies and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the L and P BPOP OUs and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The L and P BPOP OUs were inspected by SRNS and USDOE personnel on August 1, 2012. No issues were identified for the L and P BPOP OUs during this inspection and interviews.

On January 16, 2013 site inspections were conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No problems regarding the remedies of these OUs as implemented were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The maintenance of the native soil cover with land use controls is effective in preventing human exposure to contaminated media. The Land Use Control Implementation Plan for L- and P-BPOPs OU is included in the FRR and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2000). Semiannual inspection and maintenance data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk. Completed field inspection checklists between February 2006 and August 2011 were reviewed to make this determination. Occasional reports of small trees growing on the waste unit, the presence of dead limbs from surrounding trees, or evidence of surface soil disturbance from feral hogs were listed. Work orders to repair/rectify these conditions were immediately implemented. Frequent occurrences of active ant mounds were treated during inspections.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions and remedial action objectives (RAOs) used at the time of remedy selection are still valid for both L BPOP and P BPOP. There were no COCs for

the L BPOP. At P BPOP, only one COC, benzo[a]pyrene, was identified for the industrial use scenario. As discussed in Section III, Background, the land use is reasonably expected to remain as industrial use only. The RGs developed for the COCs at the P BPOP were calculated using toxicity data that was available in 1999. Toxicity data for the COCs identified for the P BPOP have since been updated. Based on a comparison of the maximum detected concentration in the P BPOP surface soils (0-0.3 m [0-4 ft] interval), the maximum concentrations of benzo[a]pyrene, benzo[b]fluoranthene, and dibenzo[a,h]anthracene exceed the USEPA Region IX corresponding RSLs. However, the potential addition of benzo[b]fluoranthene and dibenzo[a,h]anthracene as COCs for the industrial worker scenario does not impact the protectiveness of the remedy.

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. As an opportunity for optimization, semiannual inspections should be reduced to annual inspections, as discussed in Section IX, Recommendations and Follow-up Actions, and Table EE-5.

VIII. Issues

There are no issues related to current site conditions that prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

Table EE-5 presents the recommendations for the L and P BPOPs OU.

X. Protectiveness Statement(s)

The remedy at the L and P BPOPs OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled with LUCs to prevent exposure to or ingestion of contaminated soil. All threats to

contaminated soil at L and P BPOPs OU have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the L and P BPOPs OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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. *Approved Standardized Corrective Action Design (ASCAD™) Combined Document for the L- and P-Area Bingham Pump Outage Pits (U)*, WSRC-RP-97-443, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999b. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 1999c. *Record of Decision Remedial Alternative Selection for the L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)*, WSRC-RP-98-4105, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000. *Final Remediation Report for the L- and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)*, WSRC-RP-2000-4030, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist L-Area Bingham Pump Outage Pit (Bldg. 643-1G) (U)*, ER-IDS-019-005, Inspection period 2007 through 2011, semiannually

Various - *Inspection Data Sheets – Field Inspection Checklist P-Area Bingham Pump Outage Pit (Bldg. 643-1G) (U)*, ER-IDS-019-033, Inspection period 2007 through 2011 (semiannually)

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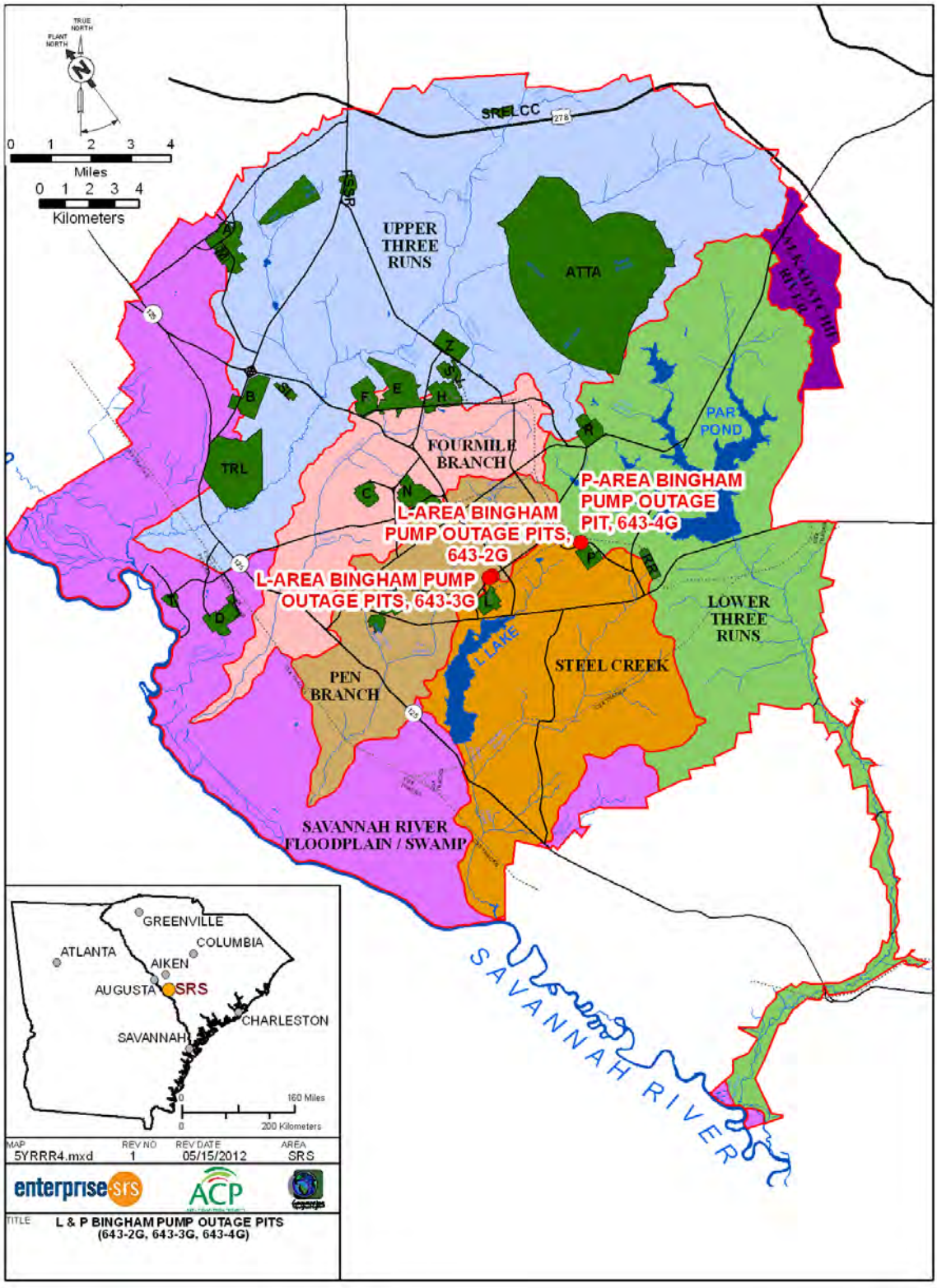


Figure EE-1. Location of the L-Area Bingham Pump Outage Pits at SRS

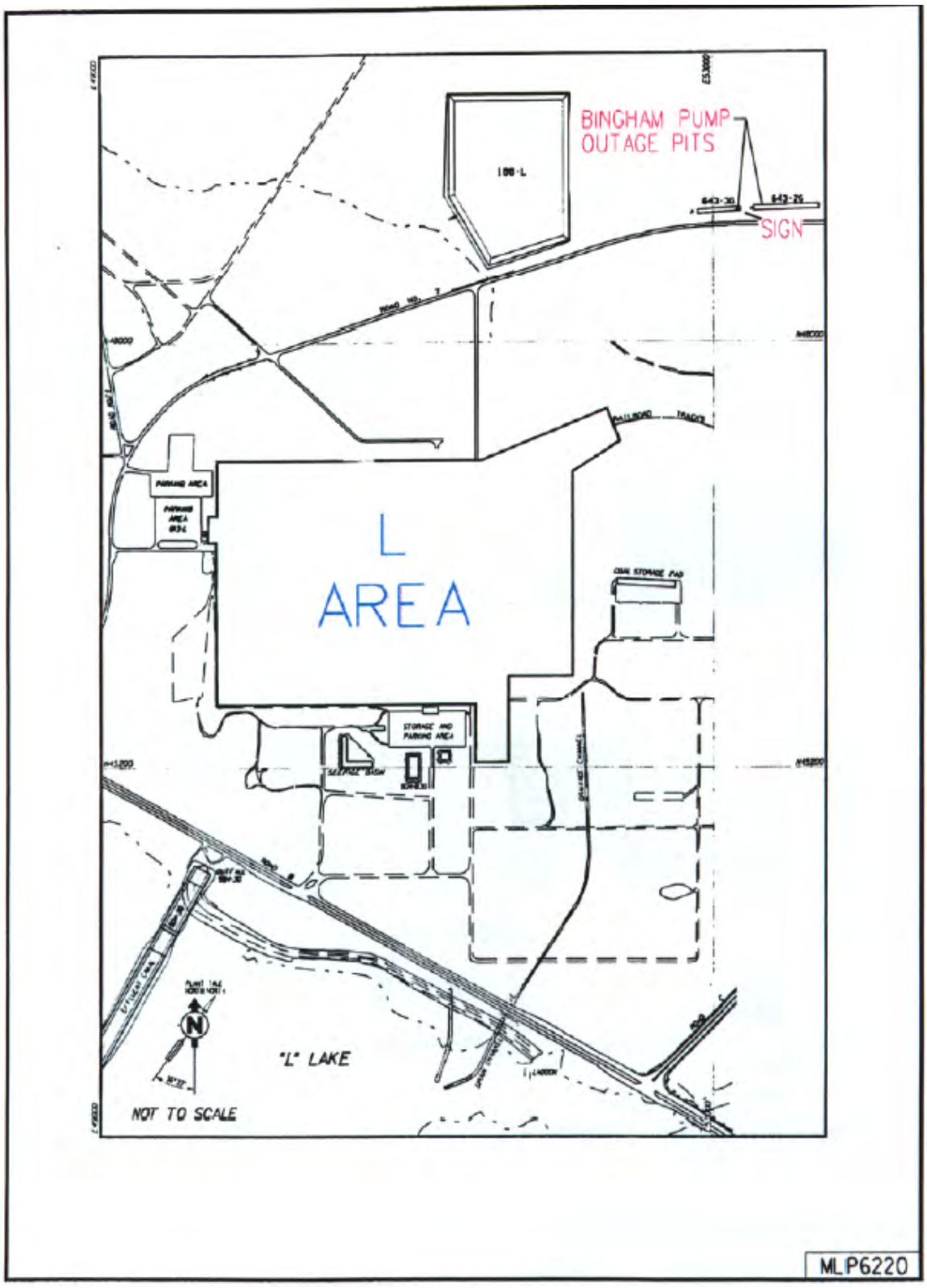


Figure EE-2. Layout of L-Area Bingham Pump Outage Pits

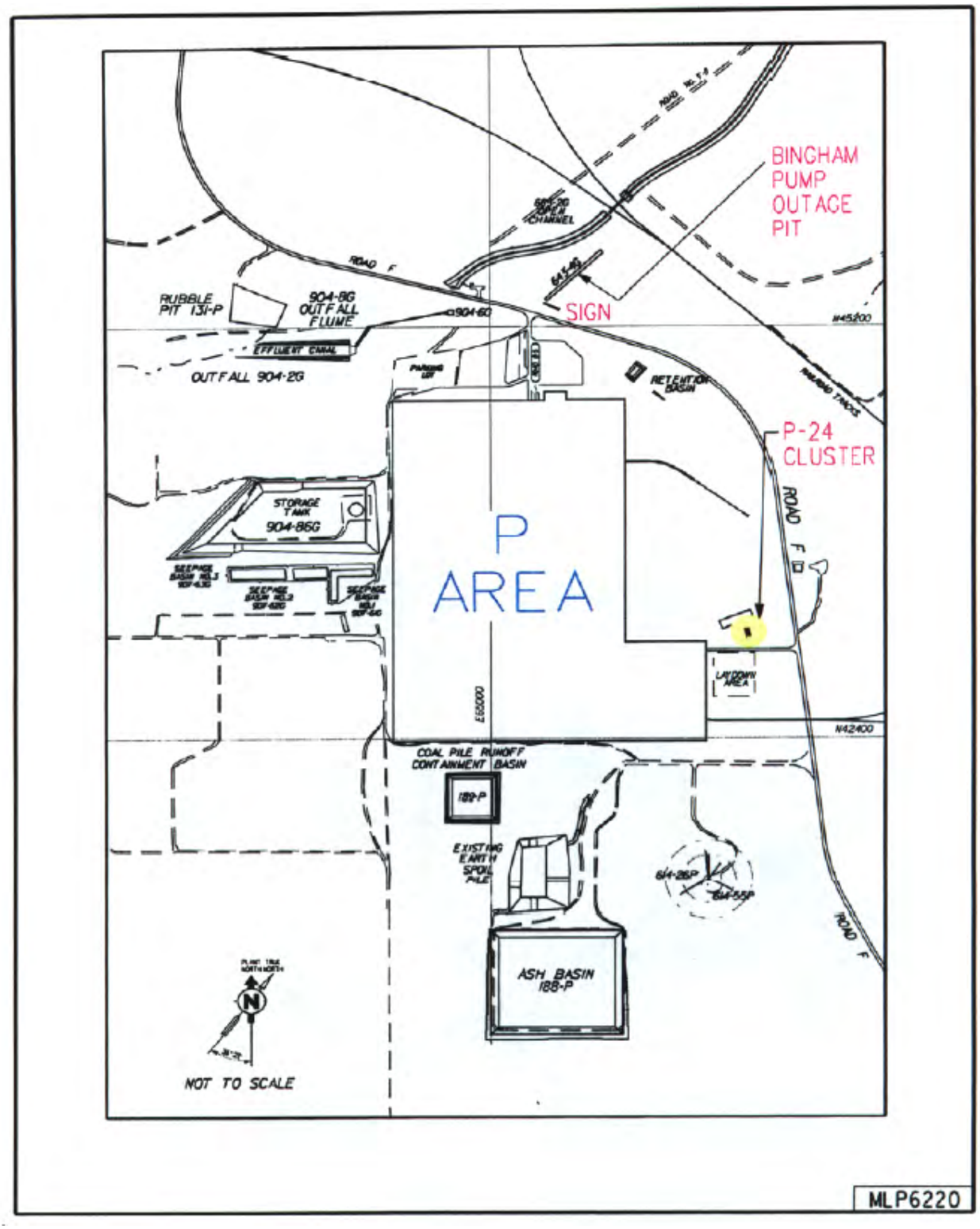


Figure EE-3. Layout of the P-Area Bingham Pump Outage Pit

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Figure EE-4. Current (2012) Photo of L-Area BPOP



Figure EE-5. Current (2012) Photo of P-Area BPOP

Table EE-1. Chronology of OU Events

Event	Date
Remedial Investigation (RI) Field Start / Complete	March 3, 1997 / May 27, 1999
Record of Decision (ROD) Issuance	August 31, 2000
Remedial Action Start / Complete	September 11, 2000 / September 11, 2000
Previous Five-Year Review	February 12, 2004; February 4, 2009

Table EE-2. RCOCs and RGs in Soil at the P BPOP

COC	Future Resident Adult	Future Industrial Worker
Aroclor 1254	0.94 mg/kg*	1.7 mg/kg
Aroclor 1260	No RfD*	1.7 mg/kg
Benzo[a]anthracene	8.38E+05 µg/kg*	2.56E+03 µg/kg
Benzo[a]pyrene	8.38E+05 µg/kg*	256 µg/kg*
Benzo[b]fluoranthene	8.38E+05 µg/kg*	2.56E+03 µg/kg
Dibenzo[a,h]anthracene	8.38E+05 µg/kg*	256 µg/kg

* RCOC for listed receptor;
RfD Reference Dose

Table EE-3. Comparison of Actual vs. Estimated O&M

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$7,300	$8,300	$4,600	$5,000	$4,300	$29,500
Total ROD Estimated Direct O&M Costs *	$38,700	$2,700	$2,700	$2,700	$2,700	$49,500

* Source of estimate: Tables B1 and B2 of the ROD (WSRC 1999c) provide the annual maintenance cost estimates for L and P BPOPs. These annual maintenance estimates (FY08-FY11) were added for L and P BPOP. The tables in the ROD provide a present worth value for the ROD reviews (every 5 years for 30 years) of $50,000 for each OU. A standard present worth analysis was used to convert the estimated total present worth cost of the ROD reviews into six unit costs of $18,000 for each OU. A discount rate of 5% was used in this analysis. The estimate for FY07 includes the maintenance and ROD review costs for L and P BPOPs.

Table EE-4. Recommendations and Follow-up Actions for L and P BPOPs OU

Issues	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Optimization of Inspections	Request change to the inspection frequency from semi-annual to annual via USDOE letter to the USEPA and SCDHEC within 45 days of final regulatory approval for the Fourth Five-Year Remedy Review Report	USDOE	USEPA/ SCDHEC	September 2014	N	N

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G)

I. SITE INFORMATION			
Site Name:	**L-Area Bingham Pump Outage Pits (643-2G and 643-3G)**	**Date of Inspection:**	**08/01/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #26**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Foggy 87°F**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. **Local Regulatory Authorities and Response Agencies** (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Semi-annual site inspections are performed per SRS procedure ER-SOP-019, *Waste Unit Inspection and Maintenance*, ER-IDS-019-005, *Field Inspection Checklist for the L BPOP*._____

_____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

IV. O&M COSTS

1. **O&M Organization:**
   - ☐ State In-House
   - ☐ Contractor for State
   - ☐ PRP In-House
   - ☐ Contractor for PRP
   - ☒ Other: SRS

2. **O&M Cost Records:**
   - ☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
   - ☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From: _____ (Date)	To: _____ (Date)	_____ (Total Cost)	☐ Breakdown attached
From: _____ (Date)	To: _____ (Date)	_____ (Total Cost)	☐ Breakdown attached
From: _____ (Date)	To: _____ (Date)	_____ (Total Cost)	☐ Breakdown attached
From: _____ (Date)	To: _____ (Date)	_____ (Total Cost)	☐ Breakdown attached
From: _____ (Date)	To: _____ (Date)	_____ (Total Cost)	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damage:** ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. **Signs and Other Security Measures:** ☐ Location shown on site map ☐ N/A

Remarks: Signs were located and in good condition. _____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(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: semi-annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/09/12 (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: Orange ball survey markers 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 EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks:

B. Other Site Conditions

Remarks: Site vegetation is mowed routinely

VII. COVER SYSTEMS ☐ Applicable ☒ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Cracks: ☐ Location shown on site map ☐ Cracking not evident
Lengths Widths Depths
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Holes: ☐ Location shown on site map ☐ Holes not evident
Areal extent Depth
Remarks:

5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress
Areal extent Depth
Remarks:

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment EE-1. Five-Year Review Site Inspection Checklist – L-Area Bingham Pump Outage Pits (643-2G and 643-3G) *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The remedy for this OU is institutional controls with a no action for groundwater. As part of the Land Use Controls (institutional controls), signs were posted at the L BPOP. This remedy is functioning as intended and the inspection verified the accuracy and legibility of identification signs, visible subsidence or erosion of the waste unit, proper vegetative growth, mowing, etc. All other routine maintenance activities and corrective actions have been implemented and documented.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of semi-annual site inspections and site maintenance (repair of erosion damage, mowing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the OU, the condition of the warning signs is good. There are no issues requiring corrective action.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

A request to reduce the inspection frequency from semiannual to annual has been recommended as an opportunity for optimization.

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Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G)

I. SITE INFORMATION			
Site Name:	**P-Area Bingham Pump Outage Pit (643-4G)**	**Date of Inspection:**	**08/08/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #39**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Cloudy 83°F**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Semi-annual site inspections are performed per SRS procedure ER-SOP-019, *Waste Unit Inspection and Maintenance*, ER-IDS-019-006, *Field Inspection Checklist for the P BPOP*.

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☐ Other: Project cost data is summarized in Section IV of this OU-specific review

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs were located and in good condition. _____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(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:

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/09/12 (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: Orange ball survey markers 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 EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☐ Roads adequate ☐ N/A Remarks:_____
B. Other Site Conditions
Remarks: Site vegetation is mowed routinely_____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

1. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

2. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks: _____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent _____ Depth _____
Remarks: _____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks: _____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks: _____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent _____ Depth _____
Remarks: _____

2. Performance Monitoring:
Type of Monitoring _____ ☐ Performance not monitored
Frequency _____ ☐ Evidence of breaching Head Differential _____
Remarks: _____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment EE-2. Five-Year Review Site Inspection Checklist – P-Area Bingham Pump Outage Pit (643-4G) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is institutional controls with a no action for groundwater. The remedial action for this unit is institutional controls to prevent exposure of future industrial workers to hazardous substances. The selected remedies for the P BPOP are functioning as intended. There are no issues requiring corrective actions.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of semi-annual site inspections and site maintenance (repair of erosion damage, mowing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the OU, the condition of the warning signs is good. There are no issues requiring corrective action.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. A request to reduce the inspection frequency from semiannual to annual has been recommended as an opportunity for optimization.

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L-AREA BURNING/ RUBBLE PIT (131-L), GAS CYLINDER DISPOSAL FACILITY (131-2L), AND L-AREA RUBBLE PILE (131-3L) OPERABLE UNIT

I. Introduction

This report is the second five-year review for the L-Area Burning/ Rubble Pit (131-L), Gas Cylinder Disposal Facility (131-2L), and L-Area Rubble Pile (131-3L) (LBRP/GCDF/LRP) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the LBRP/GCDF/LRP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the PBRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table FF-1 lists the chronology of site events for the LBRP/GCDF/LRP OU.

III. Background

The LBRP/GCDF/LRP OU is a Resource Conservation Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with this OU are soil and groundwater.

The scope of the LBRP/GCDF/LRP OU remedial action includes five subunits: (1) LBRP, (2) GCDF, (3) LRP, (4) LRP Ditch, and (5) groundwater (Figure FF-2).

Physical Characteristics

The LBRP/GCDF/LRP OU is located in the interior of SRS approximately 6 miles from the nearest SRS boundary (Figure FF-1) and is close to the industrially developed L-Reactor Area, one of several inactive nuclear reactor areas at SRS. LBRP/GCDF/LRP is approximately 396 m (1,320 ft) northwest of L-Reactor Area.

The LBRP/GCDF/LRP OU is comprised of five subunits (Figure FF-2):

- LBRP was a single burning/rubble pit (trench), approximately 69 m x 8.7 m x 3 m (230 ft x 29 ft x 10 ft) deep.

- The GCDF is an area 4.2 m (14 ft) wide by 8.1 m (27 ft) long, located on the southwest corner of the LBRP, where gas cylinders were placed and vented;
- LRP is an area of rubble piles located north of the LBRP. The topography slopes gently (3 percent grade) to the north-northwest toward LRP Ditch. LRP is approximately 150 m (500 ft) long by 36 m (120 ft) wide.
- LRP Ditch is approximately 1.5 m (5 ft) wide and 0.9 m (3 ft) deep and is a natural drainage ditch north of the rubble piles. The LRP Ditch in the vicinity of LRP is generally dry. Approximately 420 m (1,400 ft) downgradient of LRP (based on 2012 data), LRP Ditch intersects the water table and is a perennial stream below that point.
- Groundwater - The depth to groundwater is approximately 12 m (40 ft) in this area.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a) designates the LBRP/GCDF/LRP OU as being within the site industrial support area. The future land use for the LBRP/ GCDF/LRP OU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

LBRP was used from 1951 to 1973 for periodic burning of combustible wastes. Information obtained from historical records and from characterization of similar burning/rubble pits at SRS indicates that materials such as wood, cardboard, paper, plastics, rubber, rags, waste oils, degreasers, and organic liquids of unknown use and origin were disposed in the pit and burned on a monthly basis. Waste burning was discontinued in 1973, and a soil layer was placed over the pit contents. The pit continued to receive non-salvageable wastes such as lumber, wood, concrete, scrap metal, cable, electrical wiring, zinc-mercury and lead-acid batteries, non-returnable empty drums, wallboard, brick, asphalt, tile, cans and bottles, rubber and plastic items, a transformer

that did not contain polychlorinated biphenyls (PCBs), and other debris. Historical records indicate that LBRP was the only rubble pit at SRS to receive batteries. When the pit reached capacity in 1978, it was filled to grade with clean soil. In April 1998, exploratory trenching identified numerous zinc-mercury and lead-acid batteries and other debris in the northwest end of the pit.

The GCDF was used into the 1970s as a location for venting gas cylinders. Records indicate that 28 gas cylinders containing hazardous gases had been placed in GCDF in 1977.

LRP originally consisted of 15 rubble and soil piles randomly scattered throughout the area. The disposal history is largely unknown. Based on the sizes and shapes of the rubble piles, disposal practices at LRP likely consisted of dumping truckloads of waste on the land surface.

No waste was placed in LRP Ditch. The ditch was assessed as part of this OU because it could have received stormwater runoff from LRP and, therefore, could have been contaminated.

Groundwater was assessed because it may have been impacted by leaching from one or more of the source units (i.e., LBRP, GCDF, and/or LRP).

Initial Response

In 1998, a time-critical removal action was implemented at LBRP with the primary objective of removing all principal threat source materials (PTSM) from the pit. Approximately 450 zinc-mercury batteries, 870 lead-acid batteries, a non-PCB transformer, and other miscellaneous debris were removed from the northwestern half of the pit. In addition to the batteries and pit debris, 0.3 to 0.6 m (1 to 2 ft) of soil was removed from the floor of the northwest end of the pit. The resulting final excavation was approximately 3.3 m (11 ft) deep and approximately 5.4 m (18 ft) wide at grade and 3 m (10 ft) wide at the bottom.

In 1997 at the GCDF, a time-critical removal action was performed with the primary objective of removing the gas cylinders. Visual inspection revealed puncture holes in the

cylinders and confirmed that the cylinders were empty and that no PTSM (e.g., hazardous gases) remained inside. All of the cylinders, as well as concrete, asphalt, and approximately 0.3 m (1 ft) of soil from the footprint of the GCDF, were removed and dispositioned as non-hazardous solid waste.

In 1997, a time-critical removal action was performed at LRP to recover assorted cans, bottles, incandescent and fluorescent lights, light ballasts, railroad ties, electrical wiring, and scrap metal. Approximately 153 m^3 (200 yd^3) of non-hazardous waste (paper, plastic, metal, wood, etc.), 1.53 m^3 (2 yd^3) of hazardous waste (miscellaneous paint), and 36 m^3 (47 yd^3) of Toxic Substances Control Act (TSCA) waste (PCB-contaminated soil) were removed, transported, and disposed at CERCLA Off-Site-Rule-approved facilities. About 191 m^3 (250 yd^3) of soil and debris remained stockpiled at LRP.

Basis for Taking Action

The potential for exposure to or ingestion of contaminated soil and groundwater poses a potential increased risk of cancer to human receptors and is the basis for taking action at the LBRP/GCDF/LRP OU. The RFI/RI/BRA characterization identified contamination warranting remediation in two of the five subunits, the LRP, and groundwater (WSRC 2000a).

- LRP soil sampling after the 1997 removal action indicated there was contamination in the soil within the footprints of the original piles.
- Groundwater is contaminated by a small, diffuse plume of carbon tetrachloride (CCl_4). In addition, groundwater modeling indicates that the plume will not discharge to surface water at levels above maximum contaminant levels (MCLs) in the future. The plume is slowly moving to the west, with local groundwater flow toward Pen Branch and the LRP Ditch (Figure FF-2). Chloroform was recognized as a human health COC; however, groundwater concentrations are well below MCLs.

The three other subunits (LBRP, GCDF, and LRP ditch) required no further action.

- LBRP confirmatory sampling at the base of the excavation determined that no contaminated soil that represents a future residential human health risk > $1x10^{-6}$

remained. The excavation was backfilled with clean soil and returned to grade. No additional remedial actions (i.e., land use controls [LUCs] including signage or inspections were required for LBRP following the excavation.

- GCDF confirmatory soil samples collected from the excavation footprint after the time-critical removal action, confirmed that there were no problems warranting further action. The excavated area was backfilled to grade with clean soil in July 1998.

- LRP Ditch sample results demonstrate that it has not been impacted by the OU. No constituents warranting remedial action (refined constituents of concern [RCOCs]) were identified.

IV. Remedial Actions

Remedy Selection

L-Area Rubble Pile

Per the ROD (WSRC 2002), the following remedial action objectives (RAOs) have been established for the LRP:

- Prevent exposure of industrial workers to lead above minimum remedial goals (RGs); and

- Prevent exposure of ecological receptors to barium, cadmium, chromium, copper, lead, mercury, zinc, and Aroclor 1254 (PCB) above minimum RGs.

Groundwater

Per the ROD, the following RAOs have been established for the groundwater:

- Prevent human exposure to CCl_4 in groundwater above the MCL of 5.0 µg/L;

- Prevent or limit discharge of CCl_4 from groundwater to surface water at levels above the MCL of 5.0 µg/L; and

- Reduce CCl_4 concentrations in groundwater to below the MCL of 5.0 µg/L.

L-Area Rubble Pile

Per the ROD, the selected remedy for the LRP subunit is:

- Removal and disposal of contaminated soil and debris with institutional controls contingent on confirmation sampling.

Groundwater

Per the ROD, the selected remedy for the groundwater subunit is:

- Groundwater mixing zone (GMZ) with institutional controls, monitoring and periodic reporting until the MCL is attained for CCl_4 (WSRC 2000b).

No RA or RAO for the surface water is required because the carbon tetrachloride plume in the groundwater is not impacting the surface water and is not expected to impact the surface water in the future (WSRC 2000b).

Remedy Implementation

The implementation of the selected remedy included the following activities:

L-Area Rubble Pile

- Performing a removal action that achieved residential RGs for the surface subunit. Approximately 1,550 m^3 (2,025 yd^3) of sanitary, hazardous, and PCB waste was removed and disposed of at approved disposal facilities.
- Collecting confirmatory soil samples and verifying that residential RGs have been met (WSRC 2004).
- Backfilling, grading, and seeding excavated areas using the surrounding soil in the waste unit.

Per the ROD, institutional controls (i.e., LUCs) at LRP were contingent upon confirmation sampling. As documented in the Post Construction Report (PCR) (WSRC 2004), the removal and disposal action performed at the LRP achieved residential RGs and no LUCs including signage and inspections are required.

Groundwater

- Establishing a groundwater monitoring network which includes plume and compliance boundary wells in accordance with the approved Groundwater Mixing Zone Application (GMZA). The individual wells that are used in the monitoring network are described in the Post Construction Report (WSRC 2004).

- Implementing land use controls (LUCs) (i.e., institutional controls) for the groundwater plume to prevent use of the groundwater as a drinking water source at least until the MCL is attained. This consists of general site access controls (gates, fences and patrol at the site boundary), groundwater use restrictions, the SRS Site Use/Site Clearance program, and future deed restrictions and notifications to prevent exposure of human health receptors to contaminated groundwater if property is transferred to non-federal ownership.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Sampling of the GMZ monitoring wells. The monitoring program verifies the natural decrease of contaminant concentrations in the groundwater to levels below MCLs for CCl_4. Sampling will continue until the MCL of 5.0 µg/L has been attained, the RAO has been achieved, and the remedial action is complete. The results have been reported via annual EMRs since 2004. Starting in 2008, the monitoring results for LBRP/LRP OU were combined with the KBRP/KRP OU and PBRP OU monitoring reports into a single abbreviated annual groundwater data summary, with full detailed reports every five years (WSRC 2008). The first five-year detailed report was submitted in June 2012 (SRNS 2012). Based on the prolonged stable conditions and lack of contamination in downgradient wells, sampling optimizations have been instituted which will reduce the number of wells sampled and also reduce the sampling frequency to annually (SRNS 2012). CCl_4 groundwater concentrations were originally expected to be below MCLs by 2004 due to the processes of

advection and dispersion (WSRC 1999b). However, although contamination still exists above MCLs, core concentrations continue to decline and a GMZ is still reasonable for monitoring.

- LUCs are being enforced (preclude unauthorized access to the groundwater) (WSRC 2004) as long as groundwater concentrations exceed MCLs. LUCs are implemented by providing access controls to onsite workers via the Site Use Program/Site Clearance Program, protecting authorized monitoring well workers via worker training and work control procedures, and providing access controls against trespassers at the SRS boundary.

Operation and maintenance (O&M) costs associated with the selected remedy for the LBRP, LRP, and GCDF OU include institutional controls and groundwater mixing zone monitoring and reporting. The ROD estimated O&M cost associated with the selected remedy has a present worth of $70,000 discounted at 7% per year for 30 years of maintenance activities. The actual O&M cost since the remedial action was completed in FY04 through FY11 is $261,000. The actual O&M costs (Table FF-3) are higher than originally expected, because groundwater monitoring and reporting costs were higher than estimated.

V. Progress Since Last Review

The previous protectiveness statement concluded that because the remedial actions at LRP (removal/disposal) and the groundwater subunits (GMZ with institutional controls) are protective, the site is protective of human health and the environment. The Removal/Disposal remedy is protective because no contamination above minimum RGs remains. The GMZ remedy is protective because groundwater monitoring tracks the evolution of the plume as it naturally attenuates. Exposure pathways that could result in unacceptable risks are controlled by the LUCS.

Since the previous review in 2007, an agreement was reached in 2008 to combine the reports for K-, L-, and P-BRPs into an annual groundwater monitoring data summary letter with a detailed groundwater report every fifth year beginning June 2012 (WSRC 2008).

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;
- Reviewed existing groundwater data (Table FF-3);
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist, provided in Attachment FF-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Annual groundwater reports or data summaries have been submitted for the LBRP/GCDF/LRP OU since 2004 and were thoroughly reviewed for this Five-Year Remedy Review. The latest 2012 report includes time-series plots of carbon tetrachloride at each station, a plume map, and a comprehensive review of the monitoring activities and monitoring results (SRNS 2012).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and with George Joyner, O&M Site Manager, on May 21, 2013 at the O&M organization offices. The LBRP/GCDF/LRP OU was inspected by SRNS and USDOE personnel on May 21, 2013. No issues were identified for the LBRP/GCDF/LRP OU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The Removal/Disposal remedy for the LRP is effective in preventing industrial workers and ecological receptors exposure to hazardous contamination. The removal and disposal of contaminated soils has reduced soil contaminant levels to below residential levels. Per the ROD, no LUCs are necessary for the LRP, therefore, no access control warning signs are installed at this OU. Confirmation soil sample concentrations compared to RGs are provided in Table FF-5.

- The GMZ with LUCs is effective in preventing human exposure to groundwater concentrations of CCl_4 above MCLs, and in preventing the discharge of CCl_4 to surface water above MCLs. The seepline samples from a nearby stream continue to be non-detect (Table FF-4).

- The in situ treatment through natural processes using a GMZ with LUCs is effective for reducing CCl_4 concentrations to below MCLs. Monitoring of the groundwater plume verifies that the contaminant concentrations are decreasing, consistent with cleanup objectives. A time-series plot of CCl_4 at the plume wells LRP 6R and LRP 7D are provided in Figure FF-5.

This remedy was selected because existing groundwater data and modeling indicate the plume is small and diffuse and is expected to attenuate below MCLs within five years (by approximately 2004). However, concentrations have remained above the MCL of 5 µg/L, but are well below the Mixing Zone Concentration Limits (MZCLs) of 13 µg/L. Results from 2011 were at a maximum of 5.6 µg/L in one well, LRP 6R (Figure FF-2). All other wells were below the 5 µg/L MCL, including plume well LRP 7D and the three compliance wells (LRP 8D, LRP 9D, and LRP 10D). All other monitored constituents (chloroform, chloromethane, and dichloromethane) were non-detect in 2Q12. Based on 2012 monitoring data (Table FF-4), the requirements of the GMZ continue to be satisfied. Based on the prolonged stable conditions and lack of contamination in downgradient

wells, sampling optimizations have been instituted which will reduce the number of wells sampled and also reduce the sampling frequency to annually (SRNS 2012).

The Land Use Control Implementation Plan is included as Appendix A in the PCR and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2004). The remedy is meeting the LUC objective to prevent access or use of contaminated groundwater until cleanup levels are achieved.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions and toxicity data used at the time of remedy selection are still valid. The MCL for chloroform has been revised from 100 µg/L to 80 µg/L. This change does not affect the circumstances for the GMZA as groundwater values have been non-detect or of very low concentrations below the MCL for chloroform (Table FF-4). All other MCLs for the remaining monitored groundwater constituents have remained the same. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

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 that prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the LBRP/GCDF/LRP OU.

X. Protectiveness Statement(s)

The remedy at LBRP/GCDF/LRP OU is protective of human health and the environment.

All threats to contaminated soil at the LRP subunit were addressed through the removal/disposal of contaminated soils and confirmation sampling that residential cleanup values were achieved. Groundwater 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. LUCs include access controls to onsite workers via the Site Use Program/Site Clearance Program, protecting authorized monitoring well workers via worker training and work control procedures, and providing access controls against trespassers at the SRS boundary.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2012. *K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G)(KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-3L, and 131-2L)(LBRP), and P-Area Burning/Rubble Pit (131-P)(PBRP) Operable Units (OUs) Detailed Combined Groundwater Monitoring Report (U)*, SRNS-RP-2012-00200, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1999a. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1999b. *Groundwater Flow and Transport Modeling for the L-Area Burning/Rubble Pit (131-L), L-Area Rubble Pile (131-3L), and L-Area Gas Cylinder Disposal Facility (131-2L) Savannah River Site, Aiken, South Carolina (U)*, WSRC-RP-99-4154, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000a. *RCRA Facility Investigation/ Remedial Investigation Report with Baseline Risk Assessment for the L-Area Burning Rubble Pit (131-L), Gas Cylinder Disposal Facility (131-2L), and L-Area Rubble Pile (131-3L) (U)*, WSRC-RP-98-4076, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2000b. *Groundwater Mixing Zone Application for the L-Area Burning Rubble Pit (131-L), Gas Cylinder Disposal Facility (131-2L), and L-Area Rubble Pile (131-3L) Operable Unit Savannah River Site, Aiken South Carolina (U)*, WSRC-RP-2000-4139, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Record of Decision Remedial Alternative Selection for the L-Area Burning/ Rubble Pit (131-L), Gas Cylinder Disposal Facility (131-2L), and L-Area Rubble Pile (131-3L) (U)*, WSRC-RP-98-4195, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Post-Construction Report for the L-Area Burning/ Rubble Pit (131-L), Gas Cylinder Disposal Facility (131-2L), and L-Area Rubble Pile (131-3L) including the Land Use Control Implementation Plan (Appendix A) (U)*, WSRC-RP-2003-4126, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Proposal to Standardize Sampling and Reporting Requirements of Groundwater Data for P, L, and K Area Burning/Rubble Pit Operable Units*, ACP-08-133, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

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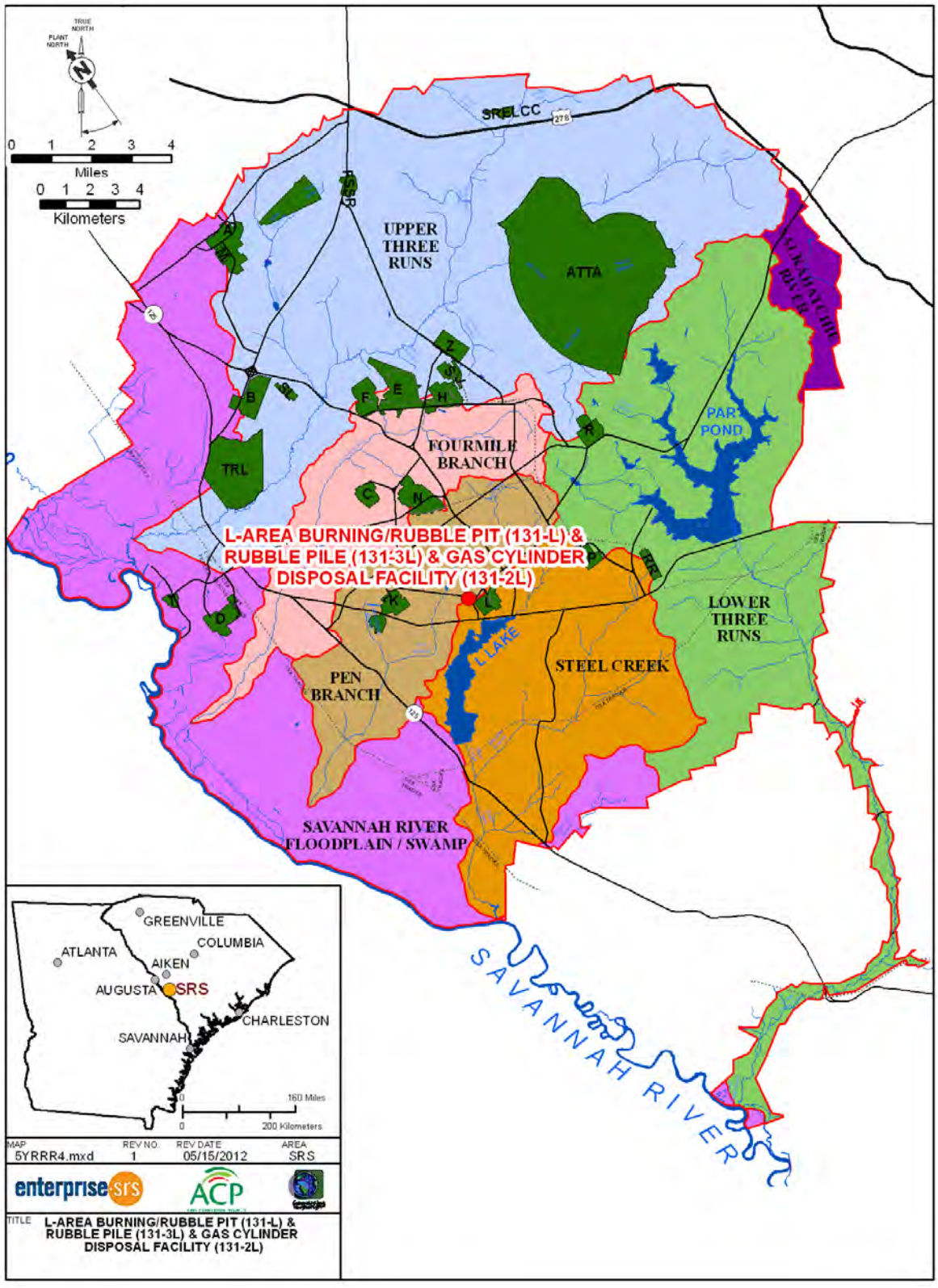


Figure FF-1. Location of the LBRP, GCDF, and LRP OU within SRS

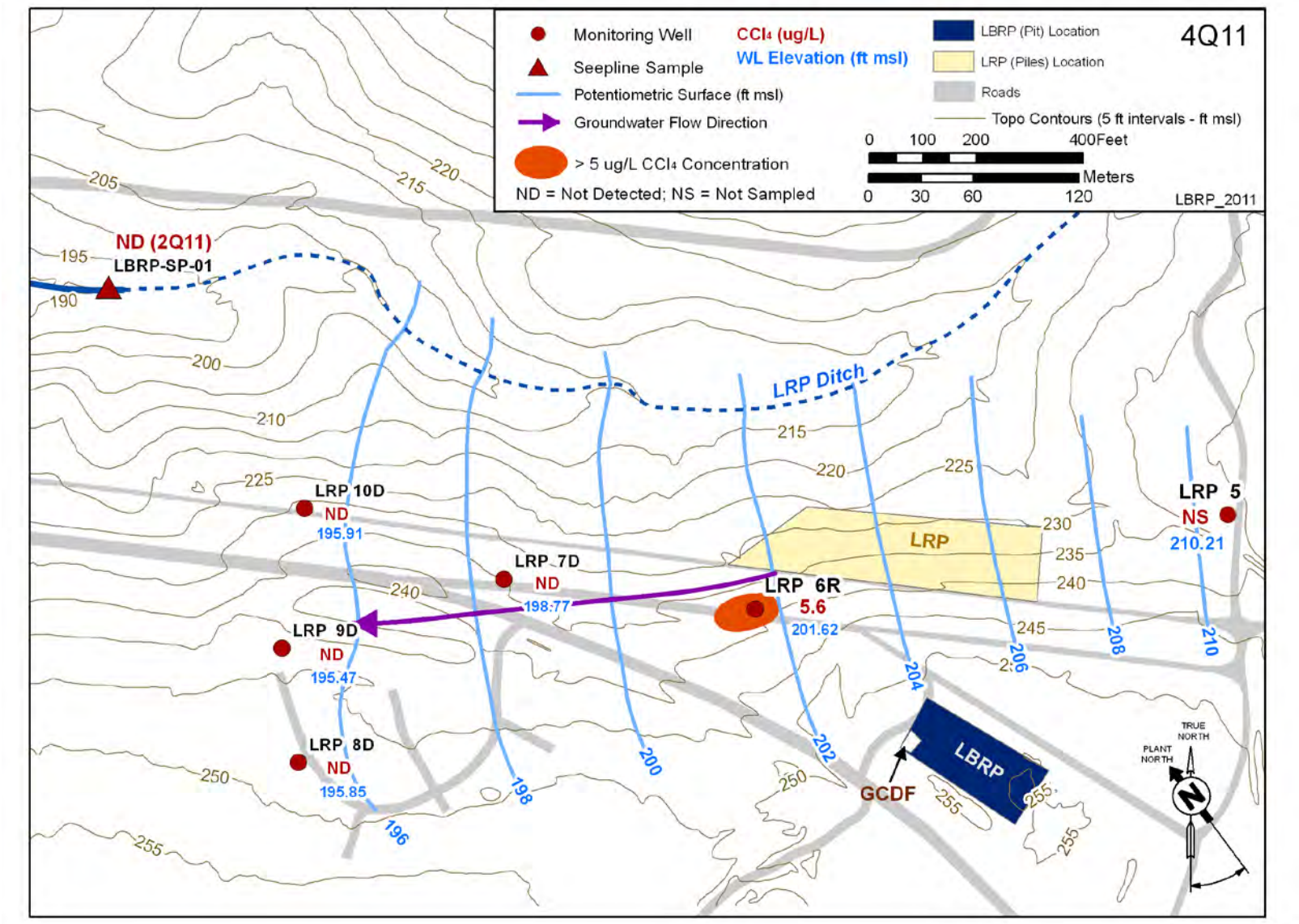


Figure FF-2. LBRP, GCDF, LRP, Monitoring Wells, CCl_4 Plume Location, and Water Table Surface



Figure FF-3. Photo of LBRP During Disposal Activities (Mid 1970's)



Figure FF-4. Photo of LBRP Currently (2012)

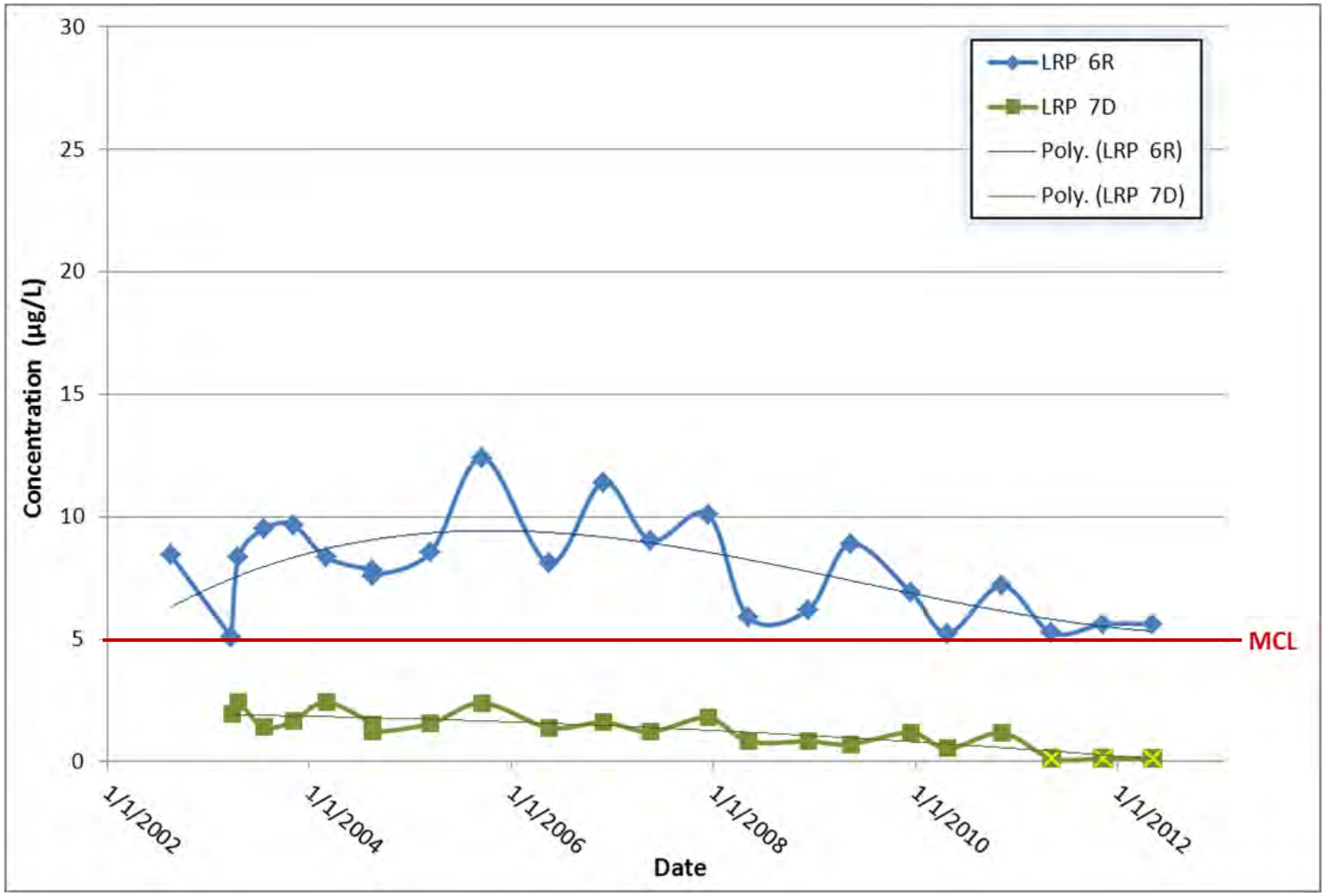


Figure FF- 5. Time Series Plot of CCl_4 at Plume Wells LRP 6R and LRP 7D

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Table FF-1. Chronology of OU Events

Event	Date
RFI/RI Start/Complete	October 31, 1997/October 5, 2000
Time Critical Removal Action Start / Complete	1997 / 1998
Record of Decision (ROD) Issuance	January 10, 2003
Remedial Action Start/Complete	April 15, 2003/ March 6, 2004
Previous Five-Year Review	February 4, 2009

Table FF-2. RCOCs and RGs for the Future Industrial Worker

Subunit	Medium	RCOC	Type	RG
LBRP	Soil	none	none	none
GCDF	Soil	none	none	none
LRP Ditch	Soil/Sediment	none	none	none
LRP◊	Soil	Barium	ECO	235 mg/kg
		Cadmium	ECO, HH	1.73 mg/kg
		Copper	ECO	60 mg/kg
		Lead	ECO, HH ARAR	500 mg/kg
		Mercury	ECO, HH	3.54 mg/kg
		Zinc	ECO	107 mg/kg
		Aroclor 1254 (PCB)	ECO, HH	0.219 mg/kg
Groundwater	Groundwater	Carbon tetrachloride	HH, ARAR	5 µg/L
		Chloroform	HH, ARAR	80* µg/L

ARAR Applicable or relevant and appropriate requirement RCOC
ECO Ecological RCOC
HH Human health RCOC
PCB Polychlorinated biphenyl
◊ In accordance with the ROD, chromium is not included as a RCOC for the industrial worker because the risk-based RG for chromium was less than background concentrations. Dibenzo[a,h]anthracene exceeded the residential RG but was not an RCOC for the future industrial worker and is therefore not included in this table.
* The MCL has changed from 100 µg/L to 80 µg/L.

Table FF-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	55,000	51,600	23,100	15,300	15,700	160,700
Total ROD Estimated Direct O&M Costs	18,000	3,000	3,000	3,000	3,000	30,000

Table FF-4. Groundwater Monitoring Results Compared to MZCLs and MCLs

Station	Station Type	CCl_4 MZCL (µg/L)	MCL			
			5	80	190*	5
			2Q12 Results (µg/L)			
			CCL_4	Chloroform	Chloromethane	Dichloromethane
LRP 6R	Plume	13	**5.62**	3.55	ND	ND
LRP 7D	Plume	13	ND	ND	ND	ND
LRP 8D	Compliance	5	ND	ND	ND	ND
LRP 9D	Compliance	5	ND	ND	ND	ND
LRP 10D	Compliance	5	ND	ND	ND	ND
LBRP-SP-01	Seepline Surface Water	5	ND	ND	ND	ND

*Chloromethane does not have an MCL, so the RSL Tapwater value is used

Table FF-5. Confirmation Soil Sample Results Compared to RGs

Analyte (RCOC)	Max Result (mg/kg)	RG (mg/kg)	
		Industrial Worker	Residential
Barium	210	235	235
Cadmium	1.3	1.73	1.73
Copper	26.9	60	60
Lead	50.6	500	400
Mercury	0.4	3.54	0.748
Zinc	92.6	107	107
Aroclor 1254 (PCB)	0.11	0.219	0.141
Dibenzo[a,h]anthracene	Non Detect	Not Applicable	0.0613

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit

I. SITE INFORMATION			
Site Name:	**L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit**	**Date of Inspection:**	**05/21/2013**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #31**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**70°F and cloudy**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Groundwater Mixing Zone Application

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 05/21/2013 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached No issues identified.

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/21/2013 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached No issues identified.

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: South Carolina Department of Health and Environmental Control

Contact: Heather Cathcart (Name) | Federal Remediation Coord. (Title) | 1/16/13 (Date) | 803-896-4165 (Phone No.)

Problems/Suggestions: ☐ Report Attached No issues identified.

Agency: _____

Contact: _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

4. Other Interviews *(Optional):* ☐ Report Attached

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Monitoring wells are inspected per ER-SOP-011, "ACP Monitoring Well Inspection (U)"

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

1. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

2. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

3. 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:

4. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

5. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

9. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☒ N/A

Remarks: Signs at this site are in good condition. _____

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile 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.) Walk-throughs

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 05/21/13 (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 orange balls are present 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 FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile 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:

VII. COVER SYSTEMS ☐ 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.

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☒ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks:_____

_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A

Remarks:_____

_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A

Remarks:_____

_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:

Areal extent_____ Depth_____ ☐ N/A

☐ Siltation not evident

Remarks:_____

_____

2. Erosion:

Areal extent_____ Depth_____ ☐ N/A

☐ Erosion not evident

Remarks:_____

_____

3. Outlet Works: ☐ Functioning ☐ N/A

Remarks:_____

_____

4. Dam: ☐ Functioning ☐ N/A

Remarks:_____

_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement_____ Vertical displacement_____

Rotational displacement_____

Remarks:_____

_____

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
2. Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A
1. Siltation: ☐ Location shown on site map ☐ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☐ N/A Remarks:_____
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
1. Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation *(groundwater mixing zone application remedy*

☒Applicable ☐ N/A

1. Monitoring Wells):

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: All monitoring wells were inspected (LRP-6R, LPR-7D, LPR-8D, LPR-9D, LPR-10D). All well identification signs were in good condition.

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment FF-1. Five-Year Review Site Inspection Checklist – L-Area Burning/Rubble Pit, Gas Cylinder Disposal Facility, and Rubble Pile Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Groundwater monitoring network of plume and boundary wells indicates the remedial action was successful. GMZA remains the best option for the contaminated groundwater as contaminant levels are decreasing, the plume is decreasing in size, and contaminant levels in a nearby stream are non-detect.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The protectiveness of the completed remedial action is being monitored by continued groundwater sampling. The O&M procedures are effectively maintaining the monitoring wells. The wells are properly secured/locked, functioning and are in good condition. Institutional controls effectively prevent unauthorized access to the groundwater and include physical access controls to SRS (fences, guards, security patrols, etc.); administrative controls (SRS is a secured government facility with land use restrictions); and use controls (SRS Site Use/Site Clearance Program).
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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L-AREA HOT SHOP (INCLUDING CML-003 SANDBLAST AREA) OPERABLE UNIT

I. Introduction

This report is the second five-year review for the L-Area Hot Shop (Including CML-003 Sandblast Area) (LAHS) Operable Unit (OU). The review was conducted from August 2012 through September 2012. The Record of Decision (ROD) for the LAHS OU (WSRC 2003) documented that residual contamination was present at the LAHS OU at levels that did not allow for unlimited use and exposure, and the OU was classified as an Underground Radioactive Materials Area (URMA), thereby prohibiting unrestricted use. The purpose of this review is to determine whether the remedy in place at the LAHS OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table GG-1 lists the chronology of site events for the LAHS OU.

III. Background

The LAHS OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the LAHS OU include the soil. The groundwater beneath the OU is addressed in the L-Area Southern Groundwater OU.

The LAHS OU consists of five subunits including the LAHS soils (sandblast area CML-003), the LAHS manholes and associated drainlines, the LAHS surface drainage ditch, the LAHS inactive process drainlines, and the LAHS concrete slabs for Buildings 712-G, 717-G, and 707-G and Storage Areas 080-1G and 080-2G. Figure GG-1 shows the location of the LAHS OU at SRS. Figure GG-2 shows the site layout for LAHS OU.

Physical Characteristics

The LAHS OU is located at the southeast corner of L Area, which is within the south-central portion of Savannah River Site (SRS), north of L-Lake (Figure GG-1). The

LAHS OU is located on the Aiken Plateau at a ground surface elevation of approximately 61.5 m (205 ft) above mean sea level (msl) within the Steel Creek watershed. The depth to groundwater is approximately 8.4 m (28 ft) below ground surface (bgs). The LAHS originally consisted of temporary buildings constructed in the 1950s. During the 1960s, the temporary buildings were removed to make way for three permanent buildings (Buildings 712-G, 717-G, 707-G) and two storage areas (Buildings 080-1G and 080-2G).

The concrete pad for the three buildings and storage areas was approximately 870 m^2 (9,670 ft^2). Grassy fields surrounded the concrete pad. A fence controlled access to the area containing the concrete slab. The area inside the fence was approximately 5,643 m^2 (62,700 ft^2). The buildings were last used in 1983 and were removed in 1993.

At the start of the remedial action, the LAHS OU consisted of the following (Figure GG-2):

- A concrete slab with associated drainlines on which three interconnected buildings (Buildings 712-G, 717-G, and 707-G) and a former storage area (Building 080-1G) were constructed;
- A concrete slab (Building 080-2G) outside the eastern perimeter fence;
- The CML-003 Sandblast Area;
- The surface drainage ditch;
- Two manholes with associated underground pipelines, one located inside and one outside of the LAHS perimeter fence were used for transporting sanitary wastewater (Figure GG-2); and
- Two additional inactive process drainlines, one 15-cm (6-in) pipe located in the concrete slab/decontamination area (the former Building 712-G) and one 5-cm (2-in) pipe located in the concrete slab/hot shop (the former Building 717-G) were connected to the L-Area Oil and Chemical Basin (LAOCB).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the SRS (WSRC 1999) designates the LAHS OU as being within an industrial area. The future land use is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

From the 1960s until 1983, the LAHS was primarily used for repairing the equipment brought into the interconnected buildings from the reactor areas. Building 707-G was an administration building with a lunchroom, a change room, and a lavatory. Building 712-G was used to decontaminate equipment. Building 717-G was used for the repair of equipment. Building 080-1G housed a tool room. Building 080-2G was used for temporary drum storage. The CML-003 Sandblast Area was reportedly used during operation of L-Reactor for sandblasting non-radioactive equipment and metals.

The exact composition of the waste material (primarily radionuclides) is not known. However, radionuclides deposited on the concrete floors of the LAHS buildings and the associated storage facilities and in the drainlines appear to be the primary source material. The field investigations conducted at LAHS OU reveal that the primary sources of potential contamination include the floor slab in former Buildings 712-G, 717-G, and 080-1G; former Drum Storage Area (080-2G); residue from the former high-efficiency particulate air (HEPA) filter vents from the hot shop buildings, Sandblast Area (CML-003) operations; the process drainlines connected to former Buildings 712-G and 717-G; and Manholes 1 and 2 (including sanitary drainlines from 707-G) associated with LAHS OU.

Initial Response

In 1998, as a part of the LAOCB remedial action and decontamination and decommissioning (D&D), the LAHS process drainlines were grouted and removed to a cut-off point approximately 10 ft from the slab. The 5-cm (2-in) drainline was removed

except for 9-m (30 ft) extending out from the slab (Figure GG-2). The 15-cm (6-in) drainline was removed except for 9-m (30 ft) of this drainline extending past the edge of the slab. Those portions of the 15-cm (6-in) drainline and the 5-cm (2-in) drainline remaining in or beneath the slab are included in the LAHS OU. The concrete pad was painted to fix remnant radioactive contamination.

Basis for Taking Action

Based on the results of the RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan Addendum (WSRC 2002a), no refined constituents of concern (RCOCs) were identified associated with the following three subunits: LAHS soils, LAHS Manholes and Associated Drainlines and the LAHS Surface Drainage Ditch (see Table GG-2). However, radiological contamination associated with two subunits (LAHS Inactive Process Drainlines and LAHS Concrete Slab) were identified with fixed beta-gamma surface contamination of 25,000 dpm/100 cm^2 with several hot spots up to 2.5 million dpm/ 100 cm^2. The concrete slab was repainted after the first coat of paint began to peel. A to-be considered (TBC) requirement was identified based on the U.S. Environmental Protection Agency (USEPA) guidance for establishing protective cleanup levels for radioactive contamination at a CERCLA site.

The potential for human exposure to fixed radiological contamination on the concrete slab and in the associated pipelines was the basis for taking action at the LAHS OU.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 2003), the remedial action objectives (RAOs) for the LAHS OU consists of the following:

- Protect future industrial workers against unacceptable exposures by implementing institutional controls; and
- Prevent the transfer of radionuclide contamination present in the concrete slab and drainlines by removal and disposal of these sources.

As stated in Section XI of the ROD (WSRC 2003), the selected remedial action for the LAHS OU included the following key elements:

- Removing the LAHS concrete slab of the former buildings;
- Removing the contaminated 15-cm (6-in) drainline associated with the former buildings;
- Removing the 5-cm (2-in) drainline associated with the former buildings;
- Excavating contaminated soils based on confirmatory sampling;
- Transporting the contaminated concrete debris and soil resulting from removal operations and cut segments of both drainlines to P-Area Reactor Seepage Basin for final disposal; and
- Implementing institutional controls through the first five-year remedy review via access controls, (including installation and maintenance of warning signs to prevent unrestricted use) and site maintenance (including inspections of OU and mowing [when applicable]).

Remedy Implementation

Implementation of the LAHS OU remedial action included the following:

- Breaking up/saw cutting LAHS concrete slab;
- Grouting 5-cm (2-in) and 15-cm (6-in) cast-iron drainlines;
- Excavating contaminated soils under concrete slab and around drainlines until the surface soils in the excavated areas were field screened/sampled to the threshold values of 20 pCi/g for gross alpha and 50 pCi/g for nonvolatile beta;
- Removing 1300 m^3 (1,700 yd^3) of contaminated concrete slab, drainlines and soils by transporting the debris to the P Reactor Seepage Basin;
- Performing radiological survey and confirmatory soil sampling of excavated areas;
- Backfilling by placing topsoil and planting sod in excavated areas;

- Backfilling manhole number 1 with concrete; and
- Establishing land use controls (LUCs) for 0.63 hectares (1.56 acres) by installing warning signs and implementing a monitoring, maintenance and reporting program for the LAHS OU. Additional LUCs include the implementation of the SRS Site Use/Site Clearance program at this waste unit which control work activities and restrict unauthorized use.

Systems Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (repair of erosion damage, mowing and warning signs); and
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented.

The operation and maintenance (O&M) cost associated with the selected remedy for the LAHS OU includes the annual inspections and maintenance of the soil cover, institutional controls, and a five-year remedy review. The ROD estimated O&M cost has a present worth of $42,970 discounted at 3.9% per year for five years. Only five years of O&M were anticipated to be required based on the estimate. The total actual O&M cost from project support and other post-construction expense to fiscal year 2011 is $70,600. The total O&M costs as compared to the estimate provided in the ROD are higher than the estimate because annual inspections and maintenance and five-year remedy reviews are continuing past the end point of FY08 that was used in the ROD estimate. Table GG-3 compares the actual O&M costs over the last five years to the estimated costs from the ROD. The total O&M costs and the costs as compared to the estimate provided in the ROD are commensurate with the remedial actions and indicative of costs associated with similar remedies performed at other SRS OUs.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedial actions at LAHS OU are expected to be protective. The final remedial actions were not evaluated in the previous five-year review because the ROD had just been issued. The final remedial actions including concrete, pipeline and soil removal and institutional controls have now been implemented and have been functioning properly. Unacceptable risks associated with radiological contaminants present at the LAHS OU have been eliminated.

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;
- Evaluated whether residual radiological contaminants still pose a threat under the residential (unrestricted) land use scenario to determine if LUCs are still required;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment GG-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

A review of the confirmatory samples collected and documented in Post Construction Report (PCR) (WSRC 2006b) is provided in Section VII, Technical Assessment. An assessment of the semi-annual inspection documentation is also provided in Section VII.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on June 7, 2012 at the LAHS OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The LAHS OU was inspected by SRNS and USDOE

personnel on June 7, 2012. No issues were identified for the LAHS OU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No problems regarding the remedy of this OU as implemented were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The selected remedy of removing the concrete slab and all of the inactive process drainlines associated with LAHS OU is effective in preventing future industrial worker exposure to contaminants, because all contaminated material has been excavated.
- A review of the field inspection checklists indicate that there is no excavation, no evidence of burrowing animals, and no signs of erosion or subsidence.
- The performance standards of the remedial action have been met by the confirmation sampling documented in the PCR (WSRC 2006b). Twenty-two confirmation samples were collected in the soil beneath the excavated material. Results from 19 samples were found to be below the screening values of 20 pCi/g for gross alpha and 50 pCi/g for non-volatile beta. Three of the samples exceeded the non-volatile beta screening values, and one of those samples also exceeded the gross alpha screening value. These three samples were analyzed for individual radionuclides. All detected radionuclides were found at concentrations below SRS background concentrations. Table GG-4 provides a summary of the data that was provided in the appendix to the PCR as compared to the background values.

Because COC concentrations are below background levels, the LAHS OU qualifies as a No Further Action (see Section IX and Table GG-5, Recommendations). Based on the following statement from the detailed description of the selected remedy within the ROD (WSRC 2003), institutional controls are no longer applicable for this unit:

"Institutional controls will be implemented through the first five-year remedy review to confirm that the remedy is protective of human health and the environment. Institutional controls will consist of access controls and site maintenance."

The requirements of the ROD, to maintain institutional controls during the first 5 year ROD remedy review has been exceeded. The ROD estimate for O&M costs assumed O&M activities would be complete by 2008

A review of the semiannual site inspection records provided evidence that the warning signs are effective in preventing access to the area. No evidence of land disturbance was documented in any of the site inspection records. Only active ant mounds were noted and some erosion of the vegetative layer was noted. Work orders were issued, and the ant mounds were treated and bare spots were re-vegetated.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

All contaminated concrete, piping, and soil were excavated and disposed in the P-Area Reactor Seepage Basin. No human health or ecological COCs were identified for the soil. The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid since the contamination has been removed. Any changes in standards or to-be-considered guidance identified in the ROD that could call into question the protectiveness of the remedy are not applicable to this waste unit.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

Table GG-5 presents the recommendations for the LAHS OU.

X. Protectiveness Statement(s)

The remedy at the LAHS OU is protective of human health and the environment.

Exposure pathways that could have resulted in an unacceptable risk are controlled by with excavation, removal, and backfilling of excavated areas along with institutional controls (i.e., land use controls). All threats have been addressed through implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions), and warning signs and use restrictions via SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review, if necessary, is scheduled for no later than January 2019.

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, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2001. *RFI/RI Work Plan for the L-Area Hot Shop (including CML-003 Sandblast Area) Operable Unit (U),* WSRC-RP-99-4061, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002a. RFI/RI Work Plan Addendum – *Investigation Results and Risk Assessment for the L-Area Hot Shop (Including the CML-003 Sandblast Area) Operable*

Unit (U), WSRC-RP-2001-4172, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002b. *Statement of Basis/Proposed Plan for the L-Area Hot Shop (Including CML-003 Sandblast Area) Operable Unit (U)*, WSRC-RP-2001-4173, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Record of Decision Remedial Alternative Selection for the L-Area Hot Shop (Including CML-003 Sandblast Area) Operable Unit (U)*, WSRC-RP-2002-4025, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006a. *Background Soils Statistical Summary Report for the Savannah River Site*, ERD-EN-2005-0223, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006b. *Post-Construction Report (PCR)/Corrective Measures Implementation Report/Final Remediation Report (FRR) for the L-Area Hot Shop Operable Unit (U)*, WSRC-RP-2005-4061, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC.

Various - *Inspection Data Sheets – Field Inspection Checklist L-Area Hot Shop Operable Unit (U)*, ER-IDS-019-033, Inspection Period 2007 through 2011 (semiannually)

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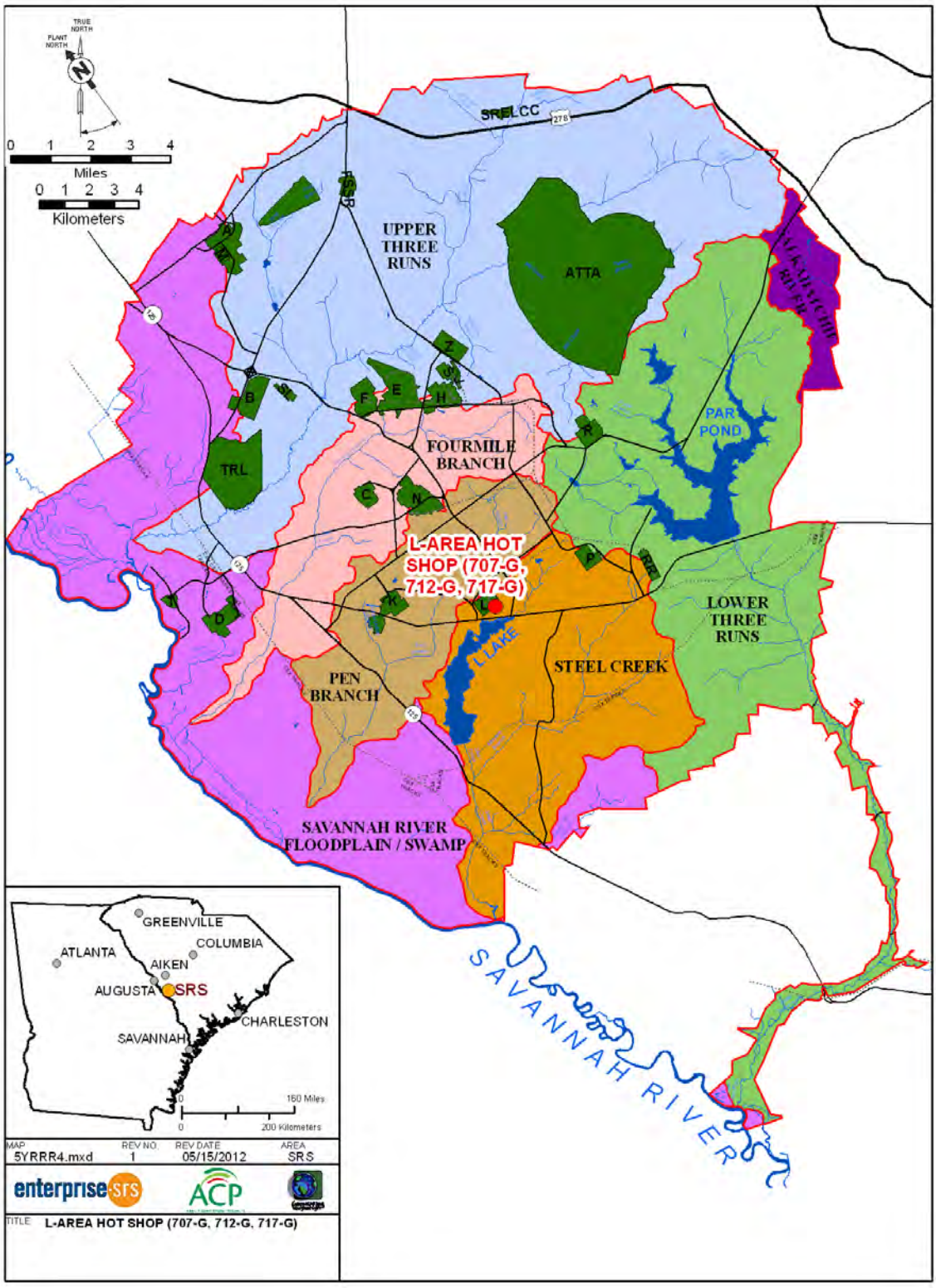


Figure GG-1. Location of the L-Area Hot Shop Operable Unit at SRS

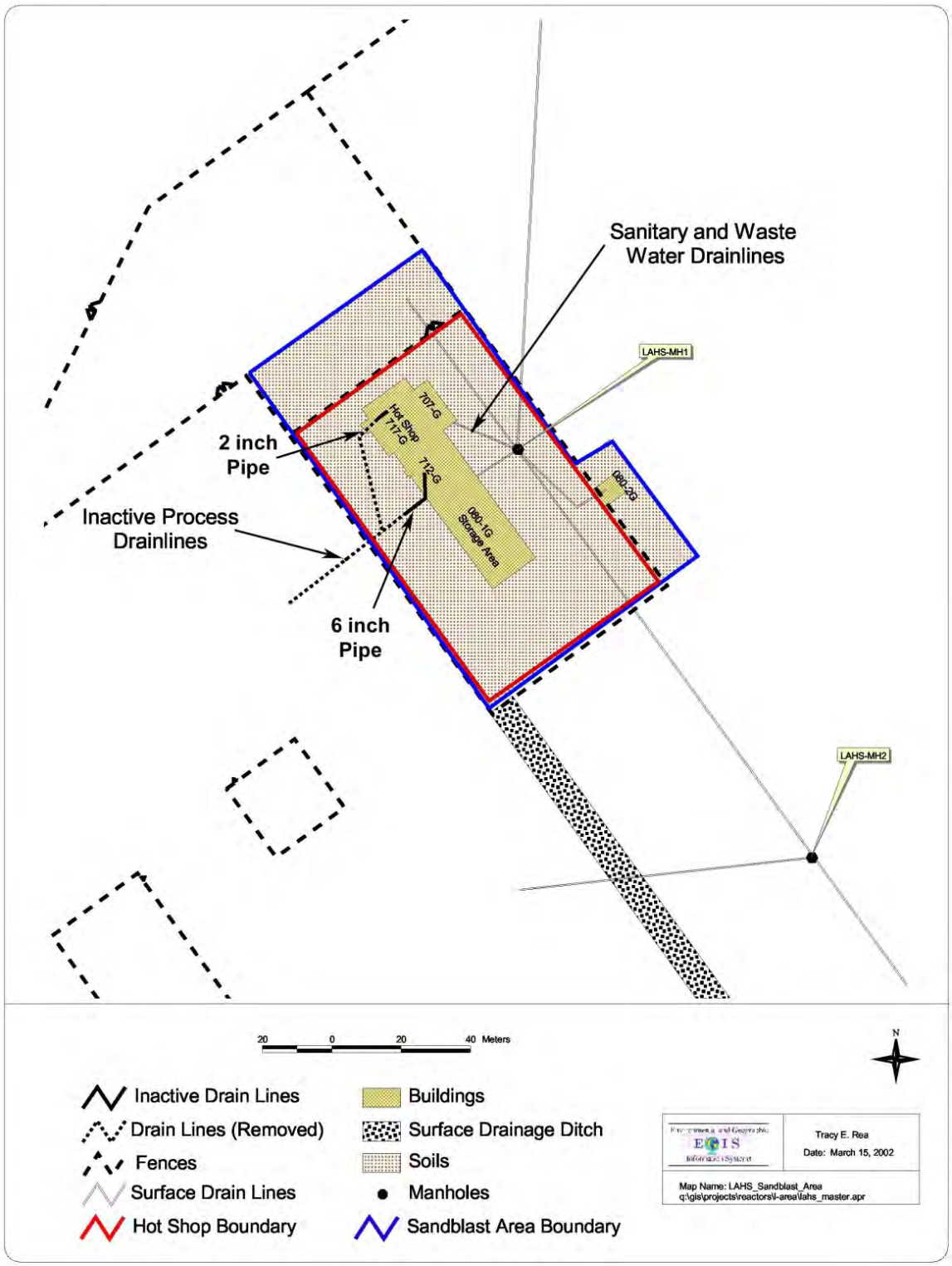


Figure GG-2. L-Area Hot Shop Operable Unit



Figure GG-3. Before and During Remedial Action



Figure GG-4. Current Photo (2012) of LAHS OU

Table GG-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	June 5, 2000 / August 14, 2002
Record of Decision (ROD) issuance	October 21, 2003
Remedial Action Start/Completed	August 5, 2004/June 16, 2005
Previous Five-Year Review	February 4, 2009

Table GG-2. Summary of LAHS OU Subunit Investigation

Subunit	Medium	Discussion
LAHS Soils	Soil	No refined human health (HH) or ecological (ECO) COCs were found at the LAHS Soils subunit.
LAHS Inactive Drainlines	Smearable surface contamination (300,000 dpm/ 100 cm^2 β–γ)	No alpha contamination was detected. A HH risk of >1E-03 for the future industrial worker was calculated based on observed beta-gamma activity and several exposure assumptions.
LAHS Manholes and Associated Drainlines	Sediments	No refined HH or ECO COCs were detected in sediment samples from any of the manholes.
LAHS Surface Drainage Ditch	Sediments	No refined HH or ECO COCs were detected in sediment samples from the drainage ditch.
LAHS Concrete Slab (Buildings 712-G, 717-G, 707-G, and 080-1G)	Smearable surface contamination (25,000 – 2,500,000 dpm/ 100 cm^2 β–γ)	No alpha contamination was detected. A HH risk of >1E-03 for the future industrial worker was calculated based on observed beta-gamma activity and several exposure assumptions.

Table GG-3. Comparison of Actual vs. Estimated O&M

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total O&M Actual Costs	$7,200	$8,200	$4,500	$4,800	$4,100	$27,800
Total ROD Direct O&M Estimated Costs*	$30,000	$5,000	$0	$0	$0	$35,000

*WSRC 2003

Table GG-4. Confirmation Sample Results: Comparison of Detected Radionuclides to SRS Background

Sample ID and Detected Radionuclides	Result (pCi/g)	Background[a] (pCi/g)
SS-08 (alpha spec only)		
U-233/234	0.520	1.202
U-235/236	0.176	0.111
U-238	0.794	1.218
SB-02 (alpha spec only)		
U-233/234	0.726	1.202
U-238	0.578	1.218
SB-03 (alpha and beta spec)		
U-233/234	0.818	1.202
U-238	0.686	1.218
Ac-228	1.080	1.905
Bi-212[b]	0.809	NA
Bi-214	0.615	1.470
Cs-137	0.035	0.166
Pb-212	1.030	2.063
Pb-214[c]	0.781	NA
K-40	1.330	3.300
Ra-228	1.080	2.218
Tl-208[d]	0.356	NA
Th-230	0.615	1.758

Notes:

a. Source: ERD-EN-2005-0223, Rev. 1

b. Bi-212 is a daughter product of Th-228, a naturally occuring radionuclide with a SRS background value of 2.25 pCi/g

c. Pb-214 is a daughter product of Ra-226, a naturally occurring radionuclide with a SRS bacground value of 1.20 pCi/g

d. Tl-208 is a daughter product of Th-228, a naturally occuring radionuclide with a SRS background value of 2.25 pCi/g

NA = not available

Table GG-5. Recommendations and Follow-up Actions for LAHS OU

Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
Remove land use control requirements at the LAHS OU after approval from USEPA and South Carolina Department of Health and Environmental Control (SCDHEC) and identify as a No Action site.	USDOE	USEPA/ SCDHEC	March 2014	N	N

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Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU

I. SITE INFORMATION			
Site Name:	**L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU**	**Date of Inspection:**	**06/07/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #76**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**85°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Removal/Disposal of pipelines and concrete pad

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 06/07/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for L-Area Hot Shop*, ER-IDS-019-033.

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*			
2. Health and Safety Plans (HASPs):			
☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER			
3. O&M and OSHA Training Records:	☒ Readily Available	☒ Up to Date	☐ N/A
Remarks: Training Records are complete and up to date per ACP training matrix.			
4. Permits and Service Agreements:			
☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
5. Gas Generation Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
6. Settlement Monument Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
7. Groundwater Monitoring Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
8. Leachate Extraction Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
9. Discharge Compliance Records:			
☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
10. Daily Access/Security Logs:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.): walkdown

Frequency: semi-annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/09/12 (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 GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks: Site vegetation is mowed routinely
VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent Depth Remarks:
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths Widths Depths Remarks:
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent Depth Remarks:
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent Depth Remarks:
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent Depth Remarks:

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:_____

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:_____

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A	
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A	
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____	
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____	
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A	
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____	

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment GG-1. Five-Year Review Site Inspection Checklist – L-Area Hot Shop Operable Unit (including Sandblast Area CML-003) OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is Decontamination, Removal, and Institutional Controls. The selected remedies are effective and functioning as designed. There are no issues requiring corrective actions.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, mowing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the surface soils, the condition of the grass and vegetative cover and warning signs are good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Waste was removed during remedial action. M&O activities are no longer needed. Section IX of this report recommends that the OU be identified as a No Action site and that land use requirements be removed pending SCDHEC and USEPA approval.

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L-AREA OIL AND CHEMICAL BASIN (904-83G) AND L-AREA ACID/CAUSTIC BASIN (904-79G) OPERABLE UNIT

I. Introduction

This report is the third five-year review for the L-Area Oil and Chemical Basin (904-83G) (LAOCB) and L-Area Acid/Caustic Basin (904-79G) (LAACB) Operable Unit (OU). The review was conducted from August 2012 through September 2012. The selected remedial action for the LAACB was No Action because soil contamination was below levels requiring remedial action. However, contaminants have been left in place at the LAOCB at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the LAOCB is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table HH-1 lists the chronology of site events for the LAOCB and LAACB OU.

III. Background

The LAOCB and LAACB OU is a Resource Conservation Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media of concern is LAOCB subsurface soils.

The groundwater beneath the LAOCB and LAACB OU is addressed by the L-Area Southern Groundwater (LASG) OU.

Physical Characteristics

LAOCB and LAACB are located within the SRS, approximately 90 m (300 ft) south of the L-Area Reactor perimeter fence and 375 m (1,250 ft) north of L Lake (Figure HH-1). The water table is approximately 7.5 m (25 ft) below ground surface (bgs) in the area of

the LAOCB. LAOCB was constructed in 1961 as an unlined seepage basin and measured approximately 54.6 m (182 ft) long by 32.4 m (108 ft) wide at the berm, with an average depth of 3.6 m (12 ft) and covering an area of 0.2 hectares (0.5 acres). The LAACB was constructed in 1954 and measured 15 by 15 m (50 by 50 ft) with an average depth of 2.1 m (7 ft) and covering an area of 0.023 hectares (0.057 acres).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999b) designates the LAOCB and LAACB OU as being within an industrial area. The future land use is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

LAOCB started operations in 1961 and remained active until 1979. The basin received wastewater from L-Area Hot Shop (717-G) (LAHS) through a 15-cm (6-in) pipeline and a 5-cm (2-in) pipeline, approximately 135 m (450 ft) long. Wastewater from other areas of SRS was transported in drums and tanker trucks and was disposed of in the basin via a bermed concrete drainage pad located outside and upgradient at the north side of the basin. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS but came primarily from the reactor areas. The LAHS discharged decontamination wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin.

LAACB started operations in 1954 and remained active until 1968. This basin received wastewater from the L-Area water treatment plant facility via a pipeline (vitrified clay) and from the received waste from the reactor and separations areas consisting of dilute sulfuric acid and sodium hydroxide solutions used to regenerate ion exchange units in the water purification processes at the in the center of the SRS.

Initial Response

No initial response actions were taken at LAOCB or LAACB prior to the remedial investigation as part of the standard CERCLA process.

Basis for Taking Action

The potential for human exposure to radiologically contaminated soils in the LAOCB OU resulting in a future industrial worker risk of greater than $1x10^{-6}$ is the basis for taking action at the LAOCB. LAOCB soils, which were contaminated with radionuclides (primarily cobalt-60 and cesium-137) to a depth of less than 0.6 m (2 ft), posed the greatest risk at the OU. The vegetation within the LAOCB security fence was contaminated with radionuclides from the basin. Four monitoring wells were potentially a conduit for the migration of contaminants of concern (COCs) to the water table aquifer. Relatively high levels of radioactive contamination were detected on the internal surface of the LAOCB pipelines, but not in the soils surrounding the LAOCB pipelines. Table HH-2 provides a list of the COCs for the LAOCB soil and associated pipelines.

The LASG OU, a comprehensive groundwater OU, was created because of uncertainty associated with the nature and extent of the known and suspected groundwater plumes in the vicinity of the LAOCB and LAACB OU, LAHS, and L-Area Reactor Seepage Basin. Groundwater beneath this OU is being addressed holistically as part of the LASG OU.

IV. Remedial Actions

Remedy Selection

LAACB is a No Action site because soil contamination was below levels requiring remedial action.

The following remedial action objectives (RAOs) were identified for the LAOCB OU:

- Reduce risks to human health and the environment associated with:
  - External exposure to radiological constituents;
  - Inhalation of radiological constituents;

- Ingestion of soil or produce grown in soil with radiological constituents;
- Prevent or mitigate the leaching and migration of COCs to unit groundwater; and
- Achieve RGs established for unit soils.

The selected remedial actions for LAOCB were as follows:

- In-situ stabilization and disposal of the LAOCB pipeline in the LAOCB; and
- In-situ stabilization and capping the LAOCB.

The selected remedial action for the LAACB, LAACB pipeline and the LAACB effluent drainage ditch soil was No Action because soil contamination was below levels requiring remedial action.

Remedy Implementation

The LAOCB soil remedial actions implemented in accordance with the ROD are listed below:

- Consolidation of 150 m^3 (200 yd^3) of contaminated debris and soils by excavating the LAOCB sidewalls, the LAOCB pipelines (the internal contamination was immobilized by grouting), and contaminated soils, vegetation and debris, and placing at the bottom of the LAOCB. Backfilling of the pipeline trenches was performed after confirmation of the absence of radiological contamination.
- A demonstration of the shearing injector soil stabilization technique and process was performed in two small areas of the LAACB. The area was backfilled with clean soil and vegetated. No remedial action was required for the LAACB, however, the selected remedial action included backfilling and grading similar to Acid/Caustic Basins in other SRS areas. In accordance with the ROD, no post ROD documentation or reviews were required for this action.
- In situ stabilization by grouting of 1660 m^3 (2,170 yd^3) of LAOCB basin soil and consolidated material from the surface to approximately 0.6 m (2 ft) below the basin bottom.

- Installation of a 0.18-hectare (0.45-acre) low permeability soil cover system designed with a hydraulic conductivity of $1x10^{-5}$ cm/sec to minimize infiltration of precipitation and serve as a barrier to shield human and ecological receptors from potential contamination from the soil. The cover system includes three layers (from bottom to top) – clean fill, a 0.6-m (2-ft) thick low permeability soil layer, and a 45-cm (18-in) topsoil/vegetation layer.
- Implementation of Land Use Controls for 0.54 hectares (1.32 acres) by installing warning signs, keeping site access/site use controls in place while the property is owned and operated by USDOE, and if the property is ever passed to nonfederal ownership, deed notifications would be provided.
- Abandonment of four existing monitoring wells and clearing of vegetation, fencing and other physical obstructions within the immediate vicinity of the LAOCB.

System Operations/Operation and Maintenance

There are no system operational requirements.

The LAOCB OU maintenance activities that have been implemented in accordance with the ROD are as follows:

- Semiannual site inspections and site maintenance (verify warning signs are intact, adequate vegetative cover exist, erosion controls are in place and drainage systems are functioning properly); and
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented.

The ROD present worth operation and maintenance (O&M) costs (for 30 years) was estimated to be $430,000. The total actual O&M costs for the last 5 years is $26,500. Table HH-3 compares the actual O&M costs over the last five years to the estimated costs from the ROD. The actual costs are less than the estimated costs. There has been no major maintenance costs associated with the cover system since the completion of the remedial action.

V. Progress Since Last Review

The previous protectiveness statement concluded that the implementation of in-situ stabilization, low permeability cover system, pipeline grouting, and institutional controls (i.e., LUCs) is protective of human health and the environment for potential exposures to the soil. There were no recommendations or follow-up actions required.

Since the previous review in February 2009, no additional action has been required at this OU. Field inspections are being performed semiannually and are being documented on the Field Inspection Checklists.

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 and interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment HH-1 with the purpose of assessing the protectiveness of the remedy and functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Two groundwater monitoring wells, LCO 2DL (upgradient of LAOCB) and LCO 6DL (downgradient of LAOCB), were sampled and analyzed in the fourth quarter of 2012 for the following constituents detected in LAOCB soils: carbon-14, cobalt-60, strontium-90, tritium, non-volatile beta, and gross-alpha. The sampling was initiated based on the recommendations and follow-up actions for the LASG OU listed in Table JJ-6. The results of these analyses were below the detection limit for all analytes except for carbon-14 and tritium. The result for carbon-14 in well LCO-6DL, 9.95 pCi/L, was estimated ("J" qualified) because the reported value was above the minimum detection limit of the

laboratory, but below the practical quantitation limit. Tritium was detected in well LCO-6DL at a concentration of 1.66 pCi/mL. While the paucity of data makes it infeasible to draw any definitive conclusions, the dominance of non-detects, the low concentration of detected values, and the estimated concentration of carbon-14 would 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 Richard Feagin, O&M staff member, on June 7, 2012 at the LAOCB OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The LAOCB OU was inspected by SRNS and USDOE personnel on June 7, 2012. No issues were identified for the LAOCB OU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No problems regarding the remedy of this OU as implemented were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The 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. A review of the semiannual inspection reports from March 2007 to September 2011 showed only minor problems such as the presence of active ant mounds, an occasional bare spot on the grass cover, or the presence of a small pine tree. In all cases, work orders were immediately submitted and these conditions were rectified.

- 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) for the LAOCB, met the acceptance criteria (UCS $\geq$ 50 psi and LI $\geq$ 6.0). As reported in the PCR, the low-permeability soil cover test results met the acceptance criteria for hydraulic conductivity (< 1.0E-5 cm/sec^2).

- 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 with respect to the LAOCB remedy performance is discussed in Appendix JJ of this document.

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 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 LAOCB OU.

No new standards or to-be-considered standards have been identified that could call into question the protectiveness of the remedy.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

Land use, exposure pathways, COCs, and risk assessment methodologies have not changed in a way that affects 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

Table HH-4 presents the recommendations for the LAOCB OU.

X. Protectiveness Statement(s)

The remedy is protective of human health and the environment.

Because the groundwater contamination associated with the LAOCB is co-mingled with contamination from other sources, the groundwater remediation is being addressed as a separate OU. As described in the LASG OU remedy review, controls are in place to prevent exposure to or ingestion of contaminated groundwater. All threats associated with the LAOCB soil have been addressed through stabilization and capping of contaminated soil, physical access controls to prevent unauthorized entry to SRS and the OU (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.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SNRS, 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

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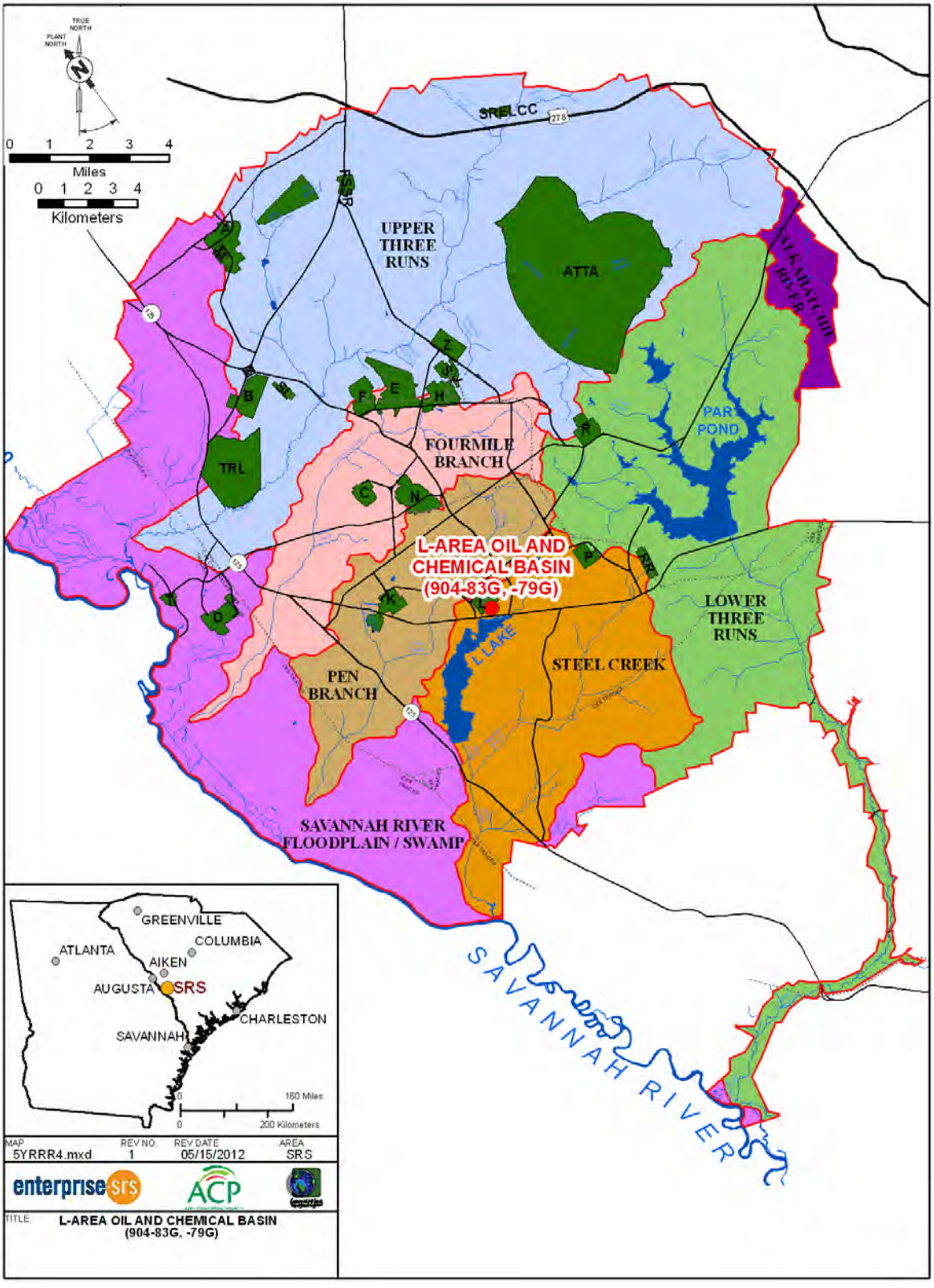


Figure HH-1. Location of the L-Area Oil and Chemical Basin OU at SRS



Figure HH-2. Photos of the L-Area Oil and Chemical Basin OU Prior to and during Remediation



Figure HH-3. Photo of the Remediated LAOCB

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Table HH-1. Chronology of OU Events

Event	Date
RFI/RI Field Start/Complete	1993/February 1996
Record of Decision (ROD) Issuance	January 5, 1998
Remedial Action Start/Complete	August 31, 1998/ May 7, 2001
Previous Five-Year Reviews	February 12, 2004/February 4, 2009

Table HH-2. COCs and Remedial Goals (RGs) for LAOCB Future On-Unit Worker

Subunit	Medium	HH COC*	RG	Unit
LAOCB Soils	Soil	Americium-241	1.20E+01	ρCi/g
		Antimony-125	5.30E-01	ρCi/g
		Cesium-137	3.20E-01	ρCi/g
		Cobalt-60	7.50E-02	ρCi/g
		Curium-244	2.00E+01	ρCi/g
		Europium-152	1.80E-01	ρCi/g
		Europium-154	1.60E-01	ρCi/g
		Plutonium-238	1.50E+01	ρCi/g
		Plutonium -239	1.40E+01	ρCi/g
		Potassium-40	1.20E+00	ρCi/g
		Strontium-90	9.00E+01	ρCi/g
		Uranium-234	2.00E+02	ρCi/g
		Uranium -235	2.60E+00	ρCi/g
		Uranium -238	1.20E+01	ρCi/g
		Chromium*	3.50E+02	mg/kg
		Lead	4.00E+02	mg/kg

* RGs to achieve 1E-06 Risk and HI = 1 for future on-unit worker
HH COC Human health constituent of concern
HI Hazard index
RG Remedial Goal
Chromium contamination was assumed to be hexavalent chromium per (WSRC 1996).

Table HH-3. Comparison of Actual vs. Estimated O&M

	FY07	FY08	FY09	FY10	FY11	5-Year Total
O&M Actual	$6,900	$7,700	$4,100	$4,200	$3,600	$26,500
O&M Estimated*	$29,300	$14,300	$14,300	$14,300	$14,300	$86,500

*Source of estimate: WSRC 1997. The estimated annual unit costs of $14,300 for O&M of the cover system and $15,000 for the FYR were estimated using the present worth formula for 30 years and discounted at 7%.

Table HH-4. Recommendations and Follow-up Actions for LAOCB OU

Issues	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Optimization of inspection	Request change to the inspection frequency from semiannual to annual via USDOE letter to the USEPA and SCDHEC within 45 days of final regulatory approval of the Fourth Five Year Remedy Review Report.	USDOE	USEPA/ SCDHEC	September 2014	N	N

Attachment HH-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

SITE INFORMATION			
Site Name:	**L-Area Oil and Chemical Basin (904-83G) and L-Area Acid/Caustic Basin (904-79G) Operable Unit**	**Date of Inspection:**	**06/07/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #17**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**85°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☒ Other In-situ Stabilization
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

INTERVIEWS *(Click all that apply)*

O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 06/07/2012 (Date)

Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment HH-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)*

II. INTERVIEWS *(Click all that apply)(Continued)*

Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Other Interviews *(Optional):* ☐ Report Attached ___

ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for L-Area Oil and Chemical Basin (U),* ER-IDS-019-007

Attachment HH-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)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

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:

Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☒ N/A

Remarks: Water elevation records only.

Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment HH-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)*

O&M COSTS

O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

Fencing

Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

Signs

Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition.

Attachment HH-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)*

Institutional Controls

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: semiannual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/09/2012 (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

Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey monuments were located and in good condition

General

Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

Land use changes onsite: ☒ N/A

Remarks:

Land use changes offsite: ☒ N/A

Remarks:

Attachment HH-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)*

GENERAL SITE CONDITIONS
Roads ☒ Applicable ☐ N/A
Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
Other Site Conditions
Remarks:
COVER SYSTEMS ☒ Applicable ☐ N/A
Landfill Surface
Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent Depth Remarks:
Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths Widths Depths Remarks:
Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent Depth Remarks:
Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent Depth Remarks:
Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress Areal extent Depth Remarks: Vegetation mowed routinely

Attachment HH-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)*

VII. COVER SYSTEMS *(Continued)*

Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks:

Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent Depth

Remarks:

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:

Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent

Remarks:

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)

Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:

Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:

Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:

Attachment HH-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)*

VII. COVER SYSTEMS *(Continued)*
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)
Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment HH-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)*

VII. COVER SYSTEMS *(Continued)*

Cover Penetrations ☐ Applicable ☒ N/A

Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

Gas Collection and Treatment ☐ Applicable ☒ N/A

Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment HH-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)*

VII. COVER SYSTEMS *(Continued)*
Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
Cover Drainage Layer ☐ Applicable ☒ N/A
Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
Dam: ☐ Functioning ☐ N/A Remarks:_____
Retaining Walls ☐ Applicable ☒ N/A
Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment HH-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)*

VII. COVER SYSTEMS *(Continued)*
Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A
Siltation: ☐ Location shown on site map ☒ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
Vegetative Growth: ☐ Location shown on site map ☐ N/A ☒ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
Discharge Structure: ☐ Location shown on site map ☒ N/A Remarks:_____
VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

Attachment HH-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)*

GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**
Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment HH-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)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

Treatment System ☐ Applicable ☒ N/A

Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment HH-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)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

Monitoring Data ☒ Applicable ☐ N/A

Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

Monitoring Data:

☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

Remarks: Monitoring data evaluates the effectiveness of the cover system

Monitored Natural Attenuation ☐ Applicable ☒ N/A

Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

Soil Vapor Extraction System ☐ Applicable ☒ N/A

Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: SVE units have concluded operations_____

Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment HH-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)*

OVERALL OBSERVATIONS
Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU is in-situ stabilization and capping for the LAOCB soil and in-situ stabilization and disposal for the LAOCB pipeline, to provide a permanent reduction in contaminant mobility and potential future impacts to groundwater. The remedies are functioning as designed because in-situ stabilization is treating the PTSM and a soil cover with institutional controls will provide access controls.
Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of semiannual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the integrity of the surface soils, the condition of the grass and vegetative cover and warning signs is good. There are no issues requiring corrective actions.
Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. A request to reduce the inspection frequency from semiannual to annual has been recommended as an opportunity for optimization.
Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. A request to reduce the inspection frequency from semiannual to annual has been recommended as an opportunity for optimization.

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L-AREA REACTOR SEEPAGE BASIN (904-64G) OPERABLE UNIT AND C- AREA REACTOR SEEPAGE BASIN (904-67G)

I. Introduction

This report is the second five-year review for the L-Area Reactor Seepage Basin (904-64G) (LRSB) Operable Unit (OU) and C-Area Reactor Seepage Basin (904-67G) (CSRB) Basin 2. The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the LRSB and CRSB Basin 2 at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the LRSB and CRSB is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table II-1 lists the chronology of site events for LRSB and CRSB OUs.

III. Background

LRSB and CRSB OUs are Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) units in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the LRSB and CRSB Basin 2 is soil.

The scope of the CRSB OU originally included all three CRSBs (904-66G, 904-67G, and 904-68G). However, documentation for remedial action at CRSB Basin 2 (904-67G) was combined with LRSB (904-64G) via a Plug-In ROD Amendment (WSRC 2002a) since both basins were closed similarly without the need for soil stabilization. The remedy review for CRSB Basin 1 (904-66G) and Basin 3 (904-68G) are discussed in Appendix H.

Physical Characteristics

The LRSB and the CRSB Basin 2 are located in the central portion of SRS, southeast of the L-Reactor facility (Figure II-1) and west of the C-Reactor facility (Figure II-1), respectively. The LRSB includes the basin, concrete pad, buffer area, perimeter, and process sewer line. The LRSB is an L-shaped unlined earthen basin with dimensions of 60 m (200 ft) on each outer side of the L-shape, 10.8 m (36 ft) in width, and 2.1 m (7 ft) in depth (Figure II-2). The basin was not backfilled to grade prior to the remedial action. A process sewer line that is approximately 135 m (450 ft) long extends from the of the L-Reactor disassembly basin to the discharge point at the north end of the basin.

The CSRB Basin 2 is an unlined (earthen) basin constructed in 1957. The basin is in an open fenced area with sparse vegetative cover. Basin 2 was constructed with an approximate outside dimension of 90 x 18 m (300 x 60 ft) and a depth of 3.3 m (11 ft) below ground surface (bgs). The ground slopes southwestward toward an unnamed tributary of Fourmile Branch approximately 180 m (600 ft) to the west. The unlined earthen basin was designed to hold contaminated wastewater that was not appropriate for discharge to local streams due to elevated radiological activity. Prior to remediation, the basin was open and had not been backfilled to grade.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* designates the LRSB and CRSBs OUs as being within an industrial area. The LRSB lies within the land use control (LUC) boundary of the L-Area Southern Groundwater Operable Unit which is also designated as an industrial area. The future land use is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

In 1958, the process sewer line began conveying low-level radioactive purge water from the L- Reactor disassembly basin to the LRSB. The LRSB received purge water from

1958 to 1968 and from 1985 to 1988. The L-Reactor was not in operation from 1969 to 1984 and no purge water was generated. However, from 1985 to 1988, mixed-bed deionizers and sand filters intercepted the purge water before it was discharged into the LRSB. In 1988, L-Reactor was placed on warm standby; in 1993, it was placed in shutdown status and has not been restarted.

The CRSB Basin 2 was used from 1959 to 1970 to dispose of low-level radioactive process purge water from the reactor disassembly basin. In 1963, disassembly basin wastewater was deionized and filtered prior to discharge, which reduced radioactivity and removed solids and sludges. The seepage basin was not used from 1971 to 1977 while purge water was mixed with large volumes of heat exchanger cooling water and discharged to area streams. After improvements for processing disassembly basin water, purge water discharges to the seepage basins resumed in 1978. The C-Reactor was shut down for repairs in 1985, placed on cold standby in 1987, followed by shutdown. The CRSBs have not received wastewater since 1986.

Initial Response

At CRSB Basin 2, a time-critical removal action was performed in 1997 in accordance with Section 300.415 of the National Contingency Plan (NCP) and Federal Facility Agreement (FFA) Section XIV to remove and dispose of contaminated vegetation from the unit. Due to the plant uptake of radiological constituents, vegetation became radiologically contaminated. As the vegetation died, the potential for contamination spreading due to wind and bioturbation increased, which warranted the time-critical removal action. No early actions were performed at LRSB.

Basis for Taking Action

The basis for taking action at the LRSB OU and the CRSB is that these waste units were determined to meet the criteria for the Plug-In ROD as demonstrated in the Technical Evaluation Report. Risk levels exceed $1x10^{-3}$ for an industrial worker scenario based on exposure to cesium-137 in the CRSB soils and cobalt-60 in LRSB soils. Additionally, strontium-90 was identified as a concern with respect to migration to groundwater at the LRSB OU.

The LRSB has been contaminated with radionuclides from past activities at SRS. Radiological risk assessments for humans are more conservative than ecological health risk assessments. Therefore, only human health risk evaluations were considered. The cumulative radiological risk to the industrial worker from the LRSB is $3x10^{-3}$, which exceeds the PTSM target threshold of $1x10^{-3}$. The primary risk driver is cobalt-60. PTSM is present to a depth of 0.3 m (1 ft) in LRSB. As stated in the TER (WSRC 2001a), the radiological activity of cobalt-60 will decline below the PTSM threshold by 2006.

The results of the contaminant migration analysis for the LRSB found that strontium-90, present in both the buffer area and in the basin, poses a potential threat to future groundwater.

CRSB Basin 2 PTSM is a result of cesium-137 contamination. The PTSM threshold was exceeded in the soil samples at 0.3 to 1.2 m (0 to 4 ft) below the basin bottom. A TER of radiological activities indicates that the cesium-137 will be below the PTSM threshold by 2002 (WSRC 2001c).

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 a Low Permeability Soil Cover for Radiological Contaminants in Soil* (WSRC 1999b) approved in October 1999. The process streamlined the normal CERCLA documentation process for units that were similar and met the criteria defined in the plug-in ROD. In lieu of Proposed Plan and ROD documents, an Explanation of Significant Difference (ESD) (WSRC 2000a) document was submitted and was approved in August 2000. The

approved ESD is the document that amends the approved plug-in ROD to include the LRSB OU and CRSB OU. Technical Evaluation Reports (TERs) (WSRC 2001a, WSRC 2001c) were prepared and verified that LRSB and CRSB Basin 2 met the plug-in ROD criteria.

After the original Plug-In Rod was signed, it was recognized that contaminants would be reduced to below PTSM levels by the year 2006 for LRSB and 2002 for CRSB Basin 2 from radioactive decay. The USDOE, the U.S. Environmental Protection Agency (USEPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) agreed that a low permeability soil cover with LUCs would effectively protect human health and the environment and in situ stabilization as prescribed in the Plug-in ROD would not be necessary. An amendment to the Plug-in ROD (WSRC 2002b) for LRSB and CRSB Basin 2 to alter the remedy was approved in October 2002.

As stated in the Plug-in ROD (WSRC 1999b), the following remedial action objectives (RAOs) were established for the LRSB and CRSB Basin 2 and are as follows:

- Prevent human exposure to contaminated basin soils (PTSM) by installing a low permeability soil cover. For soils present at PTSM levels, the remedy will also include implementing stabilization treatment to the extent practicable. Reduce risks to the future worker from surface soils (0.3 to 1.4 m [0 to 1 ft]) outside the basin by establishing remedial goals (RGs) for contaminants of concern (COCs) at concentrations equivalent to $1x10^{-6}$ for carcinogens and a hazard quotient of 1 for noncarcinogens or background (where background levels of COCs exceed $1x10^{-6}$).

- Prevent the release of COCs in soil to groundwater beneath the unit above maximum contaminant levels (MCLs) or risk-based concentrations (RBCs) (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 towards the surface.

The original selected remedy in the plug-in ROD consisted of institutional controls, in situ stabilization of PTSM, a low-permeability soil cover system, consolidation of contaminated soil, and grouting of pipelines. Table II-2 includes a discussion of the primary risk-drivers for LRSB and CRSB Basin 2, demonstrating that the risk levels will be less than the PTSM threshold by 2006 and 2002, respectively. As a result, an amendment to the plug-in remedy was prepared that did not require in-situ stabilization for the basin soils.

Per the Plug-in ROD as amended (WSRC 2002b), the selected remedial actions for LRSB and CRSB Basin 2 consisted of the following components:

- Consolidation of contaminated soil and pipelines into the basins;
- Installation of a low permeability soil cover designed to reduce water infiltration and to prevent human exposure to PTSM and prevent the release of COCs in the soil to groundwater beneath the unit above MCLs; and
- LUCs including a fence around the basins for the time period that the contaminated soil is considered PTSM and warning signs.

Per the Plug-in ROD as amended, periodic groundwater monitoring to confirm the soil cover effectiveness for the CRSB and LRSB will be addressed as part of the C-Area Groundwater OU and L-Area Southern Groundwater OU, respectively.

Remedy Implementation

Implementation of the selected remedy at the LRSB OU included the following activities:

- Consolidated approximately 47.1 m (157 ft) of a 15-cm (6-in) process pipe by grouting and along with a 3.75-cm (1.5-in) domestic water line transporting to LRSB. A 7.5-cm (3-in) HDPE pipe was grouted and left in place. The excavated areas were backfilled to grade and re-vegetated.
- Consolidated concrete pad, associated piping and handrails, contaminated chipped vegetation in LRSB. Consolidation of the soil outside the basins was not performed

because the soil did not exceed PTSM criteria, leachability RGs or surficial exposure RGs.

- Installed a 0.7-hectares (1.73-acres), 1.8-m (6-ft) minimum thick low permeability soil cover system over the LRSB consisting of three layers - grading fill, 0.6-m (2-ft) minimum thick low permeability soil and 45-cm (18-in) minimum thick vegetative common fill and topsoil. The low permeability layer was designed to qualitatively meet the $1x10^{-5}$ c/sec minimum hydraulic conductivity criteria.
- Established LUCs for 0.7-hectares (1.73 acres).

Implementation of the selected remedy at the CRSB OU included the following activities:

- Consolidation of contaminated soil outside the basins exceeding PTSM criteria, leachability remedial goals, or surficial exposure remedial goals. In accordance with the Unit-Specific Plug-In Technical Evaluation (WSRC 2000b), this action was not performed because the contaminated soil outside the basins did not exceed PTSM criteria, leachability remedial goals or surficial exposure remedial goals;
- In situ stabilization by grouting was used to address long-term PTSM soil that posed a risk in excess of $1x10^{-3}$ for future industrial workers;
- Installation of a 1.8-m (6-ft) minimum thick low permeability soil cover system over the basins to reduce water infiltration and to provide shielding to potential receptors on the surface (WSRC 2003). Although no contaminant migration COCs were identified that could impact groundwater in the future (1000 years), the soil cover system was designed with a 0.6-m (2-ft) minimum thick low permeability soil layer;
- Grouting of process piping to stabilize any potential contamination left inside and prevent access by small animals; and
- Establishment of institutional controls (i.e., LUCs).

System Operations/Operation and Maintenance

There are no system operation requirements for LRSB or CRSB Basin 2.

The following maintenance activities are ongoing as long as the waste remains a threat to human health or environment:

- Visual inspections for evidence of damage to the soil cover due to erosion or intrusion by burrowing animals are being performed annually as a minimum. The inspections also address upkeep of the vegetative cover and access control barriers (e.g., the warning signs, fence).
- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.
- LUCs including fencing and warning signs are being enforced to preclude access through the SRS Site/Use Site Clearance program and SRS site security.

The operation and maintenance (O&M) costs associated with the selected amended remedy for LRSB include O&M costs of the soil cover and institutional controls has an estimated present worth of $410,467 costs discounted at 3.9% per year for 30 years of maintenance activities. This number excludes CRSB Basin 2 costs, which are included in CRSB OU (Appendix H). Table II-3 compares the actual O&M costs over the last five years to the estimated costs from the ROD for the LRSB OU. The actual (O&M) cost since it became operable until FY2011 is $217,248.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at LRSB and CRSB Basin 2 are protective, the site is protective of human health and the environment. The PTSM in LRSB and CRSB Basin 2 has radioactively decayed to levels that no longer pose a $1x10^{-3}$ risk to future industrial workers. In accordance with the Remedial Action Implementation Plan (RAIP) for the LRSB (WSRC 2002a), risk to the future industrial workers will remain above $1x10^{-6}$ beyond the year 2033. Strontium-90 was identified as a contaminant migration COC at

LRSB; therefore remedial actions intended 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 OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment II-2 with the purpose of assessing the protectiveness of the remedy and functionality of the controls; and
- Reviewed changes in standards and to-be-considered guidance

Data Review

Groundwater monitoring well LSB-4 was sampled and analyzed for strontium-90 in the fourth quarter of 2012. The sampling was initiated based on the recommendations and follow-up actions for the LASG OU listed in Table JJ-6. The strontium-90 result was below the detection limit. While the paucity of data makes it infeasible to draw any definitive conclusions, the absence of strontium-90 in the groundwater would indicate 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.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on June 7, 2012 at the LRSB and CRSB Basin 2 and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The LRSB and CRSB Basin 2 were inspected by SRNS and USDOE personnel on June 7, 2012. No issues were identified for the LRSB and CRSB Basin 2 during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No problems regarding the remedy of this OU as implemented were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The low permeability soil cover with LUCs is effective in preventing human exposure and ecological receptors to contaminated media. LRSB and CRSB Basin 2 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 $1x10^{-3}$ by the year 2006 for LRSB and 2002 for CRSB Basin 2. The low permeability soil covers with institutional controls are still effective in preventing human exposure that could result in risk of $1x10^{-6}$ to a future industrial worker. A review of the inspection records for the 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) for LRSB 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) an 45 cm (18 inch) vegetative layer; and (3) a minimum slope of 3% to reduce infiltration.

- The effectiveness of the soil cover over the CRSB Basin 2 is addressed in the five-year remedy review for the CRSB OU. There were no contaminant migration COCs associated with the CRSB OU, therefore periodic groundwater monitoring the effectiveness of the soil cover as part of the C-Area Groundwater OU is not required.

- The technical evaluation of the groundwater monitoring data with respect to the performance of the cover system for the LRSB OU is provided in the L-Area Southern Groundwater OU remedy review (Appendix JJ).

The Land Use Control Implementation Plans for LRSB OU and CRSB Basin 2 govern LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2004 and WSRC 2003, respectively).

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or physical conditions identified in the ROD that call into question the protectiveness of the remedy.

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, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, March 2013, 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 LLC, 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 2007 through 2011 (annually)

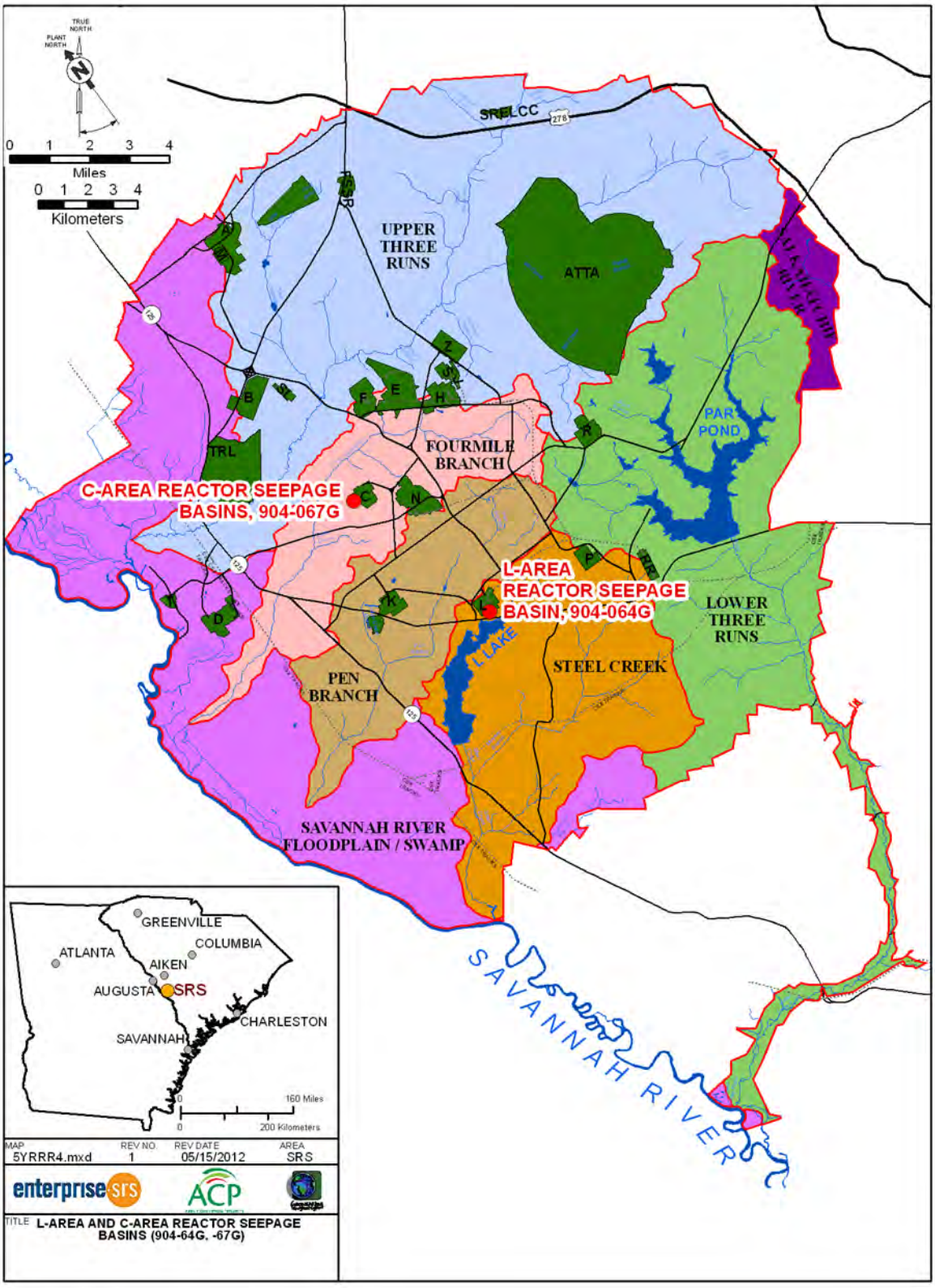


Figure II-1. Location of C&L Reactor Seepage Basins at SRS

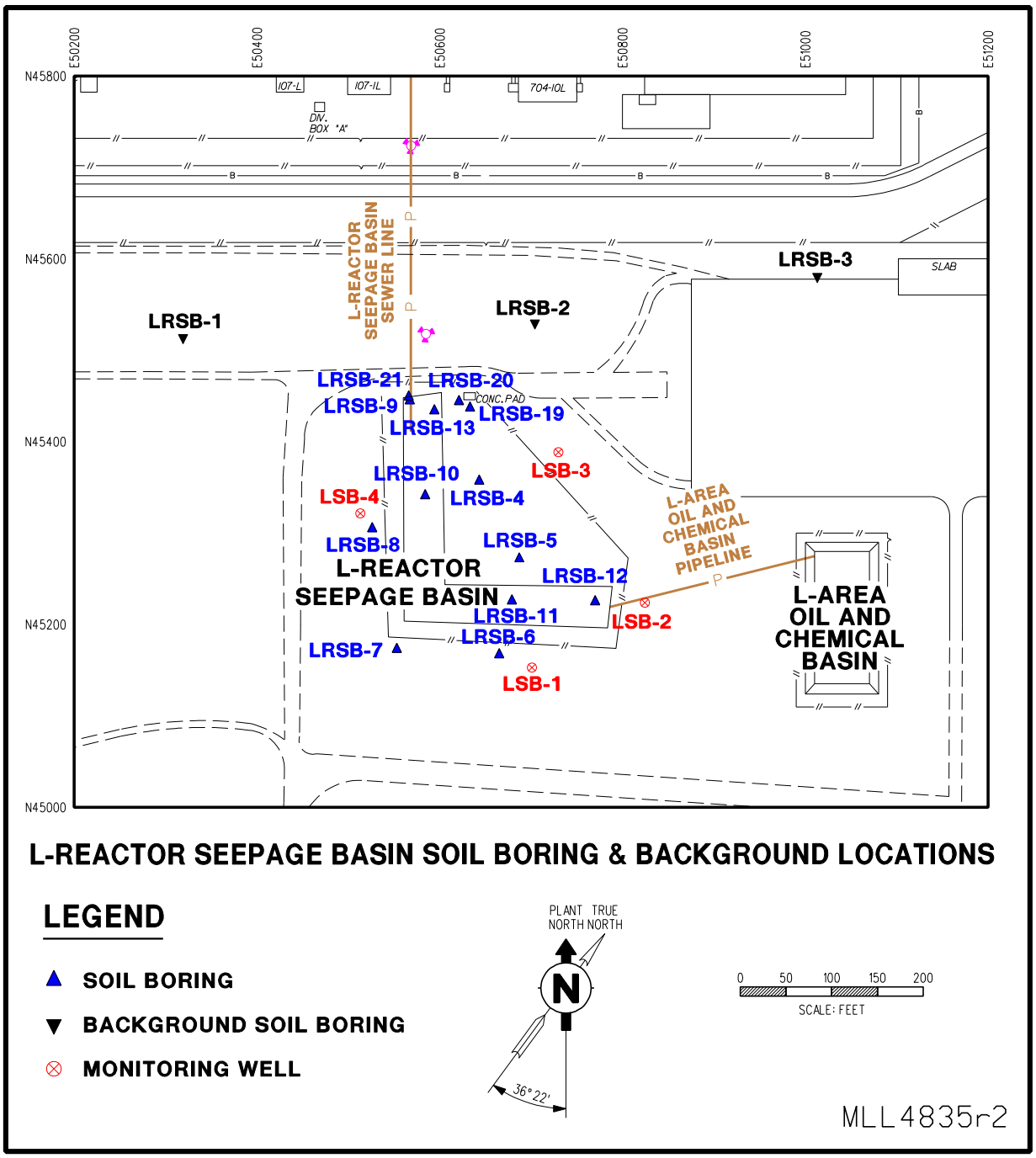


Figure II-2. Layout of the LRSB

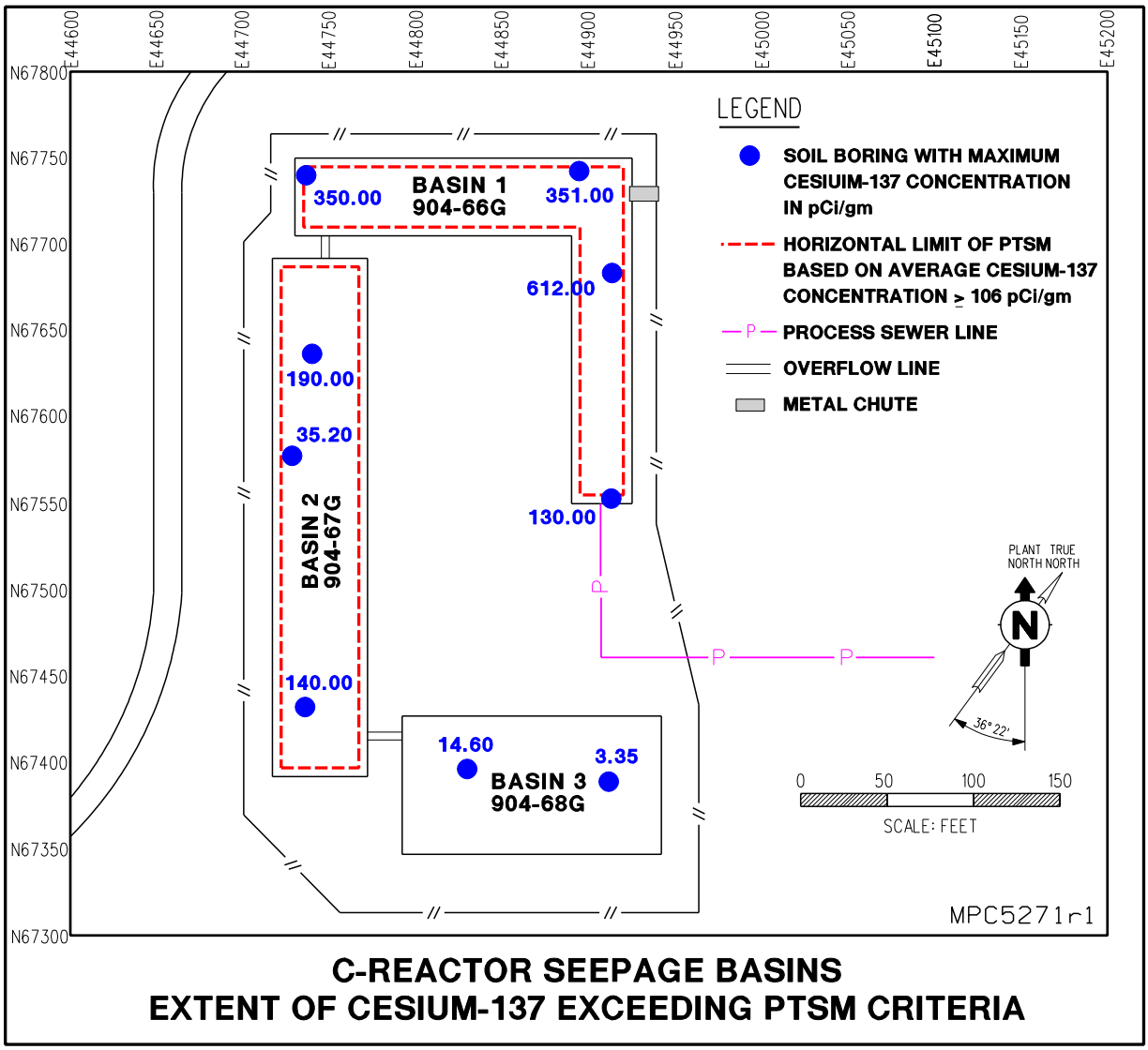


Figure II-3. Layout of the CRSB



Figure II-4. Before, During, and After Remedial Action at LRSB



Figure II-5. Before, During, and After Remedial Action at CRSB Basin #2



Figure II-6. Current Photo after Remedial Action (2012) (Top Photo LRSB OU, Bottom Photo CRSB OU)

Table II-1. Chronology of OU Events

Event	Date
RI Start/Complete	July 1998/February 13, 2002
Time-Critical Removal Action Start/Complete	1997 / 1997
Plug-in Record of Decision (ROD) issuance	November 29, 1999
CRSB ESD Issuance	August 31, 2000
CRSB and LRSB ROD Amendment	October 23, 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 Review	February 4, 2009

Table II-2. Risk Drivers in LRSB and CRSB Operable Unit 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 $3x10^{-3}$. Radionuclides in the soil were expected to decay below PTSM level (risk $>1x10^{-3}$) by 2006, but will still be above human health limits ($1x10^{-6}$) for many years. A low permeability soil cover and institutional controls can effectively protect human receptors.
CRSB #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 $2x10^{-3}$. The radionuclides in the soil were expected to decay below PTSM level (risk $>1x10^{-3}$) by 2002, but will still be above human health limits ($1x10^{-6}$) for many years. A low permeability soil cover and institutional controls can effectively protect human receptors.

Table II-3. Comparison of Actual vs. Estimated O&M Costs for the LRSB OU

	FY07	FY08	FY09	FY10	FY11	5 year Total
O&M Actual	$7,000	$8,000	$4,200	$4,400	$3,800	$27,400
O&M Estimated*	$23,450	$23,450	$23,450	$23,450	$23,450	$117,250

*Source of estimate: WSRC-RP-2002-4063

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Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2

I. SITE INFORMATION			
Site Name:	**L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2**	**Date of Inspection:**	**06/07/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #76**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**85°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 06/07/2012 (Date)
   Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for L-Area Reactor Seepage Basin*, ER-IDS-019-025, and *Field Inspection Checklist for C-Area Reactor Seepage Basin*, ER-IDS-019-013.

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☒ Location shown on site map ☒ Gates secured ☒ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(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.) Walk-through

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey monuments 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 II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(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:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☐ Cover properly established ☒ No signs of stress

Areal extent Depth

Remarks:

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A
Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident
Areal extent Depth
Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent
☐ Ponding ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent
Remarks:

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☒ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment II-1. Five-Year Review Site Inspection Checklist – L-Area Reactor Seepage Basin (904-64G) Operable Unit and C-Area Reactor Seepage Basin (904-67G) Basin 2 *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The remedy for this OU is institutional controls, contaminated soil consolidation and pipeline grouting, and a soil cover system. PTSM in the LRSB has radioactively decayed to levels that no longer pose a 1 X 10^{-3} risk to future industrial workers approximately 2006 for LRSB. PTSM in CRSB basin 2 has radioactively decayed to levels that no longer pose a 1 x 10^{-3} risk to future industrial workers as of 2002. The remedy seems to be fully established and functioning as designed.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of annual site inspections and site maintenance of the low permeability soil cover, current access controls, and the SRS Site Use and Site Clearance Program are effectively maintaining the long-term protectiveness of the remedy.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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L-AREA SOUTHERN GROUNDWATER OPERABLE UNIT

I. Introduction

This report is the second five-year review of the remedial actions implemented at the L-Area Southern Groundwater (LASG) Operable Unit (OU) which is located at the Savannah River Site (SRS). This report documents the results of the review conducted from August 2012 through September 2012. Contaminants have been left in place at the LASG OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the LASG OU is protective of human health and the environment.

II. OU Chronology

Table JJ-1 lists the chronology of site events for the LASG OU.

III. Background

The LASG OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media of concern is local groundwater. Surface water downgradient of the LASG OU is monitored to evaluate the effectiveness of the selected remedy.

As stated in the LASG OU Record of Decision (ROD), the scope of the LASG OU remedial action is limited to local groundwater in three known contaminated plumes, identified as a tritium plume west of the reactor and two commingled VOC and tritium plumes south of the reactor (WSRC 2007a).

Physical Characteristics

L Area is located in the south central portion of the SRS in Barnwell County, South Carolina (Figure JJ-1). LASG OU encompasses all of the groundwater from the L-Area

groundwater divide south to L-Lake. The original pre-work plan characterization LASG OU outline covered about 508 hectares (1,250 acres) and included several remediated/depleted source units, which supported past production activities (WSRC 2005). Groundwater characterization included the review of analytical data from 93 monitoring wells and 109 cone penetrometer technology (CPT) locations within the LASG OU (Figure JJ-3) between January 2000 and January 2004 (most of the sampling occurred in 2000).

Operation activities in L Area have resulted in three contaminant plumes in the local groundwater:

- Western tritium plume, which originated at the L-Area Emergency Retention Basin (LAERB);
- Southwest commingled VOCs and tritium plume, which originated in the vicinity of the L-Area Disassembly Basin (LADB); and
- Southeast commingled VOCs and tritium plume, with likely sources from the L-Area Reactor Seepage Basin (LRSB), L-Area Oil and Chemical Basin (LAOCB), and L-Area Hot Spot (LAHS).

There are no active sources of groundwater contamination in the LASG OU. Historical sources have been remediated, depleted, or reconditioned for new missions.

Land and Resource Use

The land use control boundaries for LASG OU are predominantly outside of the industrial area for L-Area. However, shallow groundwater and surface water at SRS are not used for drinking water, hygiene, recreation, and process water. According to the Savannah River Site Future Use Project Report (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for this OU is reasonably anticipated to be industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The L-Area Reactor achieved criticality in August 1954 and operated from 1954 to 1968 and 1984 to 1988. Tritium was produced in the reactor and the volatile organic compounds (VOCs) were used as solvents and degreasers. Past activities at or near these source units listed above (LAERB, LADB, LRSB, LAOCB, and LAHS) have resulted in groundwater contamination in LASG OU. The tritium and VOC plumes are shown in Figure JJ-2.

The primary historical sources of contamination in the groundwater in the LASG OU have been remediated or depleted. Subsurface soils beneath these remediated waste sites were the secondary sources of groundwater contamination. Details of the history of contamination and remedial activities the LRSB, LAOCB, and LASH can be found in the following appendices of this Five-Year Remedy Review: LRSB – Appendix II, LAOCB – Appendix HH, and LAHS – Appendix GG. The contamination history of the additional two source units are discussed below:

- The LAERB is no longer active and was never used as designed; tritiated water was released to the basin during testing in the 1980s. Rainwater flushed the original tritium source out of the unit into the groundwater through the permeable bottom of the basin.

- Groundwater in the vicinity of the LADB was previously contaminated by leaks and spills associated with previous operations. Upgrades to equipment and handling processes support its current mission as an active facility. Current data indicate the LADB is not an active source of groundwater contamination as tritium concentrations in adjacent wells have dramatically decreased from historical values. The LADB is being monitored for any new releases related to its new mission under a separate program.

Initial Response

There was no initial response for the LASG OU. The response actions for the LRSB, LAOCB, and LAHS OUs, which were likely sources to groundwater, can be found in the

following appendices of this Five-Year Remedy Review: LRSB – Appendix II, LAOCB – Appendix HH, and LAHS – Appendix GG.

Basis for Taking Action

The potential exposure to or ingestion of groundwater and surface water contaminated above MCLs poses a potential increased risk of cancer to human receptors and is the basis for taking action at the LASG OU.

The refined constituents of concern (RCOCs) for groundwater at LASG OU are tritium, tetrachloroethylene (PCE), and trichloroethylene (TCE). The highest contaminant levels observed in local groundwater, broken into three groups (Pre- remedial investigation [RI], RI, and Post-RI), are summarized in Table JJ-2; CPT data are included in the pre-RI data set. The remedial goals (RGs) for LASG OU are the MCLs as listed in Table JJ-2.

The bulk of contaminated groundwater is confined to the portion of the Upper Three Runs aquifer above the tan clay. Figure JJ-2 shows the LASG OU plumes. The western plume is only contaminated with tritium while the two plumes directly downgradient southwest and southeast of L Area are contaminated with tritium, PCE, and TCE. The analytical results for these three constituents are summarized in Table JJ-2. Surface water sample stations are shown on Figure JJ-2 and their results are listed in Table JJ-3; SC26 and SC27 are at the L-Lake dam standpipe and spillway, respectively. PCE and TCE have not been detected in the surface water, except once in 2010 at station SC24, but at low levels below 1 μg/L.

The only pathway with RCOCs is to future industrial workers and residents. The exposure routes are ingestion, dermal contact, and inhalation. This pathway will only be possible if institutional controls are not maintained. Groundwater contamination was evaluated against MCLs based on South Carolina Department of Health and Environmental Control (SCDHEC) groundwater regulation SCR 61-58.5, which is protective for both future residential and future industrial scenarios.

IV. Remedial Actions

Remedy Selection

The following remedial action objectives (RAOs) have been identified for the LASG OU:

- Prevent human exposure to groundwater above MCLs.
- Treat and/or mitigate groundwater contaminated above MCLs to reduce the discharge of groundwater exceeding MCLs to L-Lake.

As stated in the ROD (WSRC 2007a), the selected remedial action for LASG OU will address both of the commingled VOCs and tritium plumes of L-Area and the tritium plume west of the L Area by the following :

- Implement monitored natural attenuation (MNA).
- Implement land use controls (LUCs) to minimize the potential for human exposure to contaminated groundwater until MCLs are achieved.

Remedy Implementation

The remedial action is meeting the RAOs, by implementing the following activities:

- Established a groundwater monitoring network by installing ten new monitoring wells (WSRC 2007b).
- Established a MNA program to monitor natural attenuation processes (dispersion, dilution, and radioactive decay) which are occurring at the LASG OU and are effective in reducing contaminant concentrations below remedial goals. Twenty-six groundwater monitoring wells and five surface water monitoring stations (Figure JJ-2) make up the monitoring network. Details of the requirements for MNA monitoring at the LASG OU are presented in the Effectiveness Monitoring Plan (EMP) (WSRC 2008).
- There are no active, continuing sources of groundwater contamination at the LASG OU. As stated in the EMP, one of the groundwater monitoring data quality objectives is ensuring that there are no releases of contaminants from unknown or existing

sources and that remediated or depleted sources are under control. The ROD or post-ROD documents for LRSB (WSRC 2002) and LAOCB (WSRC 1999b) both required that evaluation of the effectiveness of those remedies would be addressed through monitoring implemented as part of the LASG OU.

- Established land use controls for 387 hectares (952 acres), which includes implementing institutional controls at LASG OU. This consists of general site access controls (gates, fences, and patrol at the site boundary), use restrictions via the SRS Site Use/Site Clearance program, and future deed restrictions and notifications to prevent exposure of human receptors to contaminated groundwater if property is transferred to non-federal ownership.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Long-term monitoring of groundwater conditions in the plumes and surface water conditions in L-Lake, including maintenance of the monitoring network. The results are reported via biennial Effectiveness Monitoring Reports (EMRs). MNA will be performed until RGs are achieved (estimated for approximately 90 years in approximately 2090).
- LUCs are being enforced for all groundwater contaminated above MCLs within the OU and under adjacent portions of L-Lake. Restrictions on the use of groundwater within the LUC outline will be enforced as long as contaminant levels exceed MCLs.

The estimated operation and maintenance (O&M) costs associated with the selected remedy for LASG include O&M costs of MNA and institutional controls has a ROD estimated present worth of $3,329,000 discounted between 2.1% and 3.9% per year for 90 years of maintenance activities. The actual O&M cost from O&M start in FY07 to and including FY11 is $189,100, compared to an estimated cost of $252,520, as shown in Table JJ-4.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedial actions at LASG OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being controlled by institutional controls that have been functioning properly.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the five-year review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed implementation of the remedial action;
- Reviewed all process and performance monitoring data provided by biennial EMRs and provided a technical assessment of whether MNA is functioning as intended by the ROD;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment JJ-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

Two biennial EMRs have been submitted to date and were reviewed (SRNS 2010; SRNS 2012). These reports include all sample results for tritium, PCE, and TCE collected from monitoring wells and surface water stations during 2008 through 2011, time-series plots at each station since 1993, and plume maps.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, and with George Joyner, O&M Site Manager, on May 21, 2013 at the O&M organization offices. The

LASG OU was inspected by SRNS and USDOE personnel on May 21, 2013. No issues were identified for the LASG OU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is expected to function as intended as demonstrated below:

- The selected remedy component of LUCs is effective in preventing human exposure to groundwater above MCLs. The Land Use Control Implementation Plan for LASG OU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2009). All LUC objectives are being met.
- The selected remedy (MNA) is effective in treating groundwater to reduce the amount of discharge of groundwater exceeding MCLs to L-Lake as reported in the biennial EMRs. The sources of the groundwater contamination have been depleted. The processes of dispersion, dilution, and radioactive decay are lowering contaminant levels at LASG OU.

Tritium levels have decreased in source zone monitoring wells dramatically over the last 10 to 15 years with values dropping from over 1,000 pCi/mL to under 100 pCi/mL. A time-series plot of one of these wells, LAW 2, is provided in Figure JJ-4. Contaminated groundwater discharging to L-Lake quickly mixes and tritium levels exiting L-Lake are well below the MCL of 20 pCi/mL, as shown is surface water results from station SC27 in Table JJ-3. All LUC boundary wells remain non-detect or of low concentrations less than the MCL. All three tritium plumes (Figure JJ-2) are shrinking and migrating as expected from modeling (WSRC 2004).

The PCE and TCE plumes have decreased in size over the last 10 years. Contaminant levels are not increasing (Figure JJ-5) and the plumes are progressing as expected from modeling (WSRC 2004). L-Lake surface water results have remained well below the

MCL

(5 µg/L) for PCE and TCE, with the majority of the results being non-detect. These results are due to the rapid dispersion and volatilization of VOCs within the lake. LUC boundary wells remain non-detect for VOCs.

More detailed discussions on the tritium and VOC plumes can found in the previous two biennial EMRs from 2010 and 2012 respectively (SRNS 2010; SRNS 2012).

Modeling predicted that groundwater would remain contaminated for approximately 90 years (until approximately 2090) (WSRC 2004). MNA remains the best option for the contaminated groundwater as contaminant levels are decreasing, the plumes are decreasing in size, and contaminant levels in L-Lake are not discharging above MCLs and are showing a decreasing trend.

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. The MCLs for tritium, PCE, and TCE have remained the same since the remedies were implemented. There have been no changes in standards or physical conditions of the LASG OU that would affect the protectiveness of the remedy.

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

Issues related to the LASG OU are presented in table JJ-5.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions for the LASG OU are presented in Table JJ-6.

X. Protectiveness Statement(s)

The remedy at the LASG 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., land use controls) to prevent exposure to or ingestion of contaminated groundwater. These land use controls include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the LASG OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1999b. *Corrective Measures Implementation/Remedial Design Report/Remedial Action Work Plan (CMI/RDR/RAWP) for L-Area Oil and Chemical Basin (904-83G) (U)*, WSRC-RP-97-844, Revision 1.4, Westinghouse Savannah River Company, LLC, 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, LLC, Savannah River Site, Aiken, SC

WSRC, 2004. *Groundwater Flow and Transport Model of the L-Area Southern Groundwater Operable Unit (U)*, WSRC-RP-2004-4082, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2005. *RCRA Facility Investigation/Remedial Investigation for the L-Area Southern Groundwater Operable Unit (U)*, WSRC-RP-2003-4171, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007a. *Record of Decision for the L-Area Southern Groundwater Operable Unit (NBN) (U),* WSRC-RP-2006-4052, Revision 1.1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007b. *Corrective Measures Implementation/ Remedial Action Implementation Plan for the L-Area Southern Groundwater Operable Unit (NBN) (U),* WSRC-RP-2007-4050*,* Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Monitored Natural Attenuation Effectiveness Monitoring Plan for the L-Area Southern Groundwater Operable Unit (NBN) (U)*, WSRC-RP-2007-4048, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2009. *Land Use Control Implementation Plan for L-Area Southern Groundwater Operable Unit (NBN) (U),* WSRC-RP-2007-4049, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

SRNS, 2010. *Biennial Effectiveness Monitoring Report for Monitored Natural Attenuation at the L-Area Southern Groundwater Operable Unit (U) 2008 through 2009*, SRNS-RP-2010-00989, Revision 1, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2012. *Biennial Effectiveness Monitoring Report for Monitored Natural Attenuation at the L-Area Southern Groundwater Operable Unit (U) 2010 through 2011*, SRNS-RP-2012-00169, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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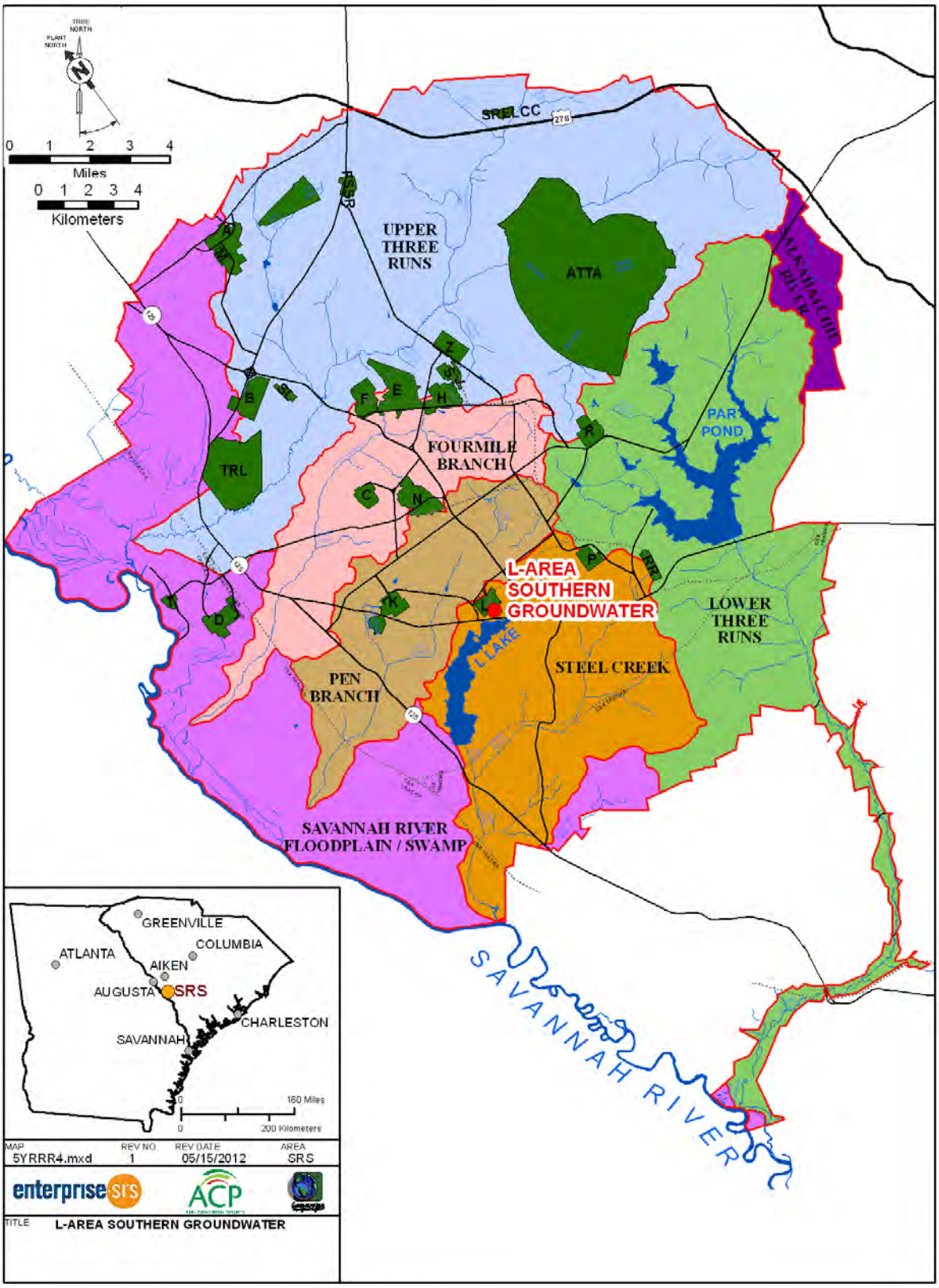


Figure JJ-1. Location of the L-Area Southern Groundwater OU at SRS

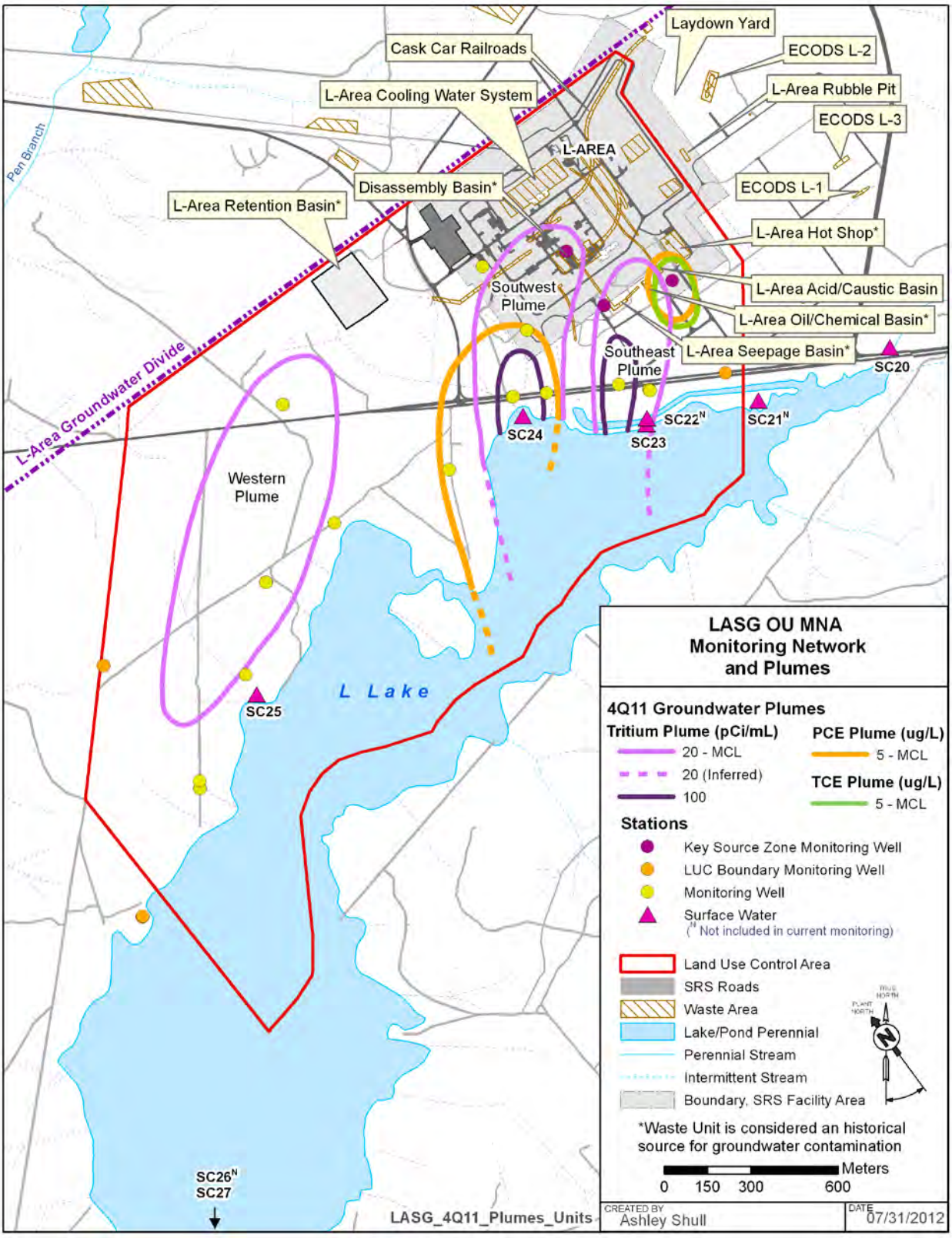


Figure JJ-2. Layout of the L-Area Southern Groundwater Operable Unit with Plumes

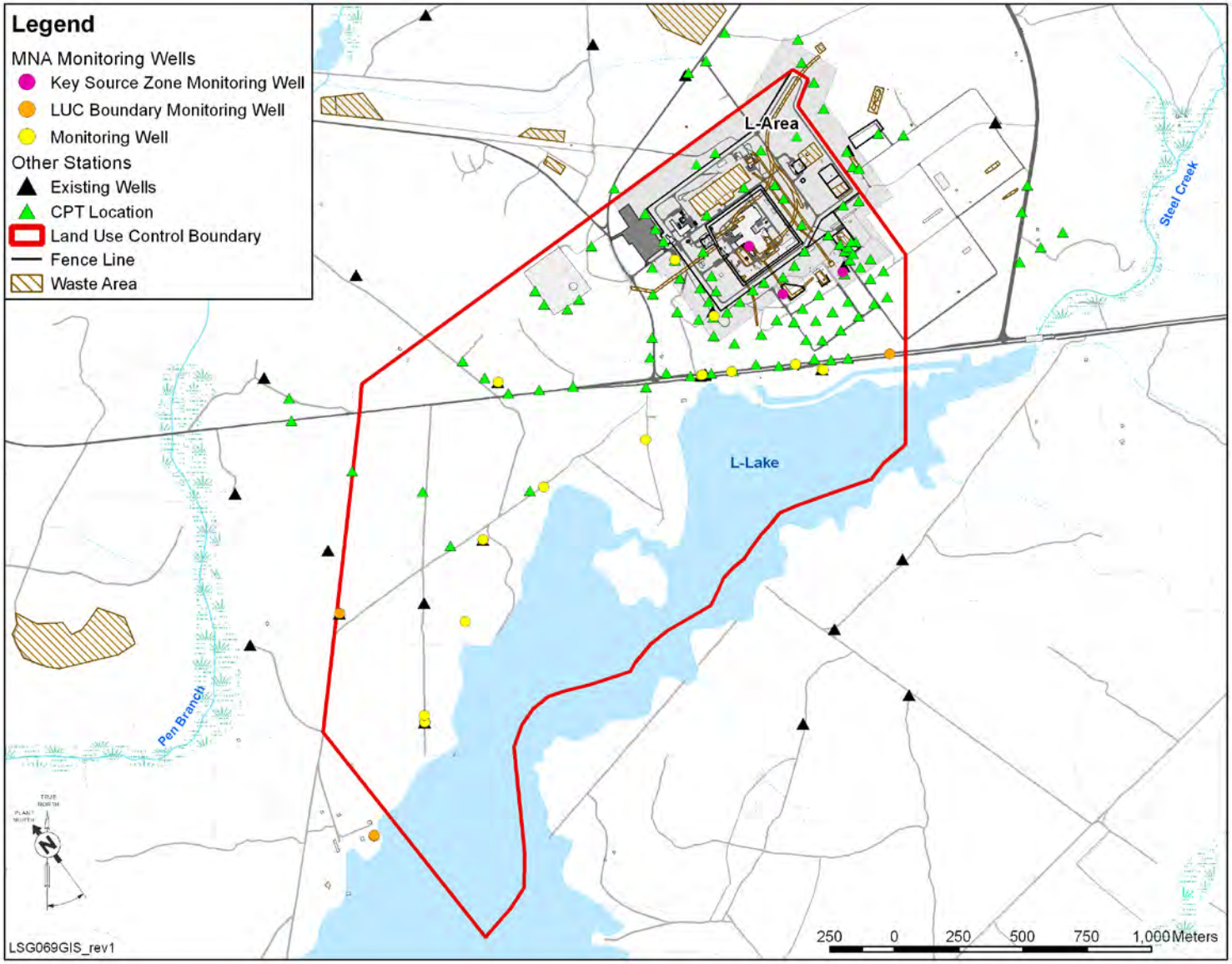


Figure JJ-3. Well and CPT Coverage Map

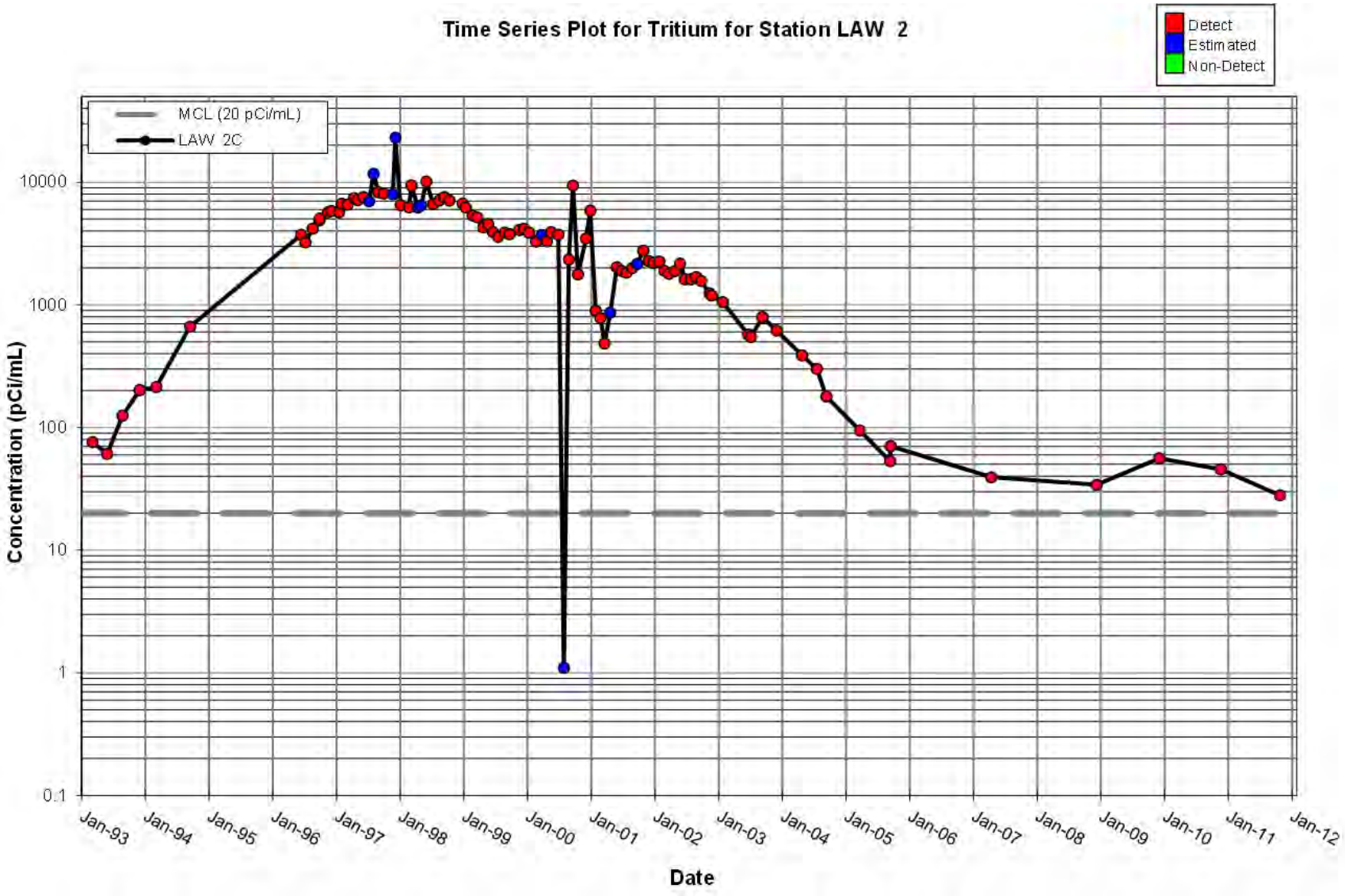


Figure JJ-4. Time Series Plot for Tritium for Source Zone Well LAW 2

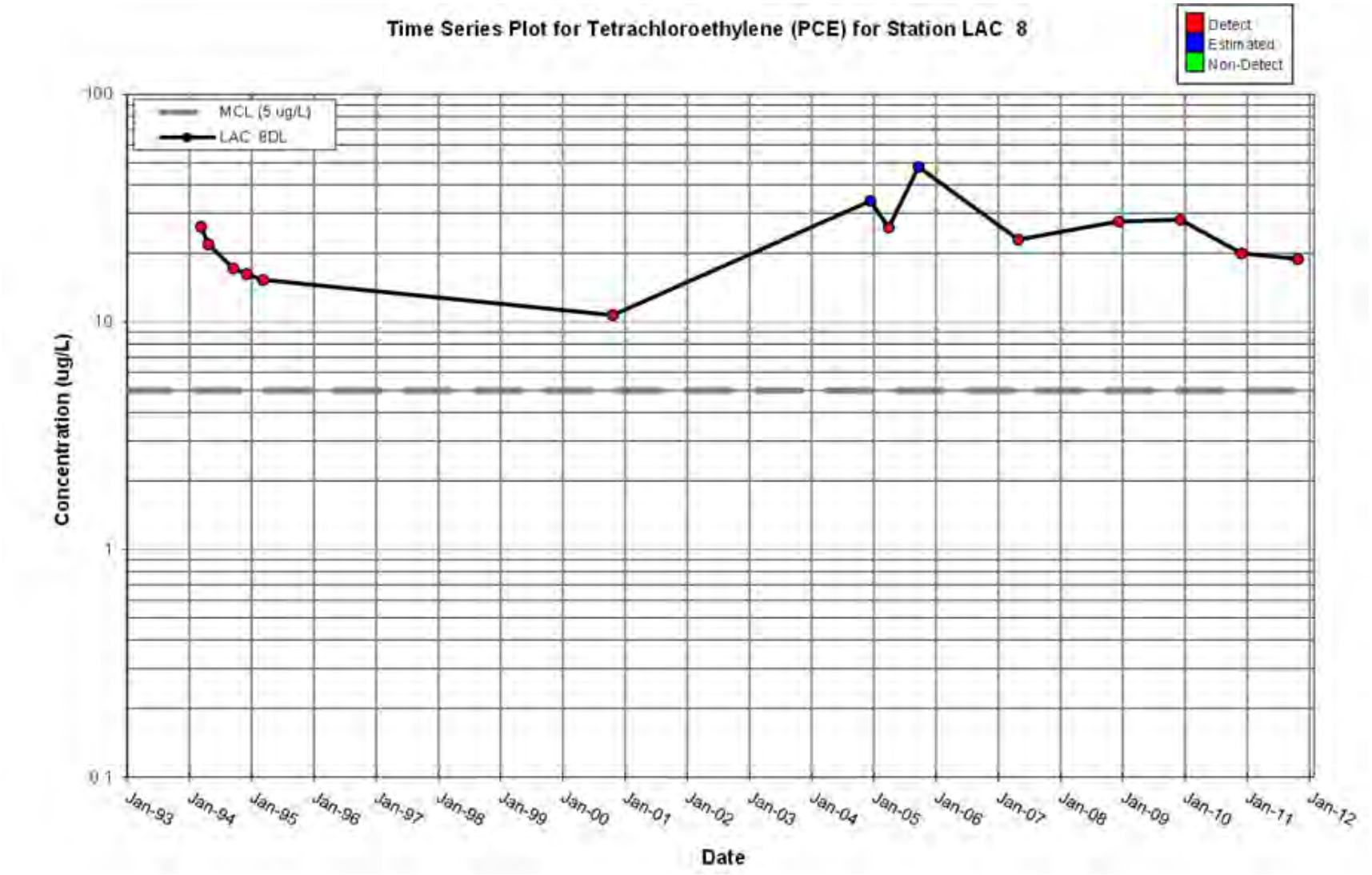


Figure JJ-5. Time Series Plot for PCE for Source Zone Well LAC 8DL

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Table JJ-1. Chronology of Events

Event	Date
Remedial Investigation (RI) Start / Complete	August 2, 2000 / July 26, 2004
Record of Decision (ROD) Issuance	April 26, 2007
Remedial Action Construction Start / Complete	February 25, 2008 / May 7, 2008
Remedial Action Operations Start / Complete	December 8, 2008 / on-going
Previous Five-Year Review	February 4, 2009

Table JJ-2. MCL Listing for LASG and Groundwater Results Summary

RCOC	MCL	Pre-RI 1981 - 1999	RI Jan '00 – Jul '04	Post-RI Jul 26, 2004 - present
Range of dates for RI Work		**Prior to 2001**	**2001 - 2004**	**2005 - 2011**
Tritium (ρCi/mL)	20	26,200	5,850	1230
PCE (µg/L)	5	165	58	60
TCE (µg/L)	5	124	9	21

Table JJ-3. Analytical Results for Tritium (ρCi/mL) in L-Lake

Station ID	Oct 2005	Jun 2006	Dec 2006	May 2007	Dec 2007	Dec 2008	Dec 2009	Dec 2010	Oct 2011
SC20	16.5	14.2	**58.1**	14.2	18.9	**20.5**	**58.2**	**49.2**	**54.5**
SC21	14.3	13.9	14.2	13.8	NS	NS	NS	NS	NS
SC22	J 0.984	2.14	J 2.1	4.27	NS	NS	NS	NS	NS
SC23	**30**	19.5	**234**	**33.5**	11.6	**54.9**	ND	J 0.558	1.34
SC24	**22.1**	**53.2**	**257**	**34.3**	**30.7**	**47.7**	**78.3**	**145**	**28.9**
SC25	13.3	9.8	12	11.9	8.98	5.17	6.41	7.2	6.49
SC26	11.3	12.9	12.8	12.7	NS	NS	NS	NS	NS
SC27	11.9	11.9	9.24	12	10	8.17	6.22	6.94	6.88

J: Qualifier on a value indicates that the analyte was positively identified in the sample at a concentration below the quantitation limit; the reported value is estimated. NS: Not Sampled. ND: Not Detected. Note: Results in bold face type exceed the 20 pCi/mL MCL for tritium.

Table JJ-4. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	4,200	75,100	34,300	36,400	39,000	189,100
Total ROD Estimated Direct O&M Costs	n/a	100,600	50,640	50,640	50,640	252,520

Table JJ-5. Issues Identified for LASG OU

Issue*	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
In the Plug-in ROD Amendment for the CRSB and LRSB (WSRC-RP-2002-4063), the text stated that periodic groundwater monitoring to confirm the soil cover effectiveness for the LRSB will be addressed as part of the LASG OU. Strontium-90, which was identified as a contaminant migration COC for the LRSB, is not being monitored in any wells downgradient of the LRSB as part of the LASG MNA remedy.	N	N
In the CMI/RDR/RAWP (WSRC-RP-97-844) for the LAOCB, the text indicated that new wells installed adjacent to the LAOCB would be used in conjunction with existing downgradient wells to monitor the performance of the LAOCB remedial action. Determination of specific well locations, sampling frequency, and analytical suites will be performed under the LASG OU. No monitoring wells immediately downgradient of LAOCB are currently included in the LASG OU monitoring well network. The effectiveness of the remedy with respect to impact to groundwater cannot be evaluated with respect to the radionuclides/COCs that were detected in the LAOCB soils.	N	N

* The additional sampling to be conducted for LRSB and LAOCB is being implemented under the LASG OU monitoring program to verify the effectiveness of the surface units' remedies, not to evaluate the effectiveness of the LASG OU MNA remedy.

Table JJ-6. Recommendations and Follow-up Actions for LASG OU

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date*	Affects Protectiveness? (Y/N)	
					Current	Future
Strontium-90 is not being monitored in LASG OU wells.	Add strontium-90 to analyte list for monitoring well LSB-4 with a monitoring frequency of every 5 years to verify the effectiveness of the LRSB remedy.	DOE	SCDHEC/ EPA	June 2017	N	N
Radionuclide constituents in LAOCB soils are not being monitored in the LASG OU monitoring well network.	Two wells, LCO 2DL (upgradient) and LCO 6DL (downgradient), will be sampled and analyzed for the following constituents detected in LAOCB soils (carbon-14, cobalt-60, strontium-90, tritium, non-volatile beta, and gross-alpha with uranium isotopes analyzed if gross-alpha exceeds the trigger limit of 15 pCi/L) The monitoring frequency should be every 5 years to verify the effectiveness of the LAOCB remedy.	DOE	SCDHEC/ EPA	June 2017	N	N
Optimization – Sample Analysis	Add VOC analyses to well LSW029DL to bound the PCE Plume	DOE	SCDHEC/ EPA	9/18/12	N	N
Optimization – Well Sampling	Reduce sampling of 19 groundwater wells (excluding Key Source Zone Wells and 4 VOC analyzed wells) from annually to biennially.	DOE	SCDHEC/ EPA	9/18/12	N	N
Optimization - Reporting	Reduce reporting frequency from a 2-year to a 4-year cycle. An interim 2-yr data summary report in letter format will be submitted.	DOE	SCDHEC/ EPA	9/18/12	N	N

*The optimization items have been incorporated into the 2012 Biennial Effectiveness Monitoring Report (SRNS 2012) and were discussed with SCDHEC and US EPA in a meeting on 9/18/2012.

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Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit

I. SITE INFORMATION			
Site Name:	**L-Area Southern Groundwater Operable Unit**	**Date of Inspection:**	**05/21/2013**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #31**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**70°F and cloudy**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 05/21/2013 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/21/2013 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: South Carolina Department of Health and Environmental Control

Contact: Heather Cathcart (Name) | Federal Remediation Coord. (Title) | 1/16/13 (Date) | 803-896-4165 (Phone No.)

Problems/Suggestions: ☐ Report Attached No issues identified.

Agency: _____

Contact: _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

Agency: _____

Contact: _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

4. Other Interviews *(Optional):* ☐ Report Attached

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Monitoring wells are inspected per ER-SOP-011, "ACP Monitoring Well Inspection (U)"

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

1. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

2. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

3. 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:

4. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

5. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

9. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☒ N/A

Remarks: Signs at this site are in good condition._____

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater 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.) Walk-throughs

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 5/21/13 (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 orange balls are present 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 JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater 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:

VII. COVER SYSTEMS ☐ 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.

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Remarks:_____

_____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident

Areal extent_____ Depth_____

Remarks:_____

_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A

☐ Vegetation does not impede flow

Areal extent_____ Type_____

Remarks:_____

_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent_____ Depth_____

Remarks:_____

_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A

Remarks:_____

_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident

Areal extent_____ Depth_____

Remarks:_____

_____

2. Performance Monitoring:

Type of Monitoring_____ ☐ Performance not monitored

Frequency_____ ☐ Evidence of breaching Head Differential_____

Remarks:_____

_____

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: _____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks: _____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks: _____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks: _____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks: _____

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: All MNA groundwater monitoring wells were inspected. All well identification signs were in good condition.

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

Attachment JJ-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Groundwater monitoring indicates the remedial action was successful. MNA remains the best option for the contaminated groundwater as contaminant levels are decreasing, the plumes are decreasing in size, and contaminant levels in L-Lake are not discharging above MCLs and are showing a decreasing trend.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The protectiveness of the completed remedial action is being monitored by continued groundwater sampling. The O&M procedures are effectively maintaining the monitoring wells. The wells are properly secured/locked, functioning and are in good condition. Institutional controls effectively prevent unauthorized access to the groundwater and include physical access controls to SRS (fences, guards, security patrols, etc.); administrative controls (SRS is a secured government facility with land use restrictions); and use controls (SRS Site Use/Site Clearance Program).
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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M-AREA HAZARDOUS WASTE MANAGEMENT FACILITY OPERABLE UNIT

I. Introduction

This report is the third five-year review for the M-Area Hazardous Waste Management Facility (904-51G, -112G) (MHWMF) Operable Unit (OU). The review was conducted from August 2012 through September 2012. The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, a separate review of the RCRA Corrective Action is not duplicated in this document. Contaminants have been left in place at the MHWMF OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the MHWMF OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table KK-1 lists the chronology of site events for the MHWMF OU.

III. Background

MHWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the MHWMF OU is soil. Groundwater is not addressed under this OU. Per the Interim Record of Decision (IROD) (WSRC 1992b), the MHWMF groundwater is being addressed under the A/M-Area Groundwater OU.

Physical Characteristics

The MHWMF is located in M Area near the northwest edge of SRS (Figure KK-1). The nearest site boundary is approximately 1,740 m (5,800 ft) northwest of this OU. The MHWMF has been designated as a source-specific OU within the A/M Area

Fundamental Study Area. The MHWMF consists of an unlined surface impoundment known as the M-Area Settling Basin (904-51G), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina Bay known as the Lost Lake (904-112G) (Figure KK-2).

The settling basin dimensions were approximately 99 m (330 ft) by 84 m (280 ft) (surface dimensions) by 5.1 m (17 ft) deep with a volumetric capacity of approximately 8,000,000 gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the SRS (SRNS 2011) designates the MHWMF OU as being within an industrial area. The future land use for the MHWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The M-Area Settling Basin was constructed in 1958 to settle out metals (primarily uranium, nickel, lead, and aluminum) discharged from M-Area manufacturing facilities for nuclear fuel components and research facilities. The manufacturing processes consisted of aluminum-forming and metal-finishing processes used to produce fuel and targets for the SRS reactors. Waste effluents were discharged from three production buildings and two support laboratories to a settling basin through an underground process sewer line. Cracks in the sewer line allowed some of the effluent to leak into the ground, contaminating underlying soils. The pipeline was slip-lined in 1983 after the cracks were discovered. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued.

The volume of waste within the settling basin was estimated to be 28,920 m^3 (37,800 yd^3). The volume of contaminated soils and dried sludge in the overflow ditch,

seepage area, process sewer line, and Lost Lake was estimated to be 30,370 m^3 (39,700 yd^3).

Initial Response

Contamination was detected in groundwater, surface water, soil, sediments, and air and evaluated in a 1985 risk analysis, which was used to develop closure alternatives. Closure of the MHWMF OU was initiated in 1988. The MHWMF OU was closed by removal and treatment of any standing water remaining in the basin; discharge of effluent to the NPDES permitted M-004 Outfall; excavation, dewatering, and stabilization of the basin sludge with Portland cement; placement, consolidation, and compaction of stabilized sludge in the basin; excavation of a portion of the process sewer line and the contaminated soils associated with the sewer line, drainage ditch, seepage area, and Lost Lake; placement and compaction of contaminated materials in the basin; construction of a low permeability cap over the settling basin and restoration of the area. The drainage ditch soils were excavated and stabilized with cement in the basin during closure activities.

The MHWMF was certified closed in 1990 and was accepted by the South Carolina Department of Health and Environmental Control (SCDHEC) in 1991 as being in compliance with RCRA requirements.

Basis for Taking Action

The MHWMF was subject to closure under South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79-265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (WSRC 1992a). Per the approved SRS Part B Permit (SCDHEC 2003), post-closure care is regulated under SCHWMR R.61-79-264.

Characterization efforts prior to the IROD (WSRC 1992b) indicated contamination was present in basin surface water, basin soil, basin sludge, overflow ditch soils/sediments, seepage area soils/sediments, and Lost Lake soils/sediments. The major contaminants identified were nitrate as nitrogen, phosphate, sulfate, chloride, sodium, aluminum,

nickel, uranium, lead, trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane (WSRC 1992c).

IV. Remedial Actions

Remedy Selection

As stated in the IROD (WSRC 1992b), the remedial action objective (RAO) is to prevent the physical exposure to contaminants and mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

As stated in the IROD, the selected final action remedy is the previous MHWMF RCRA preventative action of stabilization and placement of all contaminated materials under a low-permeability cap. Since the preventative action is protective to human health and the environment and satisfies CERCLA requirements, no further action under CERCLA is necessary for this source control OU.

Remedy Implementation

Implementation of the selected RCRA preventative action remedy (i.e., the RCRA preventative action) included the following activities:

- Dewatering of the basin;
- Treating and discharging the basin liquid to a permitted outfall;
- Stabilizing 28,820 m^3 (37,800 yd^3) of the dewatered basin sludge with Portland cement;
- Consolidating 30,370 m^3 (39,700 yd^3) of contaminated materials by excavating a portion of the process sewer line and associated soils (842 m^3 [1,100 yd^3]) and contaminated soils from the overflow ditch (5,126 m^3 [6,700 yd^3]), the seepage area (7,497 m^3 [9,800 yd^3]) and areas of Lost Lake (16,907 m^3 [22,100 yd^3]) and transporting to the top of the stabilized sludge within the basin; and

- Installation of a 0.97-hectare (2.4-acre) low permeability cover system over the settling basin consisting of a layer of backfill, a 0.6-m (2-ft) layer of low permeability compacted kaolin clay with a permeability of $1x10^{-7}$ cm/sec or less, a 0.3-m (1-ft) drainage layer, geotextile filter fabric, topped with 0.6 m (2 ft) of vegetative cover (15-cm [6-in] of topsoil over 45-cm[18-in] of common fill), 15-cm (6-in) perforated drainage collection pipe, and stormwater conveyance system.

Current photos of the MHWMF OU are presented in Figure KK-3

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Post-closure groundwater monitoring to verify that no unacceptable exposure to potential hazards posed by conditions at the OU occur in the future as required per the RCRA Hazardous Waste Permit.
- Quarterly site inspections and site maintenance for a minimum of 30 years to maintain the integrity of the cover system, fences, signs, etc. Any necessary repairs will be made as part of the maintenance program.
- Land use controls (LUCs) to restrict access to authorized personnel with appropriate training on applicable requirements and to preclude unauthorized access or intrusive activities through the SRS Site/Use Site Clearance program and SRS site security.

Costs associated with the selected remedy for MHWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost comparison is not provided in this remedy review.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at MHWMF are protective, the site is protective of human

health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls (i.e., LUCs).

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 KK-1; and
- Ensured that all actions required under the RCRA Permit were implemented (i.e., quarterly inspections and maintenance to the soil covers and groundwater monitoring).

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements (ARARs), the results of the site inspection, and subsidence monitor surveys indicates that the remedy is functioning as intended by the IROD (WSRC 1992b). The stabilization and placement of all contaminated materials (process sewer line and associated soils, contaminated soils from the seepage area and areas of Lost Lake) under the low permeability cover has achieved the purpose of the interim action, as stated in the IROD, to minimize migration of contaminants to the groundwater (WSRC 1992). Because no COCs were identified in the IROD, no evaluation of groundwater against COC standards was possible. However, review of point-of-compliance groundwater monitoring has not identified any additional potential corrective action constituents of concern. The

effective implementation of institutional controls has prevented exposure to, or ingestion of, contaminated soils, sediments, and surface waters.

O&M of the cover system has been effective. The quarterly site inspections for the period February 2007 through May 2012 had no major findings. The routine findings were active ant mounds on the soil cover and vegetation growing in ditches. These were addressed on the spot and in a few month period of time, respectively. The annual subsidence monitor logs indicate the cap is performing within design tolerances.

There were no opportunities for system optimization observed during this review.

The institutional controls 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 land use controls (SRS Site Use/Site Clearance Program). No activities were observed that would have violated the institutional controls.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

There have been no changes in exposure pathways, land use or contaminant characteristics. While no chemical specific soil remedial goals were set forth in the IROD (WSRC 1992b) for comparison with 2012 preliminary remediation goals, the remedy has eliminated the exposure pathway associated with soils.

The ARARs discussed in the IROD (WSRC 1992b) for this limited action focus on the design and construction of the remedial action which was completed in 1990. Based on the review of this OU, the requirements of the ARAR that sets forth the performance standards for the cover system (i.e. long-term minimization of migration of contaminants, function with minimum maintenance) continue to be met.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the MHWMF OU under CERCLA.

X. Protectiveness Statement(s)

The remedy at the MHWMF OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by maintenance of the low-permeability clay cover system with institutional controls (i.e., LUCs), environmental monitoring, and site inspections to prevent the physical exposure to contaminants and mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. LUCs include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the MHWMF OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 2003. *South Carolina Hazardous and Mixed Waste Permit, Permit Number SC1 890 008 989, 2003 RCRA Permit Renewal for the Savannah River Site, issued September 30, 2003, Module III – Post Closure Care, Section A, M-Area Hazardous Waste Management Facility*, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC.

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1992a. *1992 RCRA Part B Permit Renewal Application (U), Volume III, Book 6 of 8, M-Area Hazardous Waste Management*, WSRC-IM-91-53, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1992b. *Interim Action Record of Decision Remedial Alternative Selection M-Area Hazardous Waste Management Facility Operable Unit*, WSRC-RP-92-743, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1992c. *1992 RCRA Part B Permit Renewal Application (U), Volume III, Book 2 of 8, M-Area Hazardous Waste Management*, WSRC-IM-91-53, 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, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, M-Area HWMF Post Closure Inspection (U)*, ER-IDS-019-012, Inspection period 2007 through 2011 (quarterly)

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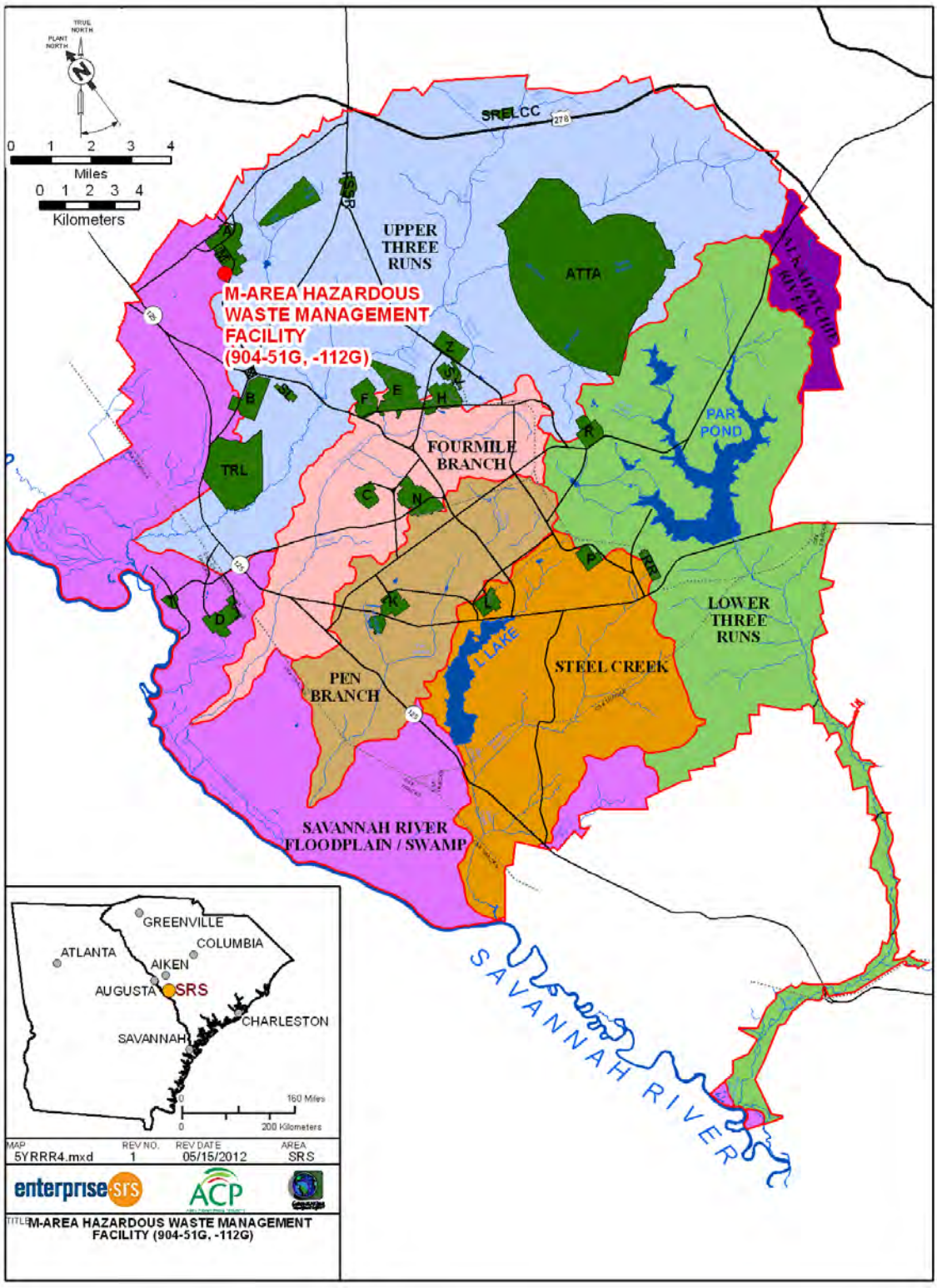


Figure KK-1. Location of M-Area HWMF at SRS

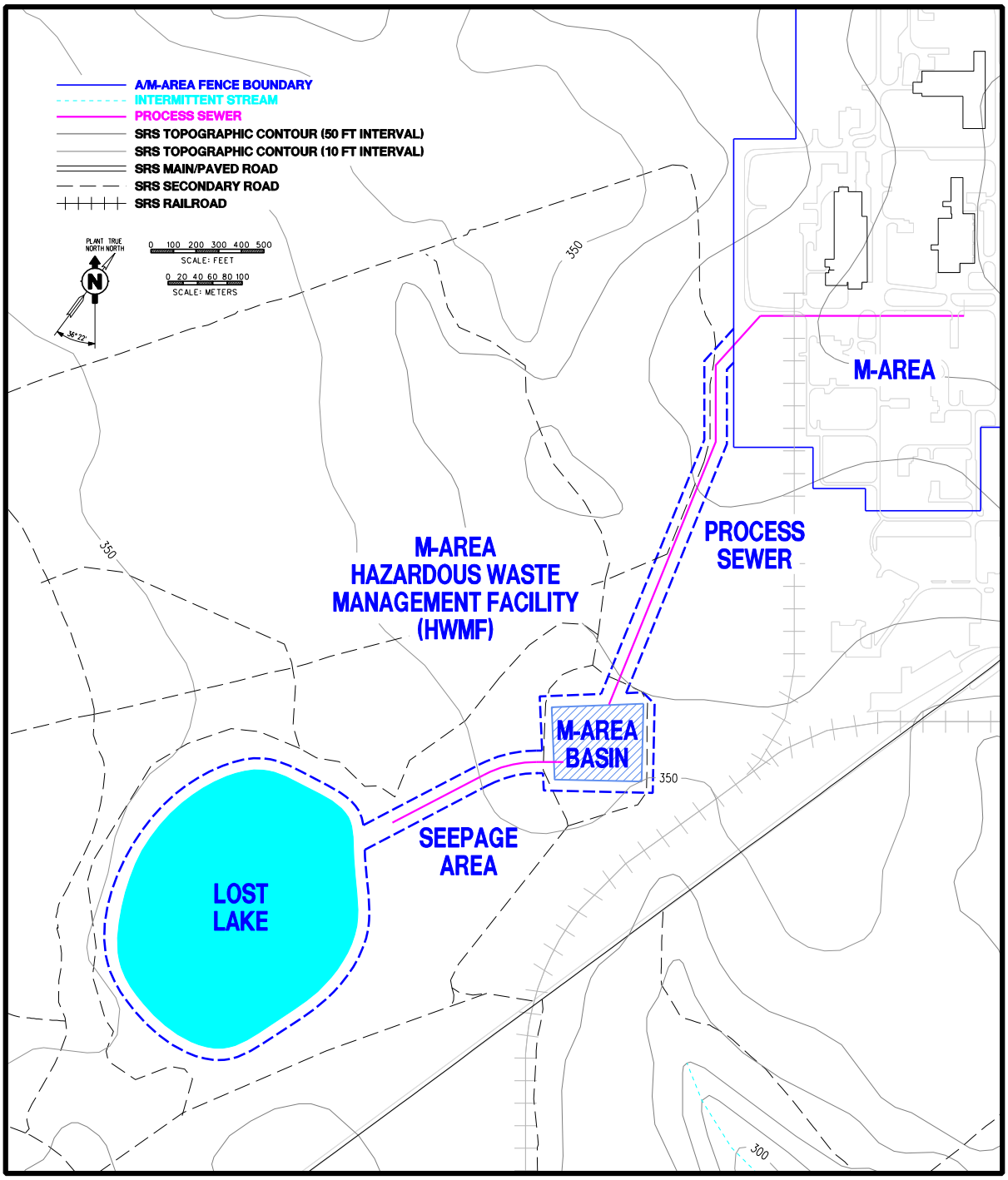


Figure KK-2. Site Layout for M-Area HWMF



Figure KK-3. 2012 Photographs of the M-Area HWMF at the SRS (highlighted square on photo on left indicates location of covered basin, shown in 2 photographs on right)

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Table KK-1. Chronology of OU Events

Event	Date
RCRA Closure Plan Approved	1987
Corrective Action Start	1988
RCRA Closure Completed	1990
Interim ROD Issuance	June 29, 1992
Previous Five-Year Reviews	June 30, 1997 / * / February 4, 2009

*No review was conducted in 2004 due to an oversight.

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Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU

I. SITE INFORMATION			
Site Name:	**M-Area Hazardous Waste Management Facility OU**	**Date of Inspection:**	**08/16/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #1**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**93°F and sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Waste Stabilization, Excavation, Disposal

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *M-Area Settling Basin Post Closure Inspection, ER-SOP-012, Field Inspection Checklist for M-Area Operable Unit*, ER-IDS-019-057

_____

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☒ N/A

Remarks: Fence is in good condition_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkthrough

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 9/17/12 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey wooden stakes were located. Several had been damaged due to control burn in the area.

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 KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks: Vegetation is mowed routinely.

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A
Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident
Areal extent Depth
Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent
☐ Ponding ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent
Remarks:

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☒ Functioning ☐ N/A
Remarks:

2. Outlet Rock Inspected: ☐ Functioning ☒ N/A
Remarks:

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:

4. Dam: ☐ Functioning ☐ N/A
Remarks:

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment KK-1. Five-Year Review Site Inspection Checklist – M-Area Hazardous Waste Management Facility OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy of stabilizing the basin contents, consolidating contaminated materials in the basin, and installing and maintaining a low permeability cap was designed and implemented to prevent physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater. The cover system is intact, long term grasses has been fully established. Soil cover system remedy appears to be functioning as designed. Drainage channels are functioning adequately.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of quarterly site inspections and site maintenance (repair of erosion damage, cover system, fencing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs and fencing is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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M-AREA INACTIVE PROCESS SEWER LINES OPERABLE UNIT (081-M)

I. Introduction

This report is the second five-year review for the M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) (081-M). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the MIPSL OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the MIPSL OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table LL-1 lists the chronology of site events for the MIPSL OU.

III. Background

MIPSL OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the MIPSL OU is vadose zone soil. Groundwater is not addressed under this OU. Any groundwater contamination resulting from the MIPSL OU is regulated by the SRS RCRA Part B Permit and addressed by the requirements of the M-Area and Metallurgical Laboratory Hazardous Waste Management Facilities Groundwater Monitoring and Corrective Action agreements.

Physical Characteristics

MIPSL OU is located in M Area in the northwest portion of SRS (Figure LL-1). It is comprised of portions of the M-Area Settling Basin Inactive Process Sewer to Manhole 1, including the segment of pipe from the slab of the 320-M Alloy Building to the Former Security Fence and the segment of pipeline starting adjacent to the slab of the 322-M Metallurgical Laboratory and extending to the A-014 Outfall (Figure LL-2).

The MIPSL OU includes approximately 1,140 m (3,800 ft) of underground piping and extends from the edges of the buildings (or former buildings) to the downstream

discharge points of each line (WSRC 2006). The sewer pipes are made of vitrified clay, with diameters ranging from 30 to 75 cm (12 to 30 in) and pipe depths ranging from about 2.1 to 3.6 m (7 to 12 ft) below ground surface (bgs). High-density polyethylene (HDPE) pipe liner, installed inside portions of the M-Area Inactive Process Sewer (MIPS) and 313-MIPS pipelines in 1983, range from 18.6 to 30 cm (6 to 12 in) in diameter.

Pre-cast concrete or brick manholes along the MIPS and 313-MIPS allowed access to the pipelines for inspection, maintenance, effluent sampling, etc. The manholes are spaced approximately 105 to 120 m (350 to 400 ft) apart along the MIPS and 313-MIPS sewer lines. An engineering review examined the construction, effluent capacity, and operational history for MIPS and 313-MIPS and found little probability of process overflows at the manholes.

The primary contaminant release mechanism at the MIPSL OU is leakage of effluents from the process sewer lines serving multiple facilities in M Area. Surficial soils in M Area consist of fine-grained sediments to a depth of approximately 9 m (30 ft). This low-permeability formation is referred to as the "Upland Unit". The Upland Unit has limited contaminant mobility to a significant degree although volatile organic compounds have migrated downward, principally by diffusion from the source zone.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates MIPSL OU as being within an industrial area. The future land use for MIPSL OU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

From 1958 until early 1985, several M-Area facilities (313-M, 320-M, and 321-M) manufactured reactor fuel and target assemblies (WSRC 2006). Associated operations included support buildings, maintenance operations, laboratories, and infrastructure for managing waste. Effluents from M Area were transported through two separate networks

of vitrified clay pipes (Figure LL-2). The MIPS network discharged waste to the M-Area Settling Basin; the 313-MIPS network released waste to the A-014 Outfall, which flowed to a tributary of Tims Branch. In May 1982, the 313-MIPS process waters were diverted from Tims Branch to conjoin with MIPS process waters already flowing to the M-Area Settling Basin, increasing the flow from an average of 1.6 to 3 million L/day (430,000 to 800,000 gal/day). In November 1982, process waters from 313-MIPS were redirected back to Tims Branch through the A-014 Outfall, resulting in a reduction of the flow to the M-Area Settling Basin to 950,000 L/day (250,000 gal/day) by the end of 1982 (WSRC 2003).

M-Area effluent wastes included chlorinated solvents (used for degreasing fuel and target assemblies), acids, caustics, heavy metals, and minor amounts of radioactive constituents. Specific constituents of interest include trichloroethylene (TCE), tetrachloroethylene (PCE), 1,1,1-trichloroethane (1,1,1-TCA), aluminum, copper, iron, lead, magnesium, manganese, mercury, nickel, zinc, and uranium.

Initial Response

By May 2003, M-Area facilities had been sufficiently deactivated. Decommissioning of various buildings, including Buildings 313-M, 322-M, 320-M, and 321-M, was completed prior to implementation of the remedial action for the MIPSL OU.

Basis for Taking Action

Findings from the risk assessment indicate that there are no exposure pathways for human or ecological receptors at the MIPSL OU (WSRC 2005).

Extensive characterization and modeling activities predicted that TCE and PCE could travel to groundwater within 1,000 years at levels that exceed maximum contaminant levels (MCLs). TCE and PCE were identified as contaminant migration (CM) constituents of concern (COCs) in the vadose zone soil adjacent to and beneath the manholes at depths greater than 1.2 m (4 ft) bgs. The higher contaminant concentrations were located beneath the manholes.

A remedial action was necessary at the MIPSL OU because there is a potential that TCE and PCE could leach to groundwater at concentrations that would exceed MCLs and

present an unacceptable risk to human receptors. For TCE, the CM remedial goal (RG) is 0.0408 mg/kg and the CM RG for PCE is 0.307 mg/kg. Exceedances of these values in soils indicate that TCE and PCE may leach to groundwater at levels above the MCL (5 µg/L).

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 2006), the remedial action objective (RAO) for the MIPSL OU is to prevent TCE and PCE from leaching to groundwater above MCLs.

The selected remedy for the MIPSL OU was Phased Soil Vapor Extraction (SVE) enhanced with Soil Fracturing and Institutional Controls (i.e., Land Use Controls [LUCs]).

The following LUC objectives for the MIPSL OU are necessary to ensure protectiveness of the selected remedy:

- Restrict worker access and prevent unauthorized contact, removal, or excavation of contaminated media (i.e., vadose zone soil and pipelines);
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds;
- Maintain the integrity of any current or future remedial or monitoring system, such as SVE systems or groundwater monitoring wells; and
- Prevent access or use of contaminated groundwater until cleanup levels are met.

Remedy Implementation

The selected final remedy for the MIPSL OU provides the greatest level of protection to human health and ecological receptors. The remedy included the following:

- Install four fractured wells at each of the four manhole locations for SVE. One deep SVE well was installed at the center of each fracture well area. Hydraulic fracturing

was used to improve the permeability of the fine-grained soils ("Upland Unit") where residual contamination remains. A threshold value of 10 ppm was recognized as appropriate for transition from active SVE to passive SVE;

- Grouting of the process sewer connections at all of the manholes and the sewer discharge point at the A-014 Outfall were plugged and the manholes were filled with grout; and

- Established LUCs for 5.29 acres to include the following:

  - Providing access controls for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health, safety requirements, and identification signs located at the waste unit boundaries;
  - Notifying USEPA and SCDHEC in advance of any changes in land use or excavation of waste:
  - Providing access controls against trespassers, as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary.
  - In the long term, if the property or any portion thereof, is ever transferred from DOE, notice of the type and quantity of any hazardous substances that were known to have stored (for more than one year), released, or disposed of on the property will be provided. In addition, if the property or any portion thereof, is every transferred by deed, the U.S. Government will satisfy the requirements of CERCLA 120(h)(3) to include a description of the remedial action taken, a covenant, and an access clause.

System Operations/Operation and Maintenance

The following system operations are ongoing:

- Operation of the SVE System continues. Since 2008, the MIPSL OU SVE system has removed 2,659 and 711 lbs of PCE and TCE, respectively, through 2012;

- Operation of the MicroBlowers™ continues.

The following maintenance activities are ongoing:

- Annual site inspections and site maintenance; and
- Site controls and land use restrictions via the SRS Site Use/Site Clearance program, which restricts invasive and permanent installation activities at the MIPSL OU.

The ROD estimated operation and maintenance (O&M) costs associated with the selected remedy has a present worth cost of $3,606,071, discounted at 2.1% for the first two years; 3.1% for the next seven years; and 3.4% for the final eight years of the active remedy. The total actual O&M costs from project support and other post-construction expenses through fiscal year 2011 is $894,304 (Table LL-2). These costs are as expected except for FY2011. The increased O&M costs in FY2011 were due to additional operating equipment repairs.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedial action at MIPSL OU is expected to be protective of human health and the environment. Exposure pathways that could result in unacceptable risks have been controlled through institutional controls (i.e., LUCs). There were no recommendations or follow-up actions from the last five-year remedy review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Reviewed all process and performance monitoring data provided by the annual performance evaluation reports and provided a technical assessment of whether the SVE is functioning as intended by the ROD and whether the shutdown criteria has been achieved;

- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment LL-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 data and results presented in the 2011 and 2012 PERs were reviewed (SRNS 2012; SRNS 2013).

The active SVE (ASVE) system at the MIPSL OU started operations in 2008. The contamination exists primarily within fine-grained sediments of the Upland Formation; therefore the ASVE system will only operate for short periods of time before the mobile contaminants are exhausted. Hydraulic fracturing was used to increase the surface area available for vapor extraction and improve permeability.

The active SVE unit is portable and cycled between the four manhole (MH) locations (i.e., MH-01, MH-11, MH-12, and MH-13) to better match the depletion and rebound behavior of soil vapor in the Upland Formation. At each MH there are four fractured wells, one conventional SVE well, and one or two pressure monitoring wells. When the MHs are not undergoing ASVE a MicroBlower™ is connected to the conventional SVE well.

The portable ASVE system was cycled through each MH location three times between 2008 and 2010. After the third cycle it was determined that vapor concentrations were reduced to less than 10 ppmv and rebound had not been observed, except for at MH-01. ASVE was replaced at MH-11, MH-12, MH-13 with passive SVE (i.e., MicroBlower™) while MH-01 was re-connected to the ASVE system for a fourth cycle. Concentrations exceeded 10 ppmv at MH-12, so the ASVE system was transferred from MH-01 to MH-12, which was considered the fifth cycle. The ASVE system was returned to MH-01 and is currently on the sixth cycle.

Since 2008, the ASVE system at the MIPSL OU has removed 2,659 lbs of PCE and 711 lbs of TCE. MH-01 and MH-12 are responsible for over 97% of the VOCs extracted

from the ASVE system. ASVE will continue to be utilized at MH-01 until the system reaches a point of diminished returns. A schedule of operation at MH-01 was presented in the 2012 PER (SRNS 2013) which will cycle the ASVE system on and off to observe rebound during 2013.

Summary of Inspections and Interviews

Interviews were conducted with Stuart Crosby, O&M staff member, on August 16, 2012 at the site. The MIPSL OU was inspected by SRNS on August 16, 2012 and USDOE personnel on September 17, 2012. No issues were identified for the MIPSL OU during this inspection and interviews.

On January 22, 2013 a site inspection was conducted by US EPA and SCDHEC personnel, accompanied by the USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The selected remedy of Phased SVE enhanced with Soil Fracturing and institutional controls (i.e., LUCs) is effective in preventing TCE and PCE from leaching to groundwater above MCLs. The Land Use Control Implementation Plan for MIPSL OU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2007a). All LUC objectives are being met. Based on the 2011 Performance Evaluation Report (SRNS 2012), the MIPSL OU SVE system has removed 2,563 and 658 lbs of PCE and TCE, respectively, through 2011.

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 standards or physical conditions of the MIPSL OU that would affect the protectiveness of the remedy.

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 MIPSL OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e. LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to contaminated vadose zone soil at the MIPSL OU are being addressed through SVE systems and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the MIPSL OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2012. *Performance Evaluation Report of 2011 for the M-Area Inactive Process Sewer Lines (MIPSL) (081-M) Operable Unit (OU) (U) January through December 2011*, SRNS-RP-2012-00130, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Performance Evaluation Report of 2012 for the M-Area Inactive Process Sewer Lines (MIPSL) (081-M) Operable Unit (OU) (U) January through December 2012*, SRNS-RP-2013-00108, 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, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2003. *M-Area Inactive Process Sewer Lines (MIPSL) and 313-M Area Inactive Process Sewer (313-MIPS) Manhole Overflow Evaluation (U)*, ERD-EN-2003-0169, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan, RFI/RI Report with Baseline Risk Assessment, and Corrective Measures Study/Feasibility Study (CMS/FS) for the M Area Inactive Process Sewer Lines (081-M) (U)*, WSRC-RP-2004-4214, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006. *Record of Decision Remedial Alternative Selection for the M-Area Inactive Process Sewer Lines Operable Unit (U)*, WSRC-RP-2006-4001, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007a. *Land Use Control Implementation Plan (LUCIP) for the M-Area Inactive Process Sewer Lines Operable Unit (081-M) (U)*, WSRC–RP–2006-4068, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007b. *Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP) for the M-Area Inactive Process Sewer Lines (081-M) (U)*, WSRC–RP–2006-4048, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Post-Construction Report for the M-Area Inactive Process Sewer Lines (MIPSL) (081-M) Operable Unit (OU)(U)*, WSRC-RP-2008-4029, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, M-Area Inactive Process Sewer Lines (U)*, ER-IDS-019-050, Inspection period 2007 through 2011 (annually)

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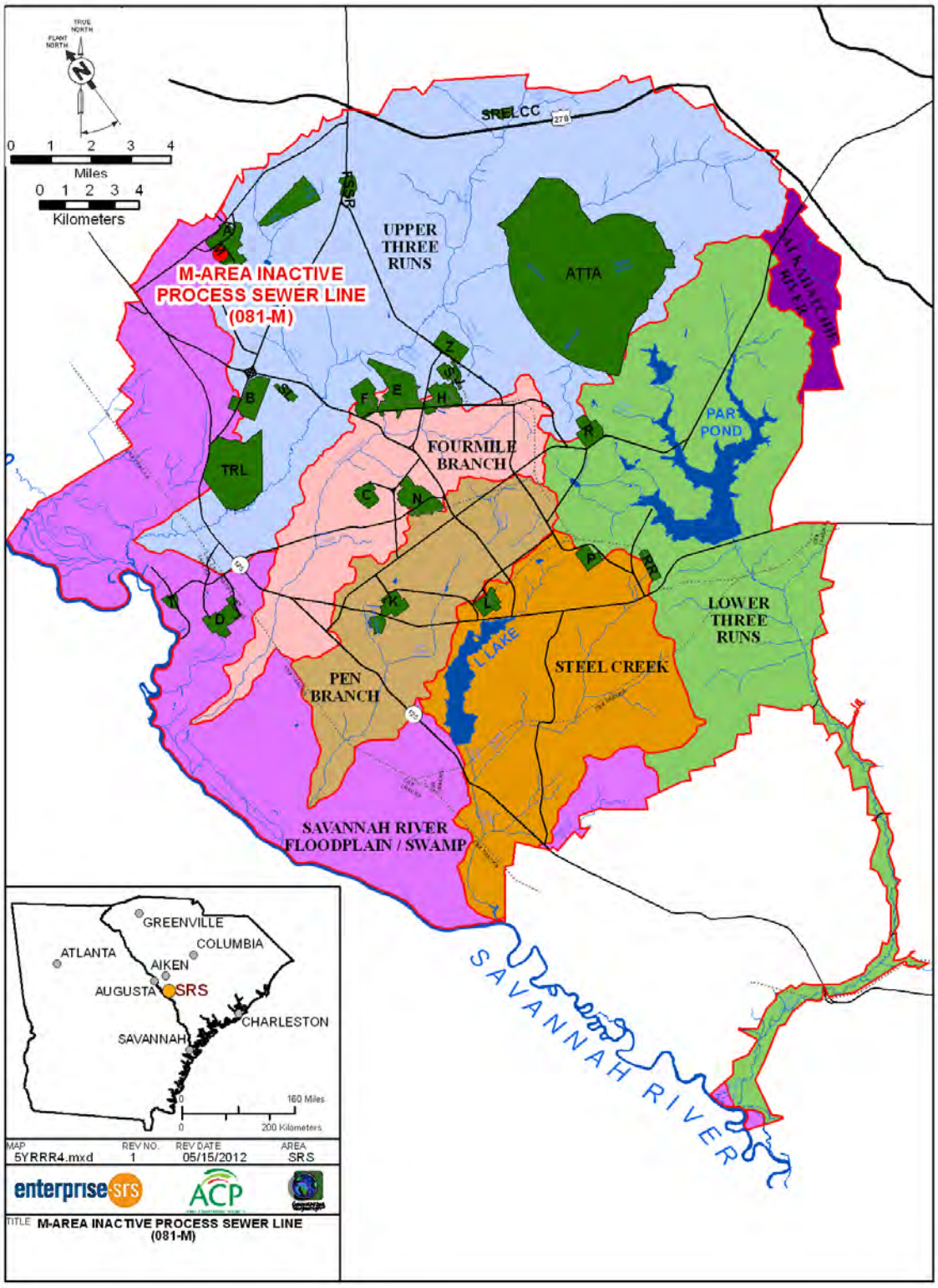


Figure LL-1. M-Area Inactive Sewer Line OU at Savannah River Site

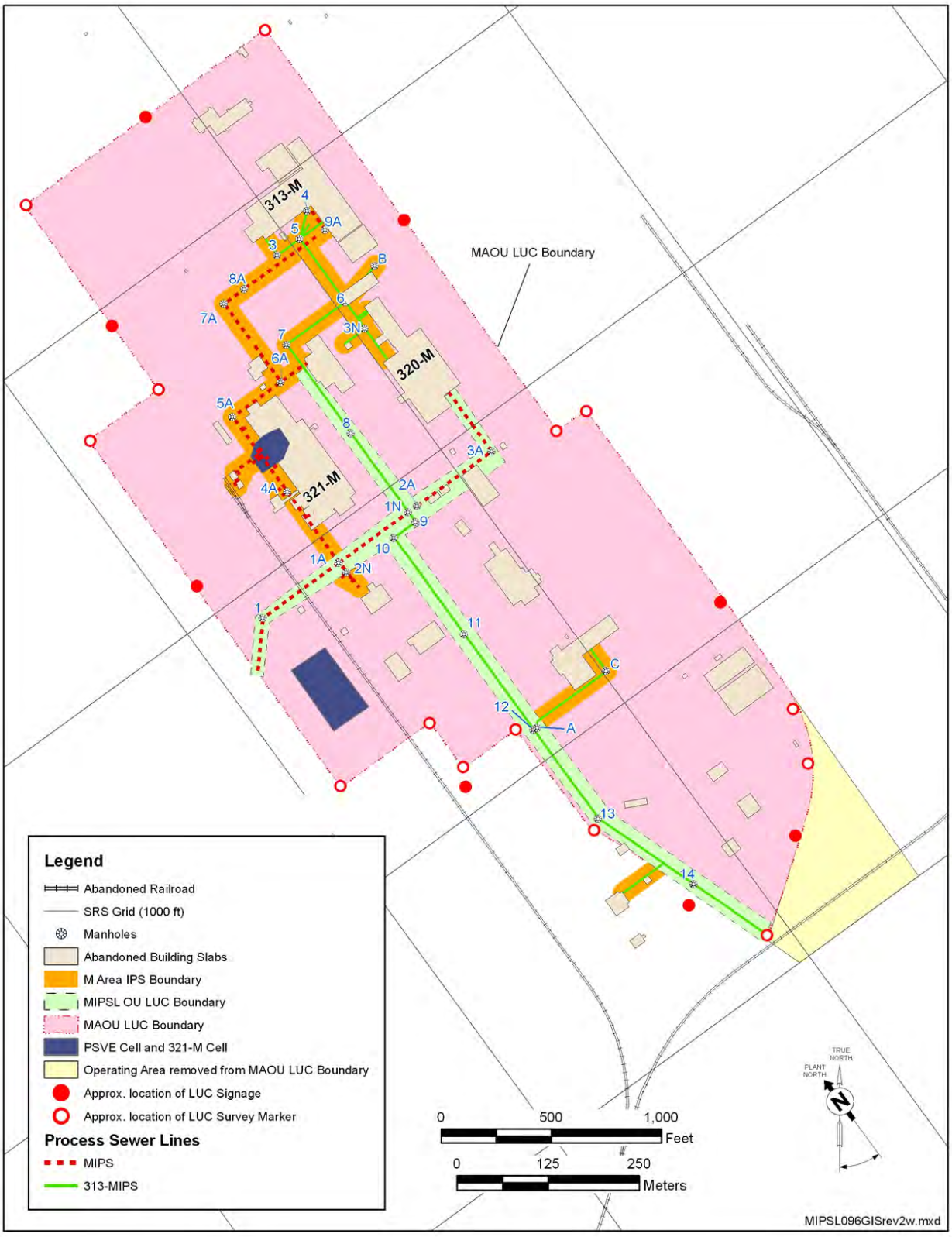


Figure LL-2. Layout of the MIPSL OU



Figure LL-3. Photos of MIPSL OU Before Remediation Activities



Figure LL-4. Current Photos of MIPSL OU (2012)

Table LL-1. Chronology of OU Events

Event	Date
Characterization Field Start	July 28, 2003
Approval of Record of Decision (ROD)	April 20, 2007
Remedial Action Construction Start / Completion	June 25, 2007 / April 30, 2008
Remedial Action Operations Start	January 1, 2008
Previous Five-Year Review	February 4, 2009

Table LL-2. Actual versus Estimated O&M Costs ($)

	FY07	FY08	FY09	FY10	FY11	Five-Year Total
Total Actual O&M Costs	7,000	250,000	186,000	142,000	309,000	894,000
Total ROD Estimated Direct O&M Costs	289,580	274,580	274,580	274,580	274,580	1,387,900

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Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU)

I. SITE INFORMATION			
Site Name:	**M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU)**	**Date of Inspection:**	**08/16/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #92**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**94°F and sunny**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Soil Vapor Extraction

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: _____ (Name) _____ (Title) _____ (Date)

Interviewed: ☐ At Site ☐ At Office ☐ By Phone Phone No.: _____

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Stuart Crosby (Name) SGW Operations Engineer (Title) 08/16/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-3021

Problems/Suggestions: ☐ Report Attached _____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for M-Area Inactive Process Sewer Lines*, ER-IDS-019-050._____

_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per 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: UIC Permit for fracturing

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☒ Air	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walk-through

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:_____

B. Other Site Conditions

Remarks:_____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident

Areal extent_____ Depth_____

Remarks:_____

2. Cracks: ☐ Location shown on site map ☐ Cracking not evident

Lengths_____ Widths_____ Depths_____

Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent_____ Depth_____

Remarks:_____

4. Holes: ☐ Location shown on site map ☐ Holes not evident

Areal extent_____ Depth_____

Remarks:_____

5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress

Areal extent_____ Depth_____

Remarks:_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent_____ Depth_____
Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Performance Monitoring:
Type of Monitoring_____ ☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching Head Differential_____
Remarks:_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____

Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance

Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks:_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☒ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plum is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☒ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment LL-1. Five-Year Review Site Inspection Checklist – M-Area Inactive Process Sewer Lines (MIPSL) Operable Unit (OU) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The final remedial action objectives (RAOs) for the vadose zone soil are to prevent TCE and PCE from leaching to groundwater above MCLs. The remedies identified in the final ROD are expected to be protective of human health and environment. Exposure pathways that could result in unacceptable risks are being controlled through institutional controls.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining MIPSL and the condition of its warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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M-AREA OPERABLE UNIT

I. Introduction

This report is the first five-year review for the M-Area Operable Unit (MAOU). The review was conducted from August 2012 through October 2012. Contaminants have been left in place at the MAOU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the MAOU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table MM-1 lists the chronology of site events for the MAOU.

III. Background

The MAOU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media of concern is subsurface vadose zone soil.

An area-based remedial strategy has been implemented in M Area; remedial decisions for the M-Area waste units and facilities addressed by the M-Area Inactive Process Sewer Lines (MIPSL) Record of Decision (ROD) will continue as planned. All other remedial actions are addressed by the MAOU ROD.

Groundwater contamination from the MAOU is regulated by the SRS Part B Permit and addressed by the requirements of the M Area and Metallurgical Laboratory Hazardous Waste Management Facilities Groundwater Monitoring and Corrective Action Agreements.

Physical Characteristics

MAOU is located in the northwest portion of SRS, and comprises approximately 29.4 hectares (72.6 acres) (Figure MM-1). The MAOU was divided into four distinct areas based on the historical operations at the unit (Figure MM-2). These areas are:

- Production Area - 313-M, 320-M, 321-M (including Component and Tube Cleaning sump referred to as Underground Sump #001 and Extrusion Press Pit referred to as Underground Sump #002), 322-M, 340-M, and 324-M (including the northern portions of the MIPSL and associated feeder lines). This area also includes two warehouses: 330-M and 331-M. The area is where fuel and target assemblies were produced between 1952 and 1988. Slugs of depleted uranium were stored in the warehouses.
- Liquid Effluent Treatment Facility (LETF) - 341-M, 341-1M and 341-8M. This facility was built in 1988 to treat all the liquid effluent from the production area.
- Test Reactor Facilities - 305-A and 777-10A. These two test reactor facilities were used to determine the appropriate properties for the fuel elements and the target assemblies before a new model was placed into production.
- Salvage Area - 740-A, 743-A and 741-A. This area stored excess materials and equipment, contained support facilities for the personnel involved in the management of excess material, and reconditioned non-nuclear material. Reconditioning involved painting and cleaning with solvents.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the Savannah River Site (WSRC 1999) designates the MAOU as being within an industrial area. The future land use for the MAOU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The manufacturing processes in M Area consumed a large quantity of industrial cleaning solvents and water, and early practices were to discharge the spent solvents and water directly into the environment. Of the reported 3.5-million pounds of solvents discarded, approximately 2-million pounds was discarded to the M-Area Settling Basin, located south of M Area, via a process sewer line. This resulted in volatile organic compound (VOC) and radionuclide contamination at the M-Area Settling Basin and process sewer lines within the MAOU. The basin was closed with the installation of a protective cap in 1991.

All of the major facilities in M Area used industrial cleaning processes and products (trichloroethylene [TCE], tetrachloroethylene [PCE], and trichloroethane) that were discarded to the M-Area Settling Basin via process sewer lines. The M-Area Settling Basin is part of the M-Area HWMF. The contaminated sewer lines were managed under the MIPSL OU and its ROD (WSRC 2006a).

Many of the buildings and facilities were dismantled to their slab foundations by the mid 2000's. However as a result of the *RCRA Facility Investigation/Remedial Investigation* (RFI/RI) work plan characterization (WSRC 2007a), areas of VOC, radiological, polychlorinated biphenyl (PCB), organic, and metal contamination still existed in and around the concrete slabs of buildings, in or near process sewer lines, and/or in soils surrounding these features and at the 741-A Salvage Yard (Figure MM-3).

Initial Response

Early action removal actions were performed in 2007 through 2008 at various buildings in the Production Area (WSRC 2006b) and at the Salvage Yard (WSRC 2007b) to prevent exposure of the future industrial worker to the maximum levels of contamination at M Area and to reduce the potential leaching of contaminants from the soils to groundwater. The key elements of each area are listed below:

313-M

- Removal of concrete (sumps/pits) with uranium-238 activity exceeding 1,900 ρCi/g (principal threat source material [PTSM] criteria);
- Removal of concrete and soils containing PCE at concentrations greater than 50 mg/kg; and
- Collection of samples from the base of each excavation to verify the goals of the early action were met.

320-M

- Removal of concrete, brick, and soils containing PCE or TCE concentrations greater than 50 mg/kg; and
- Collection of samples from the base of the Tube Cleaning excavation and from the base of each of the auger (excavation) holes at the west side of the building slab to verify the goals of the early action were met.

321-M

- Removal of concrete where uranium-235 activity exceeded the PTSM level of 402 ρCi/g;
- Removal of concrete, brick, pipe and soil (to a depth of 12.6 m [42 ft]) containing PCE concentrations greater than 50 mg/kg and stockpiled on unit and backfilled with sandy soil;
- Radiological survey of ground surface ager slab removal; and
- Collection of samples from the base of each of the auger (excavation) holes to verify the goals of the early action were met.

322-M

- Removal of sumps, pipe (containing sludge), and soils contaminated with PTSM levels of uranium-238. The sumps with activity levels greater than 1,900 ρCi/g

uranium-238 in the concrete, and the pipe containing sludge with activities greater than 1790 ρCi/g uranium-238 or 394 ρCi/g uranium-235 were removed.

- Collection of soil samples from the base of the exaction to verify the goals of the early action were met.

741-A Salvage Yard

- Soil to a depth of 0.61 m (2 ft) was removed in 2008 to protect the future industrial worker from soil contaminated with arsenic, poly-aromatic hydrocarbons (PAHs) (i.e., benzo(a)anthracene, benzo(a)pyrene, and benzo(a)fluoranthene), and PCBs (i.e., Aroclor 1254 and Aroclor 1260) greater than $1x10^{-6}$ risk. Figure MM-4 shows the area of soil removal from the 741-A Salvage Yard.

The Removal Action Reports for the Production Area (WSRC 2008b) and the 741-A Salvage Yard (WSRC 2008c) summarize the remediation and confirmatory sample results.

Basis for Taking Action

The potential exposure to or ingestion of contaminated soil, exposure to other contaminated media (i.e., concrete) and its potential to contaminate groundwater poses a potential increased risk of cancer to human receptors and is the basis for taking action at the MAOU.

Concrete slabs, below grade concrete barriers and structures, soils surrounding and underneath buildings, process sewer lines, sumps, trenches, and process feeder pipelines were sampled and summarized in the RFI/RI combined document (WSRC 2007a). VOCs (i.e., PCE and TCE) were found to be contaminant migration (CM) constituents of concern (COCs) in the vadose zone soil. Additionally PCE was found at PTSM levels in deep soils at 321-M. Figure MM-3 shows the areas of contamination before the early removal actions.

Following completion of the early removal actions, only vadose zone soils contaminated with PCE and TCE remained as the contamination requiring remedial action other than land use controls (LUCs). These areas are called out on Figure MM-3. All concrete

slabs and the 741-A Salvage Yard were effectively remediated to allow for industrial land use. PCE and TCE remained as CM COCs at the Production Area (i.e., 313-M, 320-M, and 321-M facilities) in soils. Approximately 30% of the PCE contaminated soil at PTSM levels remained in deep soil (>3 m [>10 ft] below ground surface [bgs]) after the early removal action below the 321-M slab. This is the contaminated soil that was left in-between the auger excavations done during the early removal action.

IV. Remedial Actions

Remedy Selection

As stated in the ROD, the remedial action objectives (RAOs) for the MAOU after completion of the early actions are as follows:

- Prevent human exposure to contaminants that present a risk of greater than $1x10^{-6}$ to a future resident. This RAO applies to all waste units/building remnants in the MAOU.
- Prevent migration of VOCs in building slabs, sumps, or vadose zone to groundwater above MCLs. This RAO applies to these facilities in the Production Area and their associated IPSL:
  - Buildings 313-M and 321-M: PCE in soil media; and
  - Building 320-M: TCE in soil media.

Following the early actions, VOC contamination that poses a CM threat remains in the vadose zone soils at 313-M, 320-M, and 321-M. As stated in the ROD, the remedial actions selected to meet the RAOs for the MAOU is as follows:

- Passive Soil Vapor Extraction (SVE) and Institutional Controls

An Explanation of Significant Difference (ESD) to the Revision 1 ROD for the M-Area Operable Unit was issued on July 9, 2009 to expand the selected remedy to include an additional treatment cell (i.e., the Passive SVE Cell) for contaminated soils that were excavated from 321-M during the early remedial action (SRNS 2009a).

Remedy Implementation

The selected remedies met the RAOs at MAOU by implementing the following activities:

- Grouting of manholes to prevent access to the inactive process sewer lines.
- Installing four passive SVE wells at 313-M, 320-M, and Manhole 4A with depths between 10.7 and 15.2 m (35 and 50 ft).
- Constructing two VOC treatment cells (i.e., the 321-M Cell and the Passive SVE Cell) with a passive SVE treatment system using BaroBall™ to treat 841 m^3 (1,100 yd^3) (321-M) and 2,500 m^3 (3,250 yd^3) (passive SVE) of VOC contaminated soils. Average PCE soil concentrations were 6.6 μg/kg. The configurations of two cells can be seen in the Post Construction Report (PCR) (SRNS 2011) and/or in Attachment MM-2.
- Established LUCs (including restricting worker access to contaminated media, manholes, and pipelines, prohibiting public and residential development and use of the property, maintaining the integrity of any SVE systems or monitoring wells, and preventing access to or use of the groundwater until cleanup levels are met) for approximately 28.7 hectares (70.9 acres). This area excludes the MIPSL OU LUC area of 0.69 hectares (1.7 acres) (SRNS 2009b).

System Operations/Operation and Maintenance

The following system operations are ongoing:

As of January 20, 2012 the passive SVEs are still in operation. Operation of passive SVEs started on June 16, 2010. The BaroBall™ system is anticipated to operate until RGs are achieved in at least ten years.

Only LUCs including inspection and maintenance activities are required at MAOU as follows:

- Visual inspections for evidence of damage to the soil covers due to erosion, settlement, or intrusion by burrowing animals are being performed annually as a

minimum. The inspections also address upkeep of the passive SVE units, vegetative cover, and access control barriers (e.g., the warning signs).

- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.
- Access controls and use restrictions are being enforced to preclude access through the SRS Site/Use Site Clearance program and SRS site security.

The operation and maintenance (O&M) costs associated with the selected remedy for MAOU include the soil cover and institutional controls. The ROD estimated a present worth cost of $1,139,010, which was discounted at 3.9% per year for 30 years of maintenance activities. The actual O&M cost (Table MM-3) incurred in FY10 and FY11 of $75,000 are as expected in the ROD estimate even though this estimate did not include the 2009 ESD amended selected remedy (the second passive SVE cell and its soil cover).

V. Progress Since Last Review

This is the first five-year review. Therefore, there is no previous protectiveness statement.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Evaluated passive SVE well sampling data to determine if shutdown criteria has been achieved (Attachment MM-2);
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment MM-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

Passive SVE data and evaluations of the MAOU SVE systems have been prepared and presented as Attachment MM-2 of this Five-Year Remedy Review. This is the first monitoring report for the passive SVE activities at the MAOU and includes all data collected since passive SVE operations began in 2010. Included are diagrams of each passive SVE operation, data tables of each stations results, and narrative evaluations of each unit's progress of remediation.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012, and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The MAOU was inspected by SRNS and USDOE personnel on January 22, 2013. No issues were identified for the MAOU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is expected to function as intended as demonstrated below:

- The selected remedy of LUCs (including institutional controls) is continuing to prevent human exposure to contaminated soils and concrete slabs. The Land Use Control Implementation Plan for MAOU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2009). All LUC objectives are being met. The annual inspections indicate that there are no intrusive activities and the soil covers over the passive SVE systems are intact.
- The selected remedy of a passive SVE treatment system is effective in preventing the migration of VOCs to the groundwater above MCLs. Per the MAOU PCR and

Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP) (SRNS 2009c) requirements, the passive SVE well sampling data at the treatment cells and passive SVE wells, and their evaluation are reported via the Five-Year Reviews. Semiannual monitoring was done for the first year, followed by annually sampling.

Attachment MM-2 provides the details, data, and evaluation of the three sampling events of passive SVE monitoring data. In summary, all the passive SVE systems in MAOU appear to be operating as designed. The 321-M system produced the highest concentrations of all the MAOU systems with a maximum PCE concentration of approximately 299 parts per million vapor (ppmv). This is due to the higher soil VOC concentrations associated with this unit. The other systems were of much lower concentrations; all PCE and TCE results were less than 91 and 32 ppmv, respectively. A summary of the data at each system is provided in Table MM-4. The passive SVE systems are effectively removing VOCs, therefore operation and monitoring of these systems is proposed to continue. No confirmatory soil samples are proposed to be collected to compare to RGs at this time.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. The MCLs for PCE and TCE have remained the same since the remedies were implemented. There have been no changes in standards or physical conditions of the MAOU that would affect the protectiveness of the remedy.

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 MAOU 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 contamination soil and concrete media. The passive SVE treatment systems are effective in preventing the migration of VOCs to the groundwater above MCLs. All threats to contaminated media at the MAOU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the MAOU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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 Record of Decision for the M Area Operable Unit (MAOU) (U)*, SRNS-RP-2009-00406, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009b. *Land Use Control Implementation Plan (LUCIP) for the M-Area Operable Unit (U)*, WSRC-RP-2008-4067, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009c. *Corrective Measures Implementation/Remedial Action Implementation Plan (CMI/RAIP) for the M-Area Operable Unit (MAOU) (U)*, WSRC-RP-2008-4063, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Post-Construction Report for the M-Area Operable Unit (U)*, Revision 1, February 2011, SRNS-RP-2010-00991, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2006a. *Record of Decision Remedial Alternative Selection for the M Area Inactive Process Sewer Lines Operable Unit (081-M) (U)*, WSRC-RP-2006-4001, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2006b. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for the Contaminated Surficial Soils in the 741-A Salvage Yard at the M Area Operable Unit (U)*, WSRC-RP-2006-4053, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2007a. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan, RFI/RI Report with Baseline Risk Assessment (BRA) and Corrective Measures Study/Feasibility Study (CMS/FS) for M Area Operable Unit (U)*, WSRC-RP-2006-4060, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2007b. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis at the Production Area of M Area Operable Unit (U)*, WSRC-RP-2006-4059, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2008a. *Record of Decision Remedial Alternative Selection for the M-Area Operable Unit (U)*, WSRC-RP-2008-4030, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2008b. *Removal Action Report for the Production Area of M-Area Operable Unit (U)*, WSRC-RP-2008-4055, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2008c. *Removal Action Report for the Contaminated Surficial Soil in the 741-A Salvage Yard at the M-Area Operable Unit (U)*, WSRC-RP-2008-4027, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist, M-Area Operable Unit (U)*, ER-IDS-019-057, Inspection period 2007 through 2011 (annually)

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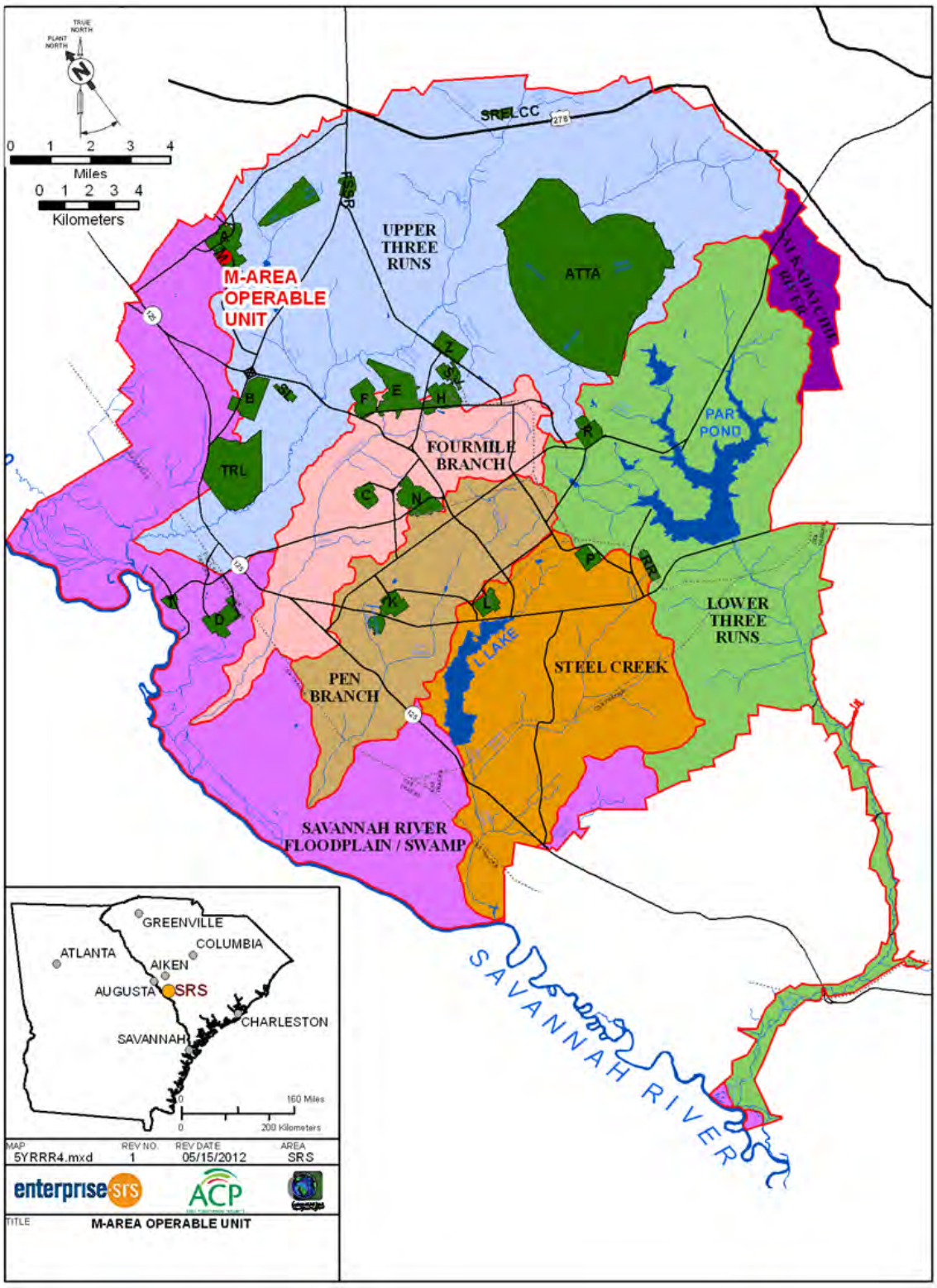


Figure MM-1. Location of MAOU at Savannah River Site

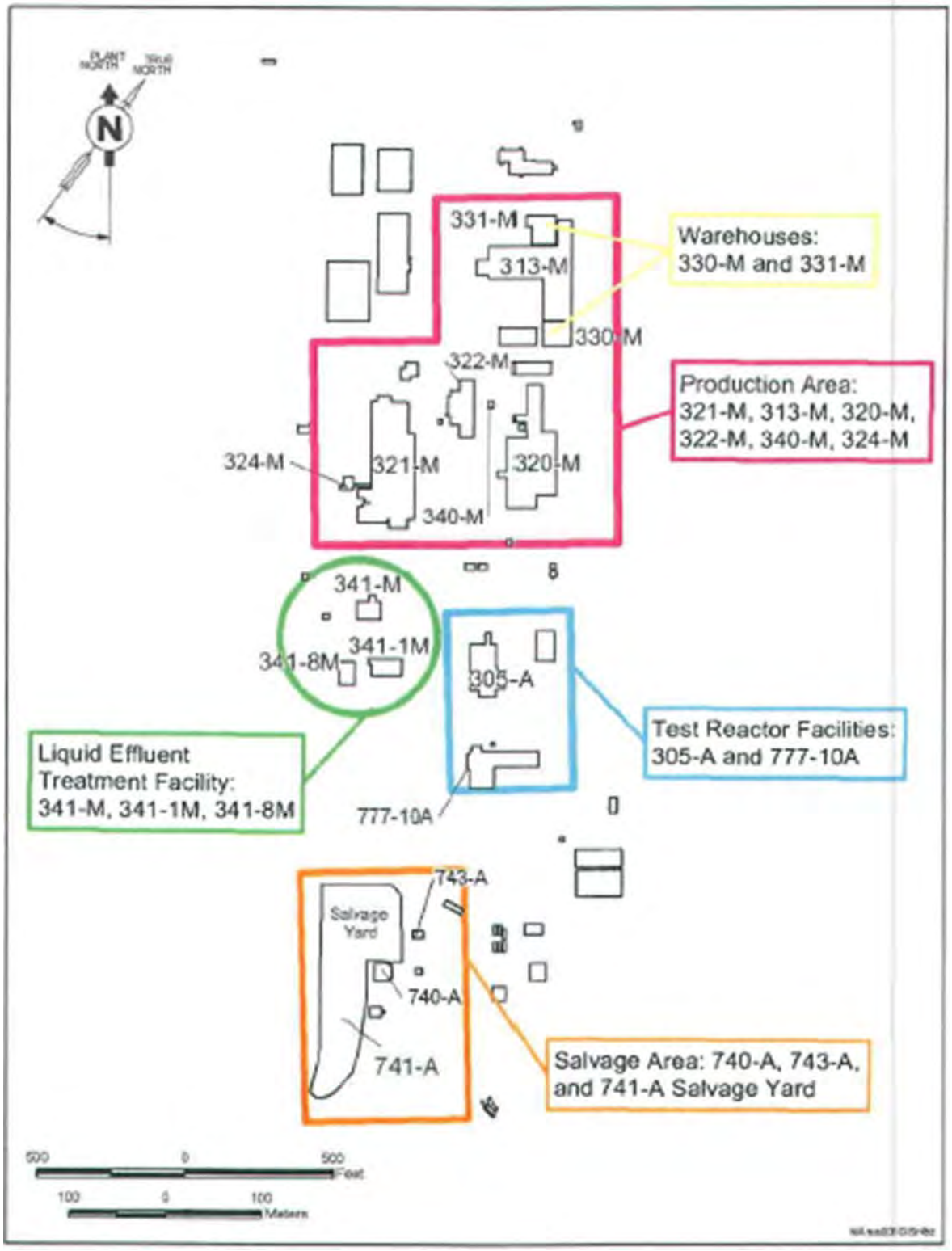


Figure MM-2. Location of MAOU Subunits

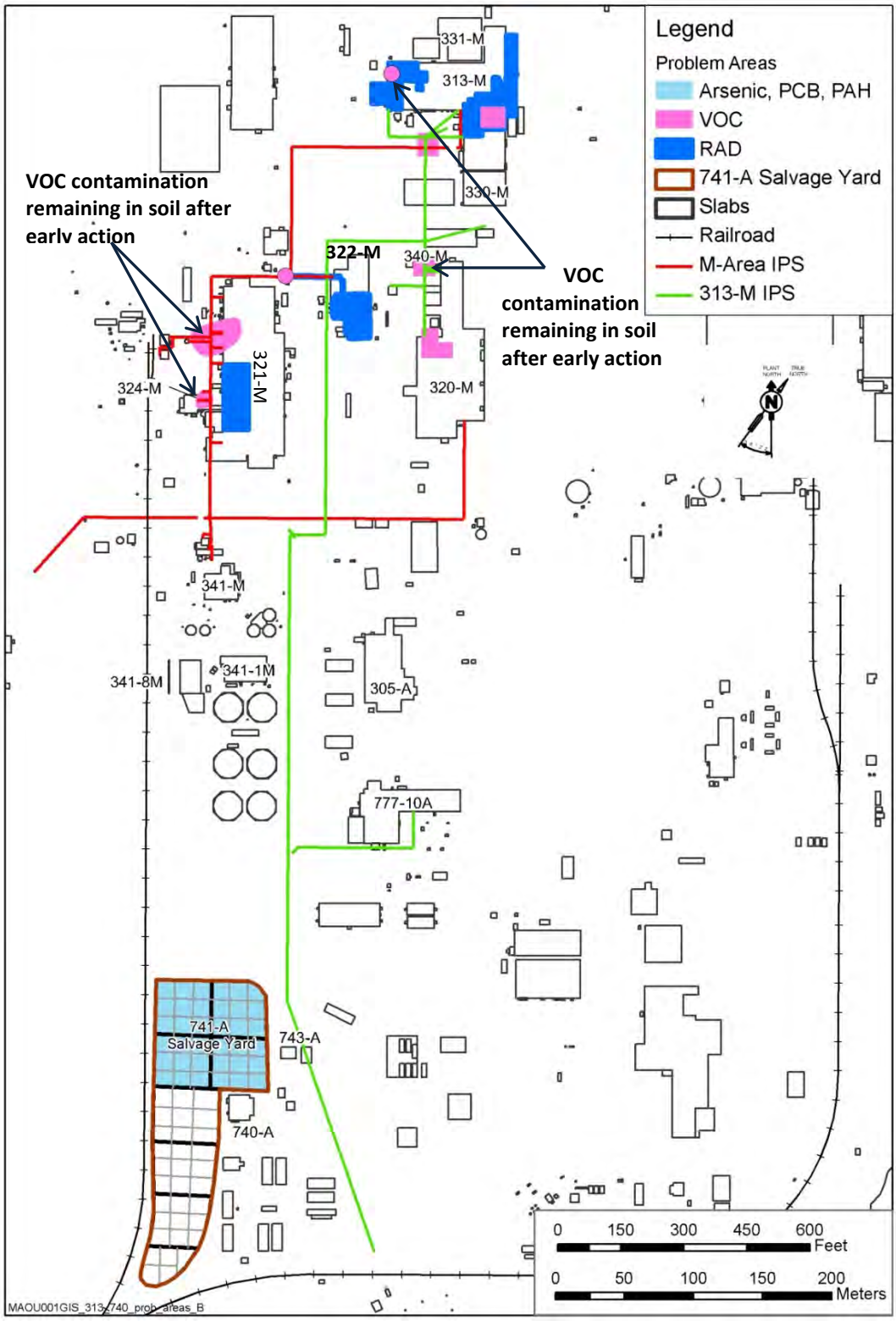


Figure MM-3. Previous Areas of Contamination at the MAOU Before Early Action Removals

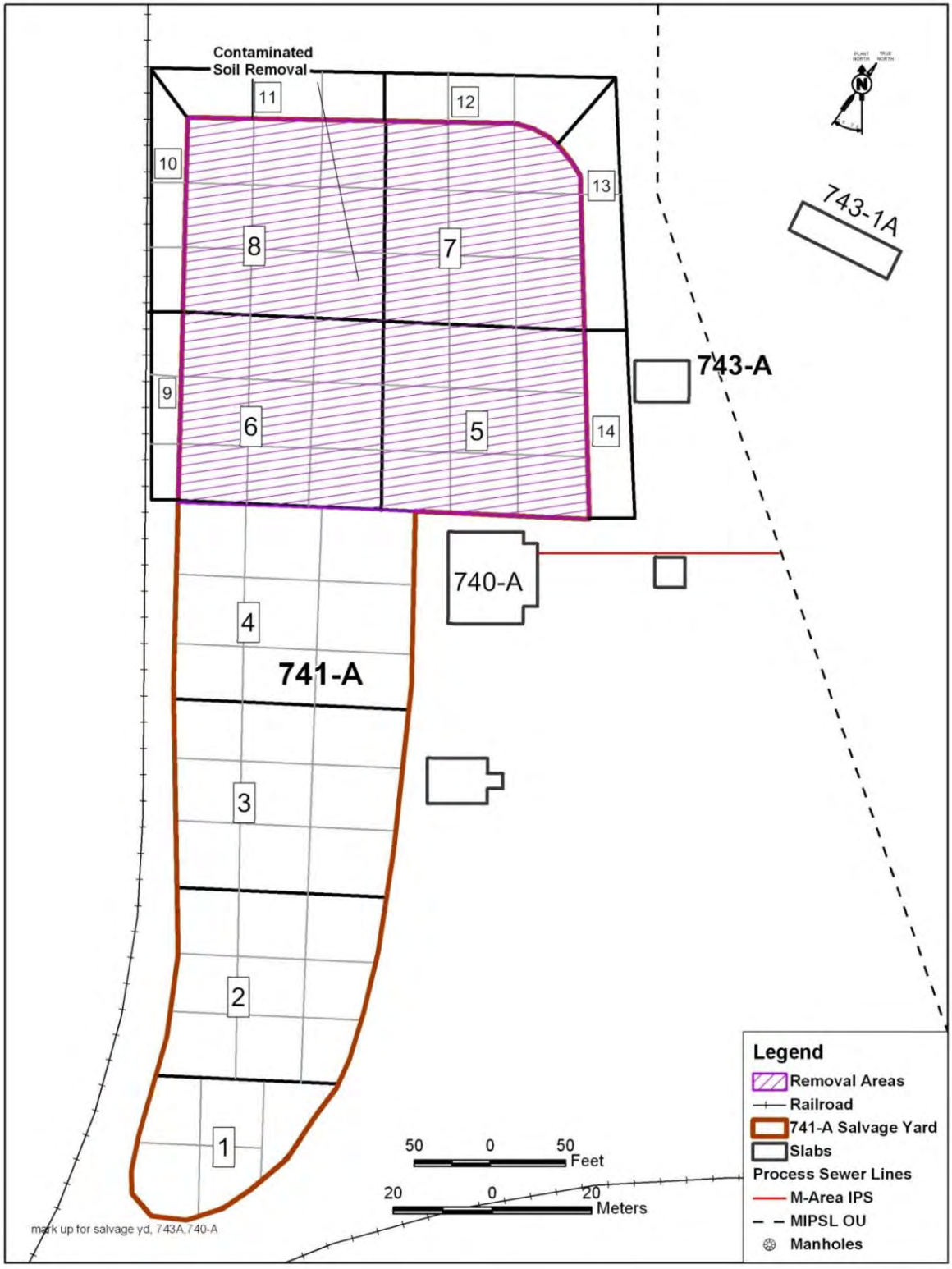


Figure MM-4. Area of Contaminated Soil Removal at the 741-A Salvage Yard



Figure MM-5. Aerial Photo of MAOU (Production Area) Before Deconstruction



Figure MM-6. Current (2012) Photos of MAOU

Table MM-1. Chronology of OU Events

Event	Date
Removal Action Start / Complete	February 21, 2007 / April 10, 2008
ROD Issuance	January 23, 2009
ESD Issued	July 9, 2009
Remedial Action Construction Start/Finish	August 10, 2009 / July 21, 2010
Remedial Action Operations Start / Finish	June 16, 2010 / On-going
Previous Five-Year Reviews	None

Table MM-2. Final RCOC RGs

RCOC	Type RCOC	RG
PCE at 313-M	CM	1.80 mg/kg
PCE at 321-M	CM	3.00 mg/kg
TCE at 320-M MIPSL Tie-in	CM	15.00 mg/kg

Table MM-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	N/A	N/A	N/A	24,400	50,600	75,000
Total ROD Estimated Direct O&M Costs	N/A	500	500	42,000	42,000	85,000

Table MM-4. Summary of Passive SVE Monitoring Data from 2010 and 2011

	2010 Max		2011 Max	
System	PCE	TCE	PCE	TCE
313-M Passive SVE	3.37	0.085	5.492	0.462
321-M Passive SVE Cell	5.946	0.163	298.748	16.162
Manhole 4A (at 321-M)	41.178	0.053	90.789	0.026
Passive SVE Cell	5.833	0.395	0.743	0.032
320-M Passive SVE	2.272	6.92	4.565	31.132

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Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit

I. SITE INFORMATION			
Site Name:	**M-Area Operable Unit**	**Date of Inspection:**	**05/24/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #92**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**93°F and Sunny**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other MicroBlowers™, Baroballs™

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for MAOU*, ER-IDS-019-057.

_____

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

1. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

2. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

3. 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:

4. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

5. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

7. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Discharge Compliance Records:

☒ Air	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

9. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-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

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area 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.) Walk-through

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area 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:_____

VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent Depth

Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent
☐ Ponding	☐ Location shown on site map	Areal extent
☐ Seeps	☐ Location shown on site map	Areal extent
☐ Soft subgrade	☐ Location shown on site map	Areal extent

Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent

Remarks:

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☒ Passive
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☒ N/A
Remarks:

E. Gas Collection and Treatment ☒ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☒ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☒ Good condition ☐ Needs maintenance
Remarks:

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☒ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☒ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: Passive SVE systems are in service._____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment MM-1. Five-Year Review Site Inspection Checklist – M-Area Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedial action for the MAOU is Passive SVE to prevent the migration of VOCs from the contaminated soils to groundwater above the MCLs, and institutional controls and a 1-foot soil cover to protect remedial workers and future industrial workers from unacceptable exposure to VOCs. As reported in Section VII, the Passive SVE operations demonstrate that these actions are effective and that the remedies are functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures are adequately maintaining the integrity of the Passive SVE Systems. The O&M procedures consisting of annual site inspections and site maintenance (soil cover and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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Attachment MM-2. Passive SVE Monitoring Data

Passive soil vapor extraction (SVE) is used at 313-M, 320-M, 321-M, Manhole 4A and the Passive SVE Cell to treat chlorinated volatile organic compounds (cVOC) in the vadose zone and in excavated soil and concrete rubble (321-M Cell and Passive SVE Cell) at the M Area Operable Unit (MAOU). Contaminant migration (CM) issues center around tetrachloroethylene (PCE), and trichloroethylene (TCE); PCE is the CM constituent for the 313-M, 321-M, Manhole 4A and Passive SVE Cell, and TCE is the CM issue for 320-M. The remedial objective of the Passive SVE systems is to remove cVOCs from the vadose zone and soil and debris excavated during the MAOU Early Action (cells), so that the remaining cVOCs no longer represent a CM threat. Figure MM-2-1 illustrates the location of the MAOU Passive SVE systems at 313-M (MSVE-313), 321-M (321-M Cell), Manhole 4A (MSVE-4A) and Passive SVE Cell, and 320-M; all of these systems operate solely on barometric pressure change and do not have mechanical support. Gas is discharged from the vadose zone or cell when barometric pressure falls. Each of the systems and their monitoring results are described in more detail below.

313-M

The 313-M Passive SVE system consists of a single well to a depth of 15.2 m (50 ft) with a screened interval between 4.6 and 13.7 m (15 and 45 ft) below ground surface (bgs).

The 313-M Passive SVE system was sampled on 12/14/2010 and 11/29/2011. The 2010 sampling, analysis identified 1,1,1-trichloroethane (0.2 parts per million vapor [ppmv]), TCE (0.085 ppmv) and PCE (3.37 ppmv); only 1,1,1-trichloroethane (0.46 ppmv) and PCE (5.49 ppmv) were identified in the 2011 sample. Table MM-2-1 presents the analytes and detections. The data indicate that the primary contaminant is PCE. This is further supported by presence of 1,1,1-trichloroethane and TCE, which are much more volatile, and are at low concentrations. The 2010 sampling event was at a time when barometric pressure was likely increasing; the 2011 sampling event was at a time of rapidly decreasing atmospheric barometric pressure. Figure MM-2-2 and MM-2-3 show the daily barometric pressure changes during 2010 and 2011, respectively; sampling events are noted. The fact that there is little concentration difference between the two

sampling events suggests that there is little contamination present and it could be somewhat diffusion limited.

321-M Passive SVE Cell

The 321-M Cell consists of a series of five perforated horizontal pipes placed on top of the vertical excavation area adjacent to the 321-M building, and 1 horizontal perforated pipe placed within the backfilled area of the excavation. Figures MM-2-4 and MM-2-5 illustrate the planar and vertical configuration of the cell, respectively. The five horizontal pipes are connected via manifold and are sampled at locations: 1A, 2A, 3A, 4A, and 5A once per year. The single horizontal pipe in the backfill is sampled at location 6A once per year.

The 321-M Passive SVE cell was sampled on 1/14/2010 and 11/29/2011. The samples from locations 1A-5A and 6A indicate that the primary cVOC is PCE. The concentration of PCE in the 2010 event is relatively low (range from 0.08 ppmv to 5.94 ppmv), however the PCE concentrations associated with the 2011 event are many time higher (range from 14.58 to 298.74). Table MM-2-2 presents the data for 2010. Table MM-2-3 present data for 2011. The range of cVOCs is also greater (dichloroethylene, 1,1,1-trichloroethane, carbon tetrachloride, TCE, PCE). The atmospheric barometric pressure was falling during the 2011 sampling of the locations. The decreasing barometric pressure causes vadose zone and cell gases to purge to the surface which resulted in the dramatic increase in concentration, and variety of cVOCs. The significant increase in concentration during low-pressure events indicates that the Passive SVE systems are working well considering that there were many low barometric pressure opportunities during 2010 and 2011. SRS has not attempted to measure the gas flow rate from the cell because it is likely relatively low, and it would be difficult to predict the timing of the barometric pressure changes.

Manhole 4A (MSVE-4A)

The Passive SVE system at manhole 4A, located west of building 321-M (Figure MM-2-1), consists of a single Passive SVE well (MSVE-4A) to a depth of 15.2 m (50 ft) with a screened interval between 3.2 and 13.8 m (10.4 and 45.4 ft) bgs.

The Passive SVE well was sampled on 6/23/2010, 12/13/2010, and 11/28/2011. The samples from both Passive SVE wells indicate that the primary cVOC is PCE. Barometric pressure was falling during the June 2010 sampling, increasing during the December 2010 sampling, and may have been falling during the November sampling event. The PCE data follows this barometric trend as concentrations dropped in December 2010, then rose in 2011 to a maximum value of 90.789 ppmv. TCE and 1,1,1-trichloroethane was detected sparingly at low concentrations less than 1 ppmv. Table MM-2-9 presents the data from the three sampling events.

Passive SVE Cell

The Passive SVE Cell, located south of the M-1 Air Stripper (Figure MM-2-1), consists of five horizontal perforated pipes installed in the contaminated soil and concrete debris from the 320-M and 321-M buildings removal actions. Figures MM-2-6 and MM-2-7 illustrate the configuration of the passive SVE cell. The Passive SVE Cell is currently monitored at locations 1B, 2B, 3B, 4B, and 5B, once per year.

The passive SVE cell was sampled on 6/23/2010, 12/13/2010, and 11/28/2011. The samples from locations 1B-5B indicate that the primary cVOC is PCE. Barometric pressure was falling during the June 2010 sampling, increasing during the December 2010 sampling, and may have been falling during the November sampling event. The cVOC concentrations from all the sampling events are relatively low; this fact is not a surprise because the cVOC concentrations in the soil within the cell are low. The highest concentration results for PCE occur in the 2010 samples. The 2011 results are lower which suggests that barometric pumping from the cell may have stopped or not started. Tables MM-2-3, MM-2-4, and MM-2-5 present the data from the three sampling events.

320-M

The 320-M passive SVE system has two passive SVE wells, 320-1 and 320-2. The wells were placed between vertical excavation areas from the early removal actions, and support cVOC removal in a similar fashion as the 321-M cell. Figure MM-2-8 shows the location of the wells with respect to the vertical excavations. Both wells have a total depth of 35 feet, and are screened between 2.7 and 10.7 m (9 and 35 ft) bgs.

The wells were sampled 6/28/2010, 12/13/2010, and 11/29/2011. The gas data indicates that the primary constituent is TCE with lesser PCE, with occasional detections of carbon tetrachloride and 1,1,1-trichloroethane. Well 320-2 produces the highest concentration gas. Both wells produced the highest concentration of PCE during the 11/29/2011 sampling event with similar response during the 12/13/2010 event. Higher concentration during the November 2011 event is consistent with the data from the 321-M cell. Tables MM-2-7 and MM-2-8 present the data from the 320-1 and 320-2 wells, respectively.

Conclusion

All passive soil vapor extraction systems in MAOU appear to operating as designed. Clearly the systems produce cVOC, and appear to have significant production during barometric pressure periods when the pressure is falling. This behavior was very apparent in the 321-M passive SVE cell, because of the well-connected underlying vadose zone and higher concentration source (residual contamination between excavated shafts in the Upland Unit, which penetrate into the Tobacco Road Formation). cVOC concentrations are lower in the 313-M, 320-M , Manhole 4A, and the Passive SVE Cell, because the sources are smaller and less concentrated. Since the passive SVE systems are effectively removing cVOCs from the soil, no confirmatory soil samples are proposed to be collected. Continued passive operation and yearly monitoring of the passive SVE systems is expected until vapor levels drop and level off to diminishing returns.

Table MM-2-1. Analytical Data for 313-M (detections are noted in red)

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-313	14-Dec-10	TOLUENE	0.421	ppmv	U
MSVE-313	14-Dec-10	CHLOROFORM	0.043	ppmv	U
MSVE-313	14-Dec-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-313	14-Dec-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-313	14-Dec-10	1,1,1-TRICHLOROETHANE	0.205	ppmv	
MSVE-313	14-Dec-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-313	14-Dec-10	TRICHLOROETHYLENE (TCE)	0.085	ppmv	
MSVE-313	14-Dec-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-313	14-Dec-10	TETRACHLOROETHYLENE (PCE)	3.37	ppmv	
MSVE-313	14-Dec-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-313	14-Dec-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-313	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-313	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-313	29-Nov-11	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-313	29-Nov-11	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-313	29-Nov-11	1,1,1-TRICHLOROETHANE	0.462	ppmv	
MSVE-313	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-313	29-Nov-11	TRICHLOROETHYLENE (TCE)	0.022	ppmv	J
MSVE-313	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-313	29-Nov-11	TETRACHLOROETHYLENE (PCE)	5.492	ppmv	
MSVE-313	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-313	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U

Detections are noted in red

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Table MM-2-2. 2010 Analytical Data for 321-M Passive SVE Cell

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-321-1A	14-Jan-10	BENZENE	0.614	ppmv	U
MSVE-321-1A	14-Jan-10	TOLUENE	0.421	ppmv	U
MSVE-321-1A	14-Jan-10	CHLOROFORM	0.043	ppmv	U
MSVE-321-1A	14-Jan-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-321-1A	14-Jan-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-321-1A	14-Jan-10	1,1,1-TRICHLOROETHANE	0.012	ppmv	J
MSVE-321-1A	14-Jan-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-1A	14-Jan-10	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-321-1A	14-Jan-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-1A	14-Jan-10	TETRACHLOROETHYLENE (PCE)	0.695	ppmv	
MSVE-321-1A	14-Jan-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-1A	14-Jan-10	DICHLOROMETHANE (METHYLENE CHLORIDE)	4.8	ppmv	U
MSVE-321-1A	14-Jan-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-2A	14-Jan-10	BENZENE	0.614	ppmv	U
MSVE-321-2A	14-Jan-10	TOLUENE	0.421	ppmv	U
MSVE-321-2A	14-Jan-10	CHLOROFORM	0.043	ppmv	U
MSVE-321-2A	14-Jan-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-321-2A	14-Jan-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-321-2A	14-Jan-10	1,1,1-TRICHLOROETHANE	0.01	ppmv	J
MSVE-321-2A	14-Jan-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-2A	14-Jan-10	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-321-2A	14-Jan-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-2A	14-Jan-10	TETRACHLOROETHYLENE (PCE)	0.399	ppmv	
MSVE-321-2A	14-Jan-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-2A	14-Jan-10	DICHLOROMETHANE (METHYLENE CHLORIDE)	4.8	ppmv	U
MSVE-321-2A	14-Jan-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-3A	14-Jan-10	BENZENE	0.614	ppmv	U
MSVE-321-3A	14-Jan-10	TOLUENE	0.421	ppmv	U
MSVE-321-3A	14-Jan-10	CHLOROFORM	0.043	ppmv	U
MSVE-321-3A	14-Jan-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-321-3A	14-Jan-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-321-3A	14-Jan-10	1,1,1-TRICHLOROETHANE	0.011	ppmv	J
MSVE-321-3A	14-Jan-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-3A	14-Jan-10	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-321-3A	14-Jan-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-3A	14-Jan-10	TETRACHLOROETHYLENE (PCE)	0.8	ppmv	
MSVE-321-3A	14-Jan-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-3A	14-Jan-10	DICHLOROMETHANE (METHYLENE CHLORIDE)	4.8	ppmv	U
MSVE-321-3A	14-Jan-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-4A	14-Jan-10	BENZENE	0.614	ppmv	U
MSVE-321-4A	14-Jan-10	TOLUENE	0.421	ppmv	U
MSVE-321-4A	14-Jan-10	CHLOROFORM	0.043	ppmv	U
MSVE-321-4A	14-Jan-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-321-4A	14-Jan-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-321-4A	14-Jan-10	1,1,1-TRICHLOROETHANE	0.009	ppmv	U
MSVE-321-4A	14-Jan-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-4A	14-Jan-10	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-321-4A	14-Jan-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-4A	14-Jan-10	TETRACHLOROETHYLENE (PCE)	0.088	ppmv	
MSVE-321-4A	14-Jan-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-4A	14-Jan-10	DICHLOROMETHANE (METHYLENE CHLORIDE)	4.8	ppmv	U
MSVE-321-4A	14-Jan-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-5A	14-Jan-10	BENZENE	0.614	ppmv	U
MSVE-321-5A	14-Jan-10	TOLUENE	0.421	ppmv	U
MSVE-321-5A	14-Jan-10	CHLOROFORM	0.043	ppmv	U
MSVE-321-5A	14-Jan-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-321-5A	14-Jan-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-321-5A	14-Jan-10	1,1,1-TRICHLOROETHANE	0.009	ppmv	U
MSVE-321-5A	14-Jan-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-5A	14-Jan-10	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-321-5A	14-Jan-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-5A	14-Jan-10	TETRACHLOROETHYLENE (PCE)	0.118	ppmv	
MSVE-321-5A	14-Jan-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-5A	14-Jan-10	DICHLOROMETHANE (METHYLENE CHLORIDE)	4.8	ppmv	U
MSVE-321-5A	14-Jan-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-6A	14-Jan-10	BENZENE	0.614	ppmv	U
MSVE-321-6A	14-Jan-10	TOLUENE	0.421	ppmv	U

Table MM-2-2. 2010 Analytical Data for 321-M Passive SVE Cell (*continued, end*)

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-321-6A	14-Jan-10	CHLOROFORM	0.043	ppmv	U
MSVE-321-6A	14-Jan-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-321-6A	14-Jan-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-321-6A	14-Jan-10	1,1,1-TRICHLOROETHANE	1.186	ppmv	
MSVE-321-6A	14-Jan-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-6A	14-Jan-10	TRICHLOROETHYLENE (TCE)	0.163	ppmv	
MSVE-321-6A	14-Jan-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-6A	14-Jan-10	TETRACHLOROETHYLENE (PCE)	5.946	ppmv	
MSVE-321-6A	14-Jan-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-6A	14-Jan-10	DICHLOROMETHANE (METHYLENE CHLORIDE)	4.8	ppmv	U
MSVE-321-6A	14-Jan-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U

Table MM-2-3. 2011 Analytical Data for 321-M Passive SVE Cell

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-321-1A	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-321-1A	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-321-1A	29-Nov-11	1,1-DICHLOROETHYLENE	0.436	ppmv	
MSVE-321-1A	29-Nov-11	CARBON TETRACHLORIDE	0.004	ppmv	J
MSVE-321-1A	29-Nov-11	1,1,1-TRICHLOROETHANE	6.725	ppmv	
MSVE-321-1A	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-1A	29-Nov-11	TRICHLOROETHYLENE (TCE)	1.246	ppmv	
MSVE-321-1A	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-1A	29-Nov-11	TETRACHLOROETHYLENE (PCE)	33.156	ppmv	
MSVE-321-1A	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-1A	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.031	ppmv	
MSVE-321-2A	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-321-2A	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-321-2A	29-Nov-11	1,1-DICHLOROETHYLENE	1.152	ppmv	
MSVE-321-2A	29-Nov-11	CARBON TETRACHLORIDE	0.011	ppmv	
MSVE-321-2A	29-Nov-11	1,1,1-TRICHLOROETHANE	19.87	ppmv	
MSVE-321-2A	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-2A	29-Nov-11	TRICHLOROETHYLENE (TCE)	5.182	ppmv	
MSVE-321-2A	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-2A	29-Nov-11	TETRACHLOROETHYLENE (PCE)	114.362	ppmv	

Table MM-2-3. 2011 Analytical Data for 321-M Passive SVE Cell (*continued; end*)

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-321-2A	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-2A	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-3A	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-321-3A	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-321-3A	29-Nov-11	1,1-DICHLOROETHYLENE	2.4	ppmv	
MSVE-321-3A	29-Nov-11	CARBON TETRACHLORIDE	0.029	ppmv	
MSVE-321-3A	29-Nov-11	1,1,1-TRICHLOROETHANE	49.02	ppmv	
MSVE-321-3A	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-3A	29-Nov-11	TRICHLOROETHYLENE (TCE)	16.162	ppmv	
MSVE-321-3A	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-3A	29-Nov-11	TETRACHLOROETHYLENE (PCE)	298.748	ppmv	
MSVE-321-3A	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-3A	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-4A	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-321-4A	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-321-4A	29-Nov-11	1,1-DICHLOROETHYLENE	2.184	ppmv	
MSVE-321-4A	29-Nov-11	CARBON TETRACHLORIDE	0.059	ppmv	
MSVE-321-4A	29-Nov-11	1,1,1-TRICHLOROETHANE	42.227	ppmv	
MSVE-321-4A	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-4A	29-Nov-11	TRICHLOROETHYLENE (TCE)	7.999	ppmv	
MSVE-321-4A	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-4A	29-Nov-11	TETRACHLOROETHYLENE (PCE)	139.953	ppmv	
MSVE-321-4A	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-4A	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-5A	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-321-5A	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-321-5A	29-Nov-11	1,1-DICHLOROETHYLENE	0.506	ppmv	
MSVE-321-5A	29-Nov-11	CARBON TETRACHLORIDE	0.008	ppmv	
MSVE-321-5A	29-Nov-11	1,1,1-TRICHLOROETHANE	8.542	ppmv	
MSVE-321-5A	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-5A	29-Nov-11	TRICHLOROETHYLENE (TCE)	2.8	ppmv	
MSVE-321-5A	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-5A	29-Nov-11	TETRACHLOROETHYLENE (PCE)	80.412	ppmv	
MSVE-321-5A	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-5A	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-321-6A	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-321-6A	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-321-6A	29-Nov-11	1,1-DICHLOROETHYLENE	0.618	ppmv	
MSVE-321-6A	29-Nov-11	CARBON TETRACHLORIDE	0.005	ppmv	
MSVE-321-6A	29-Nov-11	1,1,1-TRICHLOROETHANE	7.527	ppmv	
MSVE-321-6A	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-321-6A	29-Nov-11	TRICHLOROETHYLENE (TCE)	0.523	ppmv	
MSVE-321-6A	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-321-6A	29-Nov-11	TETRACHLOROETHYLENE (PCE)	14.589	ppmv	
MSVE-321-6A	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-321-6A	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U

Table MM-2-4. June 2010 Analytical Data for the Passive SVE Cell

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-1B	23-Jun-10	TOLUENE	0.421	ppmv	U
MSVE-1B	23-Jun-10	CHLOROFORM	0.043	ppmv	U
MSVE-1B	23-Jun-10	1,1-DICHLOROETHYLENE	0.769	ppmv	
MSVE-1B	23-Jun-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-1B	23-Jun-10	1,1,1-TRICHLOROETHANE	0.936	ppmv	
MSVE-1B	23-Jun-10	TRICHLOROFLUOROMETHANE	0.04	ppmv	
MSVE-1B	23-Jun-10	TRICHLOROETHYLENE (TCE)	0.311	ppmv	
MSVE-1B	23-Jun-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-1B	23-Jun-10	TETRACHLOROETHYLENE (PCE)	4.957	ppmv	
MSVE-1B	23-Jun-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-1B	23-Jun-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-2B	23-Jun-10	TOLUENE	0.421	ppmv	U
MSVE-2B	23-Jun-10	CHLOROFORM	0.043	ppmv	U
MSVE-2B	23-Jun-10	1,1-DICHLOROETHYLENE	0.774	ppmv	
MSVE-2B	23-Jun-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-2B	23-Jun-10	1,1,1-TRICHLOROETHANE	0.822	ppmv	
MSVE-2B	23-Jun-10	TRICHLOROFLUOROMETHANE	0.035	ppmv	
MSVE-2B	23-Jun-10	TRICHLOROETHYLENE (TCE)	0.273	ppmv	
MSVE-2B	23-Jun-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-2B	23-Jun-10	TETRACHLOROETHYLENE (PCE)	4.334	ppmv	
MSVE-2B	23-Jun-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-2B	23-Jun-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-3B	23-Jun-10	TOLUENE	0.421	ppmv	U
MSVE-3B	23-Jun-10	CHLOROFORM	0.043	ppmv	U
MSVE-3B	23-Jun-10	1,1-DICHLOROETHYLENE	0.74	ppmv	
MSVE-3B	23-Jun-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-3B	23-Jun-10	1,1,1-TRICHLOROETHANE	0.747	ppmv	
MSVE-3B	23-Jun-10	TRICHLOROFLUOROMETHANE	0.032	ppmv	
MSVE-4B	23-Jun-10	TOLUENE	0.421	ppmv	U
MSVE-4B	23-Jun-10	CHLOROFORM	0.043	ppmv	U
MSVE-4B	23-Jun-10	1,1-DICHLOROETHYLENE	1.254	ppmv	
MSVE-4B	23-Jun-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-4B	23-Jun-10	1,1,1-TRICHLOROETHANE	0.986	ppmv	
MSVE-4B	23-Jun-10	TRICHLOROFLUOROMETHANE	0.041	ppmv	
MSVE-4B	23-Jun-10	TRICHLOROETHYLENE (TCE)	0.336	ppmv	
MSVE-4B	23-Jun-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-4B	23-Jun-10	TETRACHLOROETHYLENE (PCE)	5.031	ppmv	
MSVE-4B	23-Jun-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-4B	23-Jun-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-5B	23-Jun-10	TOLUENE	0.421	ppmv	U
MSVE-5B	23-Jun-10	CHLOROFORM	0.043	ppmv	U
MSVE-5B	23-Jun-10	1,1-DICHLOROETHYLENE	0.737	ppmv	
MSVE-5B	23-Jun-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-5B	23-Jun-10	1,1,1-TRICHLOROETHANE	1.123	ppmv	
MSVE-5B	23-Jun-10	TRICHLOROFLUOROMETHANE	0.046	ppmv	
MSVE-5B	23-Jun-10	TRICHLOROETHYLENE (TCE)	0.395	ppmv	
MSVE-5B	23-Jun-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-5B	23-Jun-10	TETRACHLOROETHYLENE (PCE)	5.833	ppmv	
MSVE-5B	23-Jun-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-5B	23-Jun-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U

Table MM-2-5. December 2010 Analytical Data for the Passive SVE Cell

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-1B	13-Dec-10	TOLUENE	0.421	ppmv	U
MSVE-1B	13-Dec-10	CHLOROFORM	0.043	ppmv	U
MSVE-1B	13-Dec-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-1B	13-Dec-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-1B	13-Dec-10	1,1,1-TRICHLOROETHANE	0.009	ppmv	U
MSVE-1B	13-Dec-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-1B	13-Dec-10	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-1B	13-Dec-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-1B	13-Dec-10	TETRACHLOROETHYLENE (PCE)	0.074	ppmv	
MSVE-1B	13-Dec-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-1B	13-Dec-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-2B	13-Dec-10	TOLUENE	0.421	ppmv	U
MSVE-2B	13-Dec-10	CHLOROFORM	0.043	ppmv	U
MSVE-2B	13-Dec-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-2B	13-Dec-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-2B	13-Dec-10	1,1,1-TRICHLOROETHANE	0.013	ppmv	J
MSVE-2B	13-Dec-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-2B	13-Dec-10	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-2B	13-Dec-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-2B	13-Dec-10	TETRACHLOROETHYLENE (PCE)	0.162	ppmv	
MSVE-2B	13-Dec-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-2B	13-Dec-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-3B	13-Dec-10	TOLUENE	0.421	ppmv	U
MSVE-3B	13-Dec-10	CHLOROFORM	0.043	ppmv	U
MSVE-3B	13-Dec-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-3B	13-Dec-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-3B	13-Dec-10	1,1,1-TRICHLOROETHANE	0.016	ppmv	
MSVE-3B	13-Dec-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-3B	13-Dec-10	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-3B	13-Dec-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-3B	13-Dec-10	TETRACHLOROETHYLENE (PCE)	0.142	ppmv	
MSVE-3B	13-Dec-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-3B	13-Dec-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-4B	13-Dec-10	TOLUENE	0.421	ppmv	U
MSVE-4B	13-Dec-10	CHLOROFORM	0.043	ppmv	U
MSVE-4B	13-Dec-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-4B	13-Dec-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-4B	13-Dec-10	1,1,1-TRICHLOROETHANE	0.061	ppmv	
MSVE-4B	13-Dec-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-4B	13-Dec-10	TRICHLOROETHYLENE (TCE)	0.028	ppmv	J
MSVE-4B	13-Dec-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-4B	13-Dec-10	TETRACHLOROETHYLENE (PCE)	0.464	ppmv	
MSVE-4B	13-Dec-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-4B	13-Dec-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-5B	13-Dec-10	TOLUENE	0.421	ppmv	U
MSVE-5B	13-Dec-10	CHLOROFORM	0.043	ppmv	U
MSVE-5B	13-Dec-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-5B	13-Dec-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-5B	13-Dec-10	1,1,1-TRICHLOROETHANE	0.445	ppmv	
MSVE-5B	13-Dec-10	TRICHLOROFLUOROMETHANE	0.01	ppmv	
MSVE-5B	13-Dec-10	TRICHLOROETHYLENE (TCE)	0.211	ppmv	
MSVE-5B	13-Dec-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-5B	13-Dec-10	TETRACHLOROETHYLENE (PCE)	3.259	ppmv	
MSVE-5B	13-Dec-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U

Table MM-2-6. November2011 Analytical Data for the Passive SVE Cell

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-1B	28-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-1B	28-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-1B	28-Nov-11	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-1B	28-Nov-11	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-1B	28-Nov-11	1,1,1-TRICHLOROETHANE	0.066	ppmv	
MSVE-1B	28-Nov-11	TRICHLOROFLUOROMETHANE	0.004	ppmv	
MSVE-1B	28-Nov-11	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-1B	28-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-1B	28-Nov-11	TETRACHLOROETHYLENE (PCE)	0.679	ppmv	
MSVE-1B	28-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-1B	28-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-2B	28-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-2B	28-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-2B	28-Nov-11	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-2B	28-Nov-11	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-2B	28-Nov-11	1,1,1-TRICHLOROETHANE	0.043	ppmv	
MSVE-2B	28-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-2B	28-Nov-11	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-2B	28-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-2B	28-Nov-11	TETRACHLOROETHYLENE (PCE)	0.399	ppmv	
MSVE-2B	28-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-2B	28-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-3B	28-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-3B	28-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-3B	28-Nov-11	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-3B	28-Nov-11	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-3B	28-Nov-11	1,1,1-TRICHLOROETHANE	0.053	ppmv	
MSVE-3B	28-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-3B	28-Nov-11	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-3B	28-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-3B	28-Nov-11	TETRACHLOROETHYLENE (PCE)	0.415	ppmv	
MSVE-3B	28-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-3B	28-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-4B	28-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-4B	28-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-4B	28-Nov-11	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-4B	28-Nov-11	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-4B	28-Nov-11	1,1,1-TRICHLOROETHANE	0.122	ppmv	
MSVE-4B	28-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	J
MSVE-4B	28-Nov-11	TRICHLOROETHYLENE (TCE)	0.034	ppmv	
MSVE-4B	28-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-4B	28-Nov-11	TETRACHLOROETHYLENE (PCE)	0.548	ppmv	
MSVE-4B	28-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-4B	28-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-5B	28-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-5B	28-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-5B	28-Nov-11	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-5B	28-Nov-11	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-5B	28-Nov-11	1,1,1-TRICHLOROETHANE	0.124	ppmv	
MSVE-5B	28-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	J
MSVE-5B	28-Nov-11	TRICHLOROETHYLENE (TCE)	0.032	ppmv	
MSVE-5B	28-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-5B	28-Nov-11	TETRACHLOROETHYLENE (PCE)	0.743	ppmv	
MSVE-5B	28-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-5B	28-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U

Table MM-2-7. 2010 and 2011 Analytical Data for 320-M (320-1 Passive SVE Well)

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-320-1	28-Jun-10	TOLUENE	0.421	ppmv	U
MSVE-320-1	28-Jun-10	CHLOROFORM	0.043	ppmv	U
MSVE-320-1	28-Jun-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-320-1	28-Jun-10	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-320-1	28-Jun-10	1,1,1-TRICHLOROETHANE	0.009	ppmv	U
MSVE-320-1	28-Jun-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-320-1	28-Jun-10	TRICHLOROETHYLENE (TCE)	1.446	ppmv	
MSVE-320-1	28-Jun-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-320-1	28-Jun-10	TETRACHLOROETHYLENE (PCE)	0.331	ppmv	
MSVE-320-1	28-Jun-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-320-1	28-Jun-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-320-1	13-Dec-10	TOLUENE	0.421	ppmv	U
MSVE-320-1	13-Dec-10	CHLOROFORM	0.043	ppmv	U
MSVE-320-1	13-Dec-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-320-1	13-Dec-10	CARBON TETRACHLORIDE	0.02	ppmv	
MSVE-320-1	13-Dec-10	1,1,1-TRICHLOROETHANE	0.009	ppmv	U
MSVE-320-1	13-Dec-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-320-1	13-Dec-10	TRICHLOROETHYLENE (TCE)	6.92	ppmv	
MSVE-320-1	13-Dec-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-320-1	13-Dec-10	TETRACHLOROETHYLENE (PCE)	2.272	ppmv	
MSVE-320-1	13-Dec-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-320-1	13-Dec-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-320-1	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-320-1	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-320-1	29-Nov-11	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-320-1	29-Nov-11	CARBON TETRACHLORIDE	0.057	ppmv	
MSVE-320-1	29-Nov-11	1,1,1-TRICHLOROETHANE	0.015	ppmv	
MSVE-320-1	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-320-1	29-Nov-11	TRICHLOROETHYLENE (TCE)	31.132	ppmv	
MSVE-320-1	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-320-1	29-Nov-11	TETRACHLOROETHYLENE (PCE)	4.565	ppmv	
MSVE-320-1	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-320-1	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U

Table MM-2-8. 2010 and 2011 Analytical Data for 320-M (320-2 Passive SVE Well)

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-320-2	28-Jun-10	TOLUENE	0.421	ppmv	U
MSVE-320-2	28-Jun-10	CHLOROFORM	0.043	ppmv	U
MSVE-320-2	28-Jun-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-320-2	28-Jun-10	CARBON TETRACHLORIDE	0.004	ppmv	J
MSVE-320-2	28-Jun-10	1,1,1-TRICHLOROETHANE	0.025	ppmv	
MSVE-320-2	28-Jun-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-320-2	28-Jun-10	TRICHLOROETHYLENE (TCE)	124.718	ppmv	
MSVE-320-2	28-Jun-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-320-2	28-Jun-10	TETRACHLOROETHYLENE (PCE)	20.985	ppmv	
MSVE-320-2	28-Jun-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-320-2	28-Jun-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-320-2	13-Dec-10	TOLUENE	0.421	ppmv	U
MSVE-320-2	13-Dec-10	CHLOROFORM	0.043	ppmv	U
MSVE-320-2	13-Dec-10	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-320-2	13-Dec-10	CARBON TETRACHLORIDE	0.022	ppmv	
MSVE-320-2	13-Dec-10	1,1,1-TRICHLOROETHANE	0.057	ppmv	
MSVE-320-2	13-Dec-10	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-320-2	13-Dec-10	TRICHLOROETHYLENE (TCE)	192.899	ppmv	
MSVE-320-2	13-Dec-10	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-320-2	13-Dec-10	TETRACHLOROETHYLENE (PCE)	20.023	ppmv	
MSVE-320-2	13-Dec-10	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-320-2	13-Dec-10	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-320-2	29-Nov-11	TOLUENE	0.421	ppmv	U
MSVE-320-2	29-Nov-11	CHLOROFORM	0.043	ppmv	U
MSVE-320-2	29-Nov-11	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-320-2	29-Nov-11	CARBON TETRACHLORIDE	0.045	ppmv	
MSVE-320-2	29-Nov-11	1,1,1-TRICHLOROETHANE	0.064	ppmv	
MSVE-320-2	29-Nov-11	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-320-2	29-Nov-11	TRICHLOROETHYLENE (TCE)	196.587	ppmv	
MSVE-320-2	29-Nov-11	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-320-2	29-Nov-11	TETRACHLOROETHYLENE (PCE)	31.171	ppmv	
MSVE-320-2	29-Nov-11	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-320-2	29-Nov-11	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U

Table MM-2-9. 2010 and 2011 Analytical Data for the Manhole 4A Passive SVE (MSVE-4A)

Location	Sample Date	Analyte	Result	Unit	Lab Qualifier
MSVE-4A	6/28/2010	1,1,1-TRICHLOROETHANE	0.03	ppmv	
MSVE-4A	6/28/2010	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-4A	6/28/2010	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-4A	6/28/2010	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-4A	6/28/2010	CHLOROFORM	0.043	ppmv	U
MSVE-4A	6/28/2010	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-4A	6/28/2010	TETRACHLOROETHYLENE (PCE)	41.178	ppmv	
MSVE-4A	6/28/2010	TOLUENE	0.421	ppmv	U
MSVE-4A	6/28/2010	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-4A	6/28/2010	TRICHLOROETHYLENE (TCE)	0.053	ppmv	
MSVE-4A	6/28/2010	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-4A	12/13/2010	1,1,1-TRICHLOROETHANE	0.009	ppmv	U
MSVE-4A	12/13/2010	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-4A	12/13/2010	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-4A	12/13/2010	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-4A	12/13/2010	CHLOROFORM	0.043	ppmv	U
MSVE-4A	12/13/2010	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-4A	12/13/2010	TETRACHLOROETHYLENE (PCE)	13.658	ppmv	
MSVE-4A	12/13/2010	TOLUENE	0.421	ppmv	U
MSVE-4A	12/13/2010	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-4A	12/13/2010	TRICHLOROETHYLENE (TCE)	0.017	ppmv	U
MSVE-4A	12/13/2010	TRICHLOROFLUOROMETHANE	0.002	ppmv	U
MSVE-4A	11/29/2011	1,1,1-TRICHLOROETHANE	0.044	ppmv	
MSVE-4A	11/29/2011	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	0.016	ppmv	U
MSVE-4A	11/29/2011	1,1-DICHLOROETHYLENE	0.209	ppmv	U
MSVE-4A	11/29/2011	CARBON TETRACHLORIDE	0.003	ppmv	U
MSVE-4A	11/29/2011	CHLOROFORM	0.043	ppmv	U
MSVE-4A	11/29/2011	CIS-1,2-DICHLOROETHYLENE	3	ppmv	U
MSVE-4A	11/29/2011	TETRACHLOROETHYLENE (PCE)	90.789	ppmv	
MSVE-4A	11/29/2011	TOLUENE	0.421	ppmv	U
MSVE-4A	11/29/2011	TRANS-1,2-DICHLOROETHYLENE	2	ppmv	U
MSVE-4A	11/29/2011	TRICHLOROETHYLENE (TCE)	0.026	ppmv	J
MSVE-4A	11/29/2011	TRICHLOROFLUOROMETHANE	0.002	ppmv	U

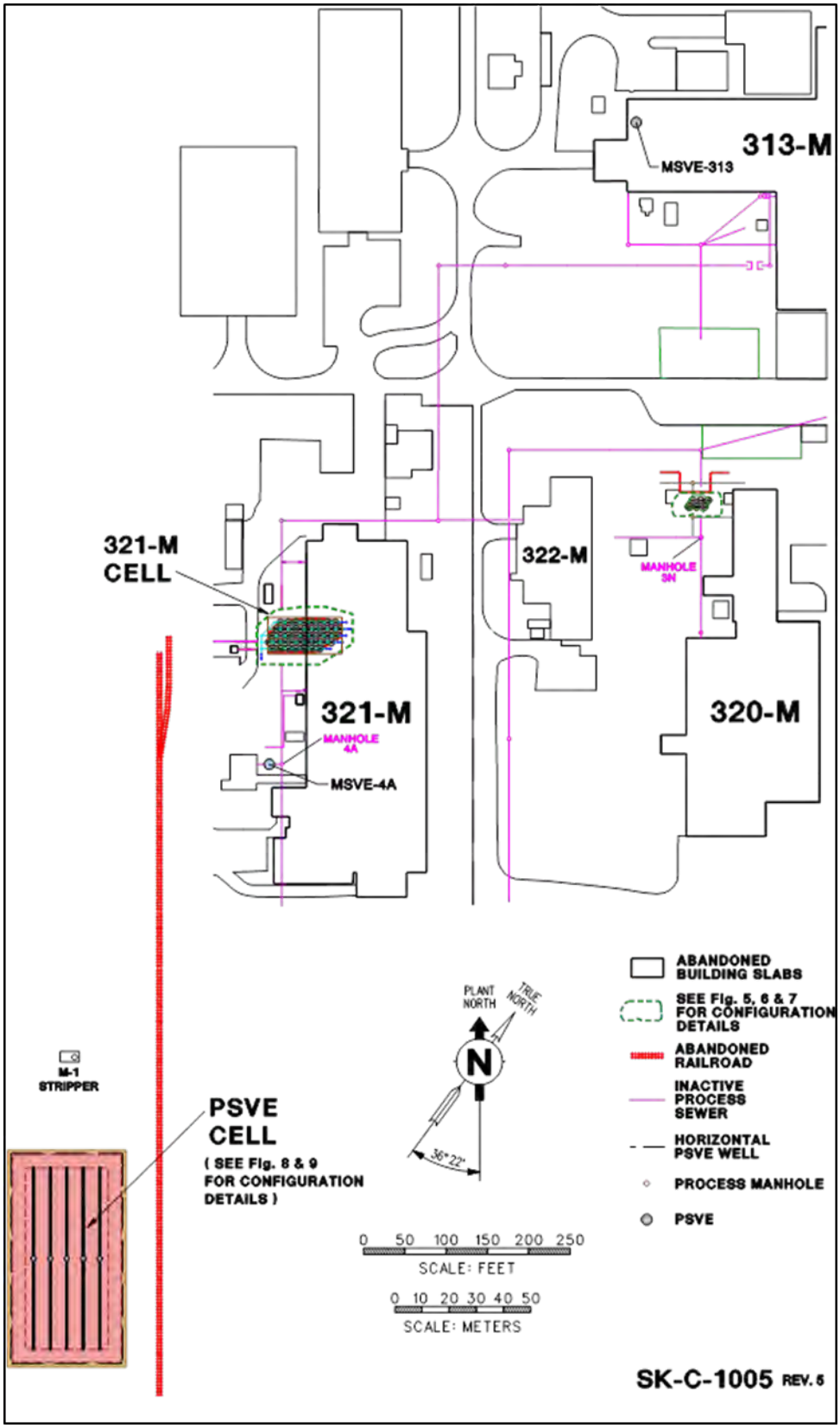


Figure MM-2-1. Location of the Passive Soil Vapor Extraction Systems in MAOU

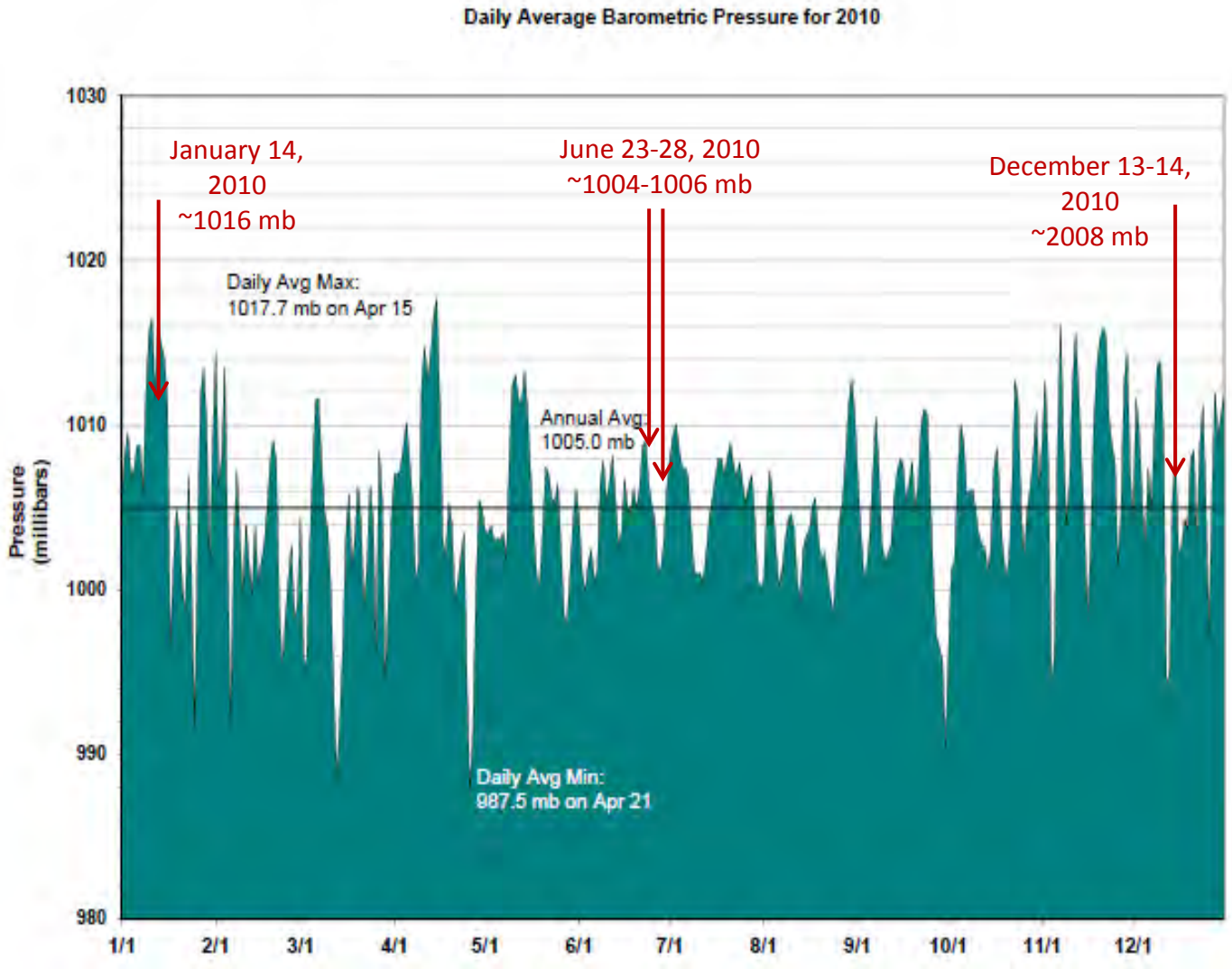


Figure MM-2-2. 2010 Daily Barometric Pressure Measurements at SRS with Passive SVE Sampling Events Identified

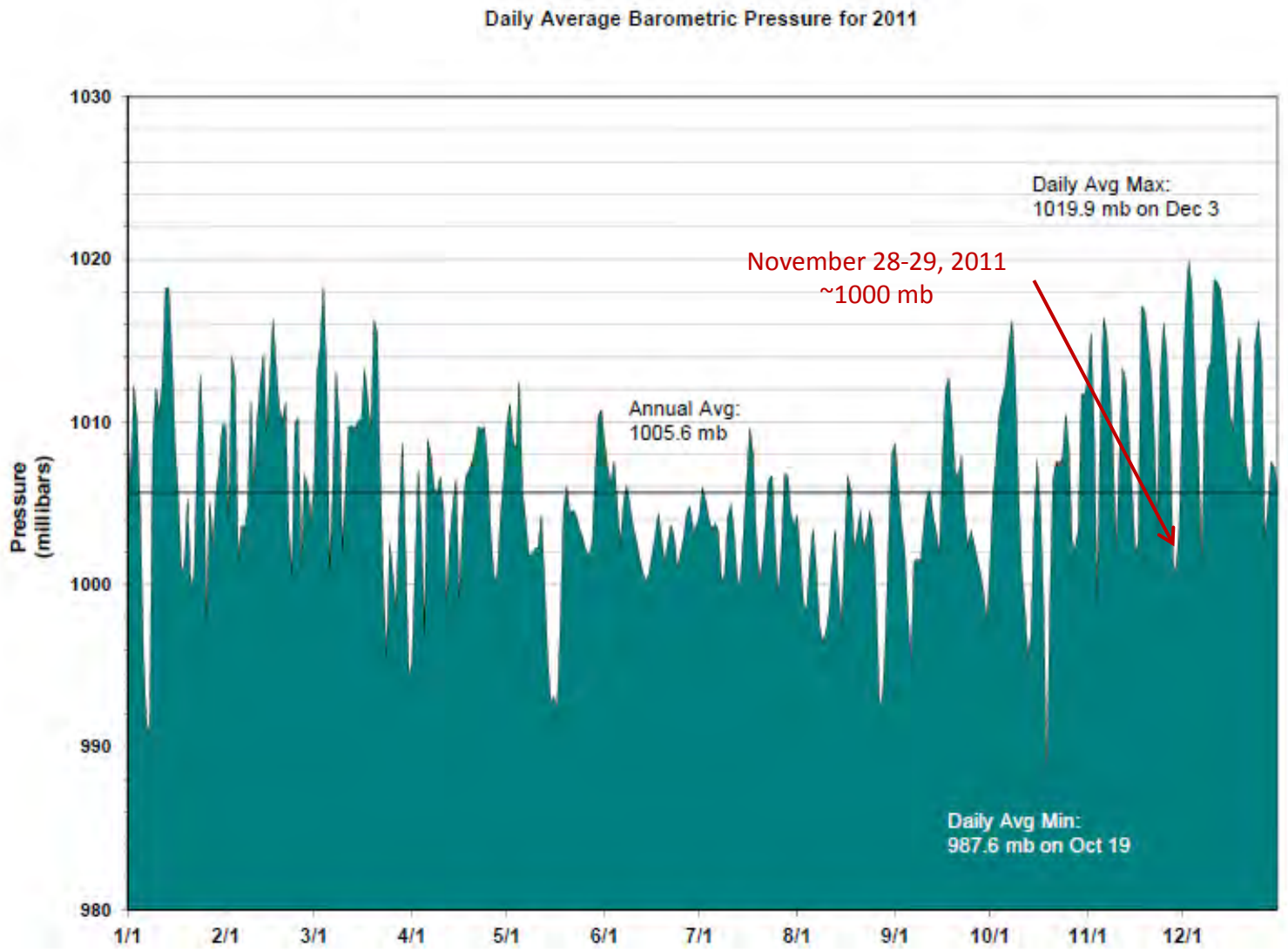


Figure MM-2-3. 2011 Daily Barometric Pressure Measurements at SRS with Passive SVE Sampling Event Identified

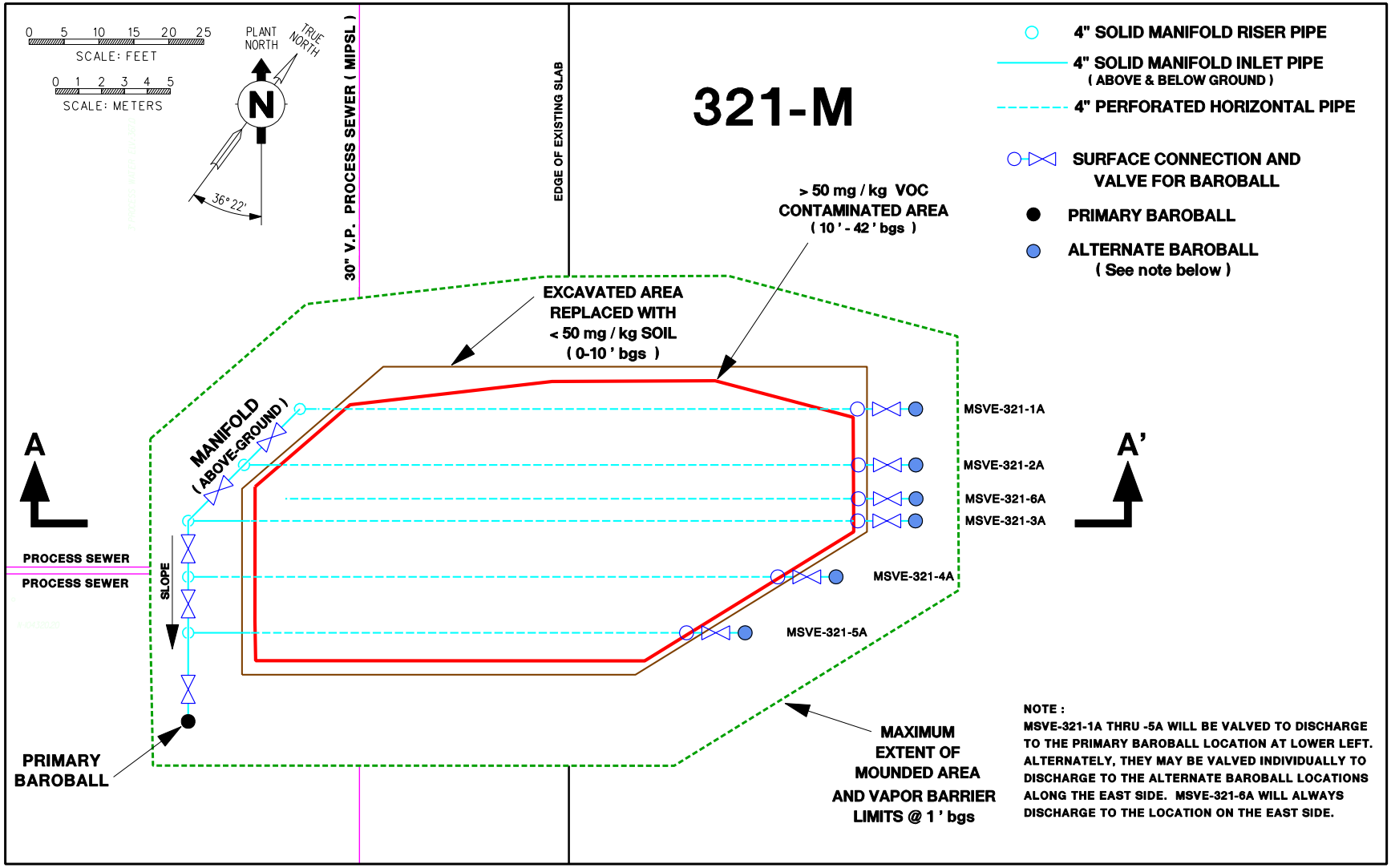


Figure MM-2-4. Planar Configuration of the 321-M Passive SVE Cell

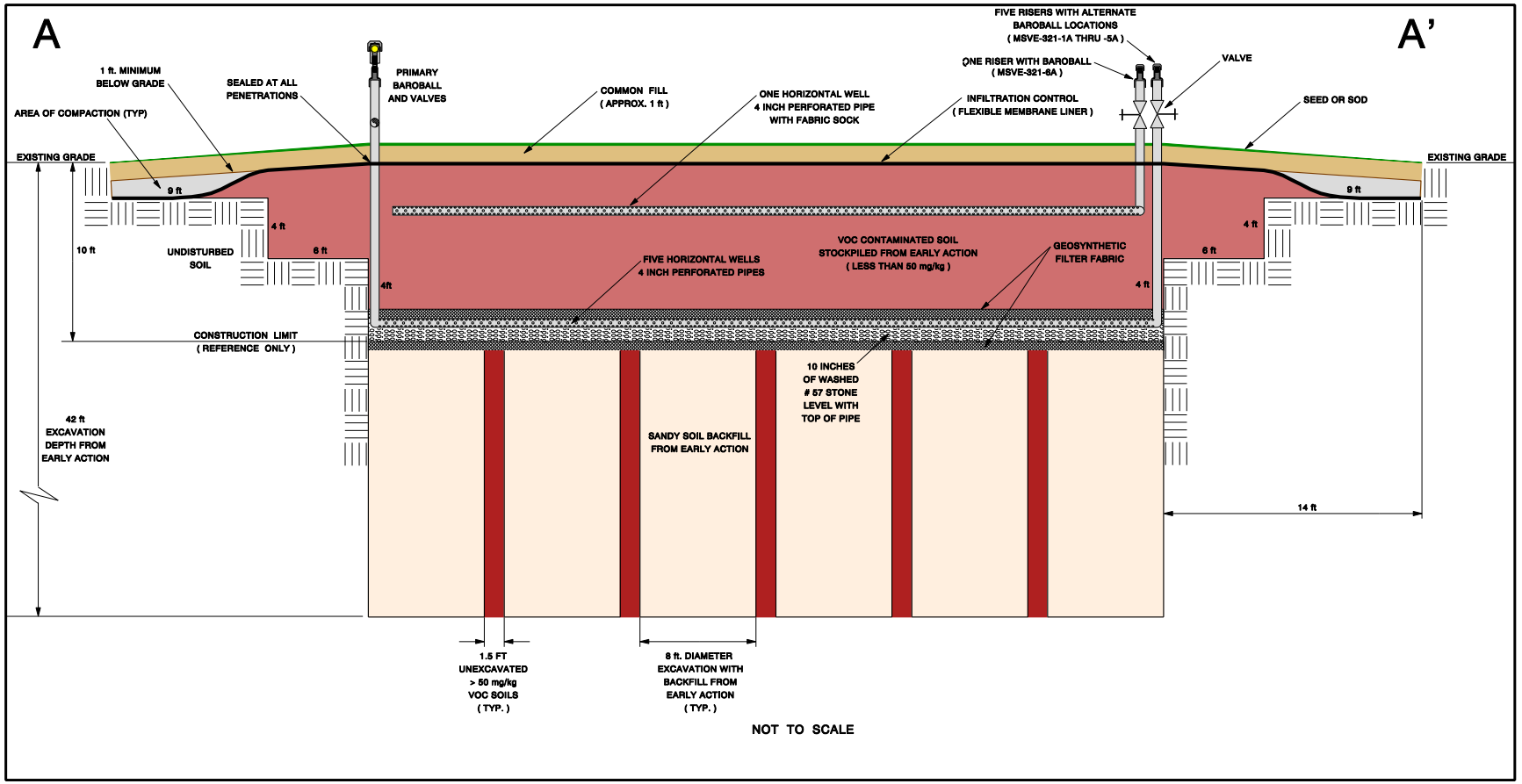


Figure MM-2-5. Vertical Configuration of the 321-M Passive SVE Cell, Showing Piping Above the Vertical Excavations and within the Fill

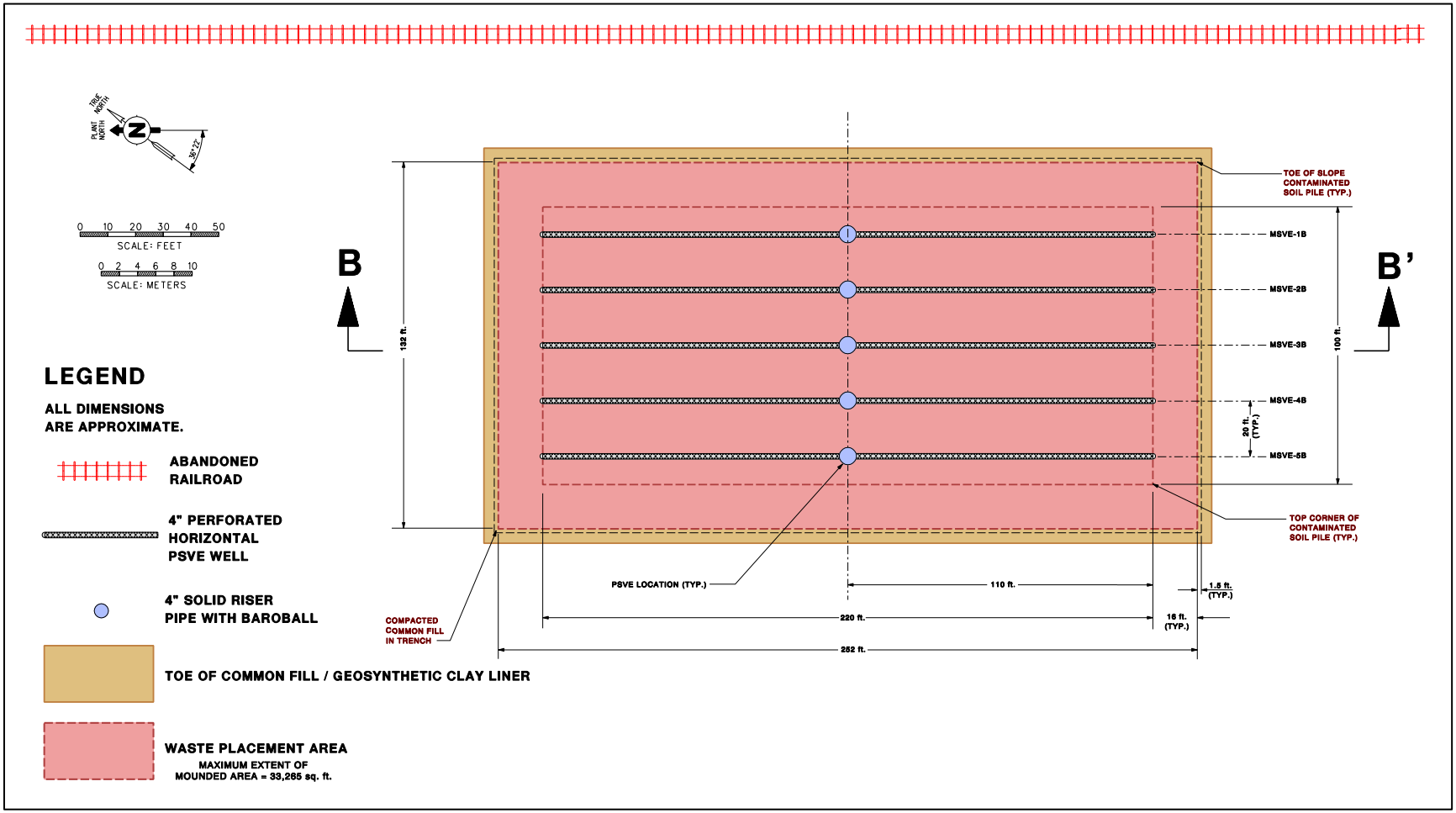


Figure MM-2-6. Planar Configuration of the Passive SVE Cell

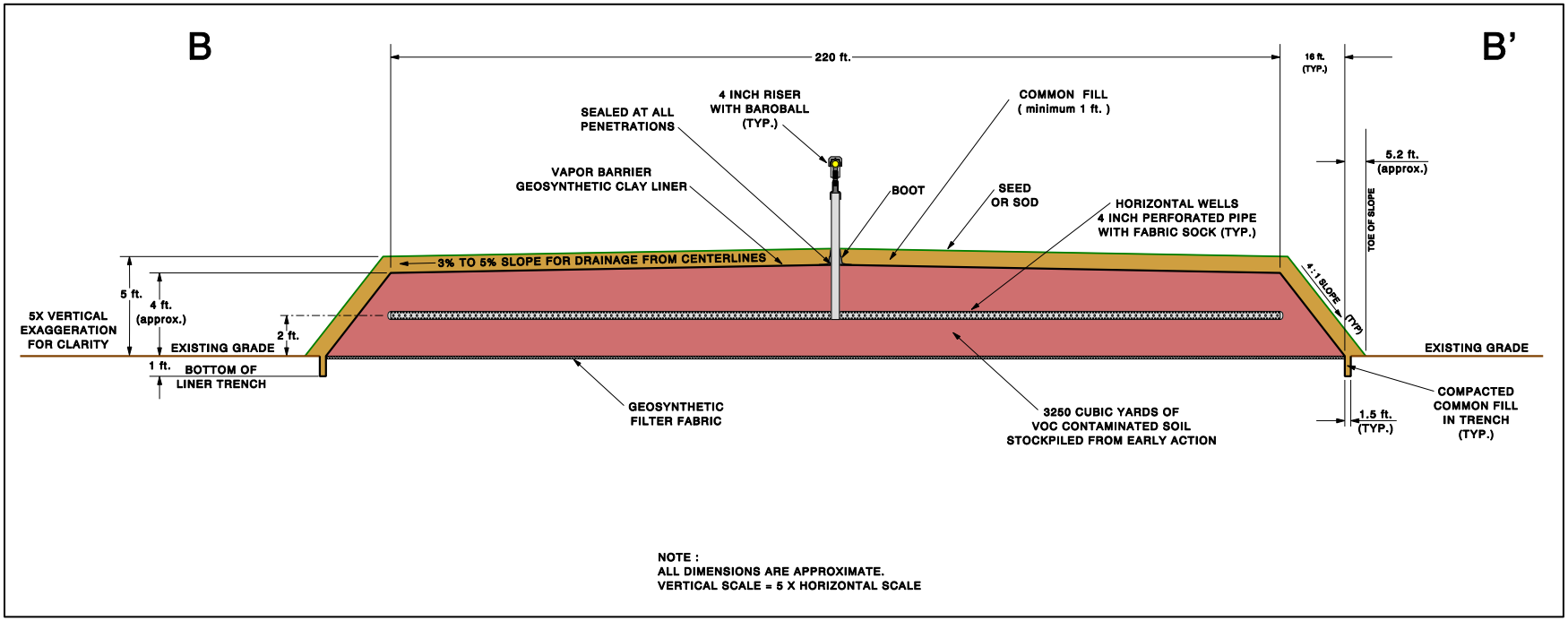


Figure MM-2-7. Vertical Configuration of the Passive SVE Cell

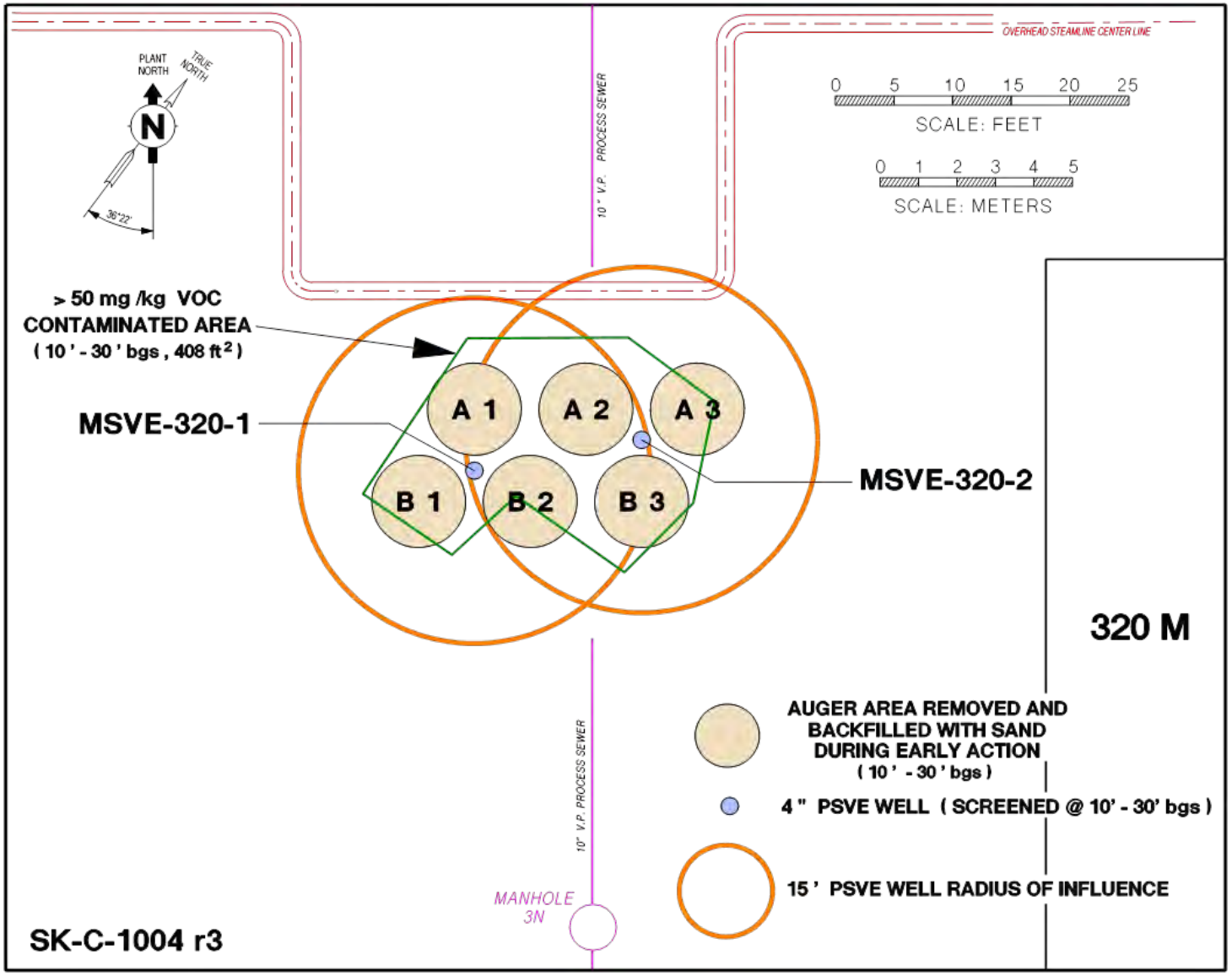


Figure MM-2-8. Location of the Passive SVE wells 320-1 and 320-2 with Respect to Vertical Excavations

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METALLURGICAL LABORATORY HAZARDOUS WASTE MANAGEMENT FACILITY (904-11G) (MET LAB HWMF) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the Metallurgical Laboratory Hazardous Waste Management Facility (904-110G) (Met Lab HWMF) Operable Unit (OU). The review was conducted from August 2012 through September 2012. The remedy for the Met Lab is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore a separate review of the RCRA Corrective Action is not duplicated in this document. Contaminants have been left in place at the Met Lab HWMF OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the Met Lab HWMF OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table NN-1 lists the chronology of site events for the Met Lab HWMF OU.

III. Background

The Met Lab HWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for SRS. The media associated with the Met Lab HWMF OU is soil. Groundwater is not addressed under this OU. Per the interim action Record of Decision (IROD) (WSRC 1992), the Met Lab HWMF groundwater is being addressed under the A/M Area Groundwater OU.

Physical Characteristics

The Met Lab HWMF OU is located in M Area of the SRS near the northwest edge of SRS (Figure NN-1). The nearest plant boundary is located approximately 1.2 km (0.75 mi) northwest of this OU. The Met Lab HWMF has been designated as a source-specific OU within the Upper Three Runs Watershed.

The Met Lab HWMF OU is located in the eastern portion of the A/M-Area Central Sector (Figure NN-2). The OU includes the unlined Met Lab Basin, the abandoned portion of the influent process sewer line, an associated Carolina Bay, and the A-008 drainage outfall to the bay (Figure NN-3). The Met Lab Basin dimensions are approximately 27 m (90 ft) by 36 m (120 ft) by 1.5 m (5 ft) deep. The Carolina Bay is a marshy, oval-shaped natural depression that covers approximately 2.4 hectares (6 acres).

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the SRS (WSRC 1999) designates the Met Lab HWMF OU as being within an industrial area. The future land use for the Met Lab HWMF OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The Met Lab Basin began receiving effluent from the Savannah River Laboratory Equipment Engineering Division Metallurgical Laboratory in 1956. The effluent consisted primarily of noncontact cooling water (water that did not contact process operations) and small quantities of laboratory rinse water containing hazardous substances. The historic wastewater discharge rate to the Met Lab Basin was estimated to be 3.8 m^3/day (5 yd^3/day). Discharges to the basin during the period from 1983 to November 8, 1985, consisted of non-hazardous effluent. All flow to the Met Lab Basin was terminated on November 8, 1985, when the process sewer line was plugged.

The Carolina Bay received wastes from three sources: (1) wastewater and surface water runoff overflow from the Met Lab Basin A-008 Outfall, (2) surface water runoff and cooling water from the A-Area coal-fired power plant and (3) A/M Area stormwater through the A-009 Outfall.

Initial Response

Contamination was detected in groundwater, basin surface water, soil, and basin sediments and evaluated in a risk assessment in 1985. The Met Lab HWMF OU was closed by removal and treatment of any standing water remaining in the basin; discharge of the effluent to the National Pollutant Discharge Elimination System (NPDES) permitted Outfall; excavation, dewatering; placement, consolidation and compaction of stabilized sludge in the basin; excavation of a portion of the process sewer line and contaminated soils associated with the sewer line. Closure of the Met Lab HWMF OU was competed in 1992.

Characterization of the Met Lab Carolina Bay for human health risks was completed in 1991 and for ecological risks in 1993. Surface sediments and soil to a depth of 0.6 m (2 ft) were contaminated with metals and organics. Risks were found to be acceptable and no further remedial action was recommended.

The Met Lab HWMF closure plan was submitted and approved by SCDHEC in June 1991. The Met Lab Basin closure was certified in July 17, 1992.

The Met Lab HWMF underlying groundwater is being addressed under the A/M Area Groundwater OU and is not included in this review.

Basis for Taking Action

On September 24, 1985, the Natural Resources Defense Council (NRDC) and others filed a complaint against USDOE concerning the Met Lab Basin and neighboring Carolina Bay. The associated lawsuit resulted in a Consent Decree in June 1988 which mandated that the Met Lab HWMF and associated Carolina Bay were subject to RCRA (WSRC 1992). The Met Lab HWMF OU was subject to closure under South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.265. Closure of the

basin was conducted as a landfill without excavation of soil from the basin (WSRC 1991).

At the time of the IROD, no contaminants of concern (COCs) were identified, though previous characterization efforts indicated contamination was present in groundwater, basin surface water, soil, and basin sediments. Detected contaminants in the basin and/or process sewer line sediments included sulfate, nitrate, cyanide, and metals (though all were substantially below the U.S. Environmental Protection Agency [USEPA] Toxicity concentration criteria). Chlorinated solvents, specifically trichloroethylene (TCE) and tetrachloroethylene (PCE), were detected in both upgradient and downgradient wells (WSRC 1992)

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the Met Lab HWMF within the RCRA closure process. Preventative activities at the Met Lab HWMF became subject to CERCLA when SRS was placed on the National Priorities List (NPL) in December 1989.

The remedial action objective (RAOs), as documented in the IROD (WSRC 1992), is to prevent the physical exposure to contaminants and mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The selected interim action remedy is the previous Met Lab HWMF RCRA preventative action of no waste removal, excavation of the Process Sewer Line and associated contaminated sediments, placement of all contaminated materials under a low-permeability cap and no action for the Carolina Bay. Since the preventative action is protective to human health and the environment and satisfies CERCLA requirements, no further action under CERCLA is necessary for this source control OU (WSRC 1992).

Remedy Implementation

Implementation of the selected interim action remedy (i.e., the RCRA preventative action) included the following activities:

- Sampling the accumulated rainwater in the basin;
- Treating and discharging excess water to a NPDES permitted outfall;
- Consolidating 344 m^3 (450 yd^3) of contaminated materials by excavating the process sewer line and associated soils and transporting to the top of the contaminated sediments in the basin; and
- Installing a 0.08-hectare (0.2-acre) low permeability cover system over the settling basin consisting of a layer of backfill, a 0.6-m (2-ft) layer of low-permeability compacted kaolin clay with a permeability of $1x10^{-7}$ cm/sec or less, a 0.3-m (1-ft) drainage layer, geotextile filter fabric, topped with 0.6 m (2 ft) of vegetative cover (15 cm [6 in] of topsoil over 45 cm [18 in] of common fill), and stormwater conveyance system.

Recent photographs of the unit are presented in Figure NN-4.

Systems Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Post-closure groundwater monitoring to verify that no unacceptable exposure to potential hazards posed by conditions at the OU occur in the future as required per the RCRA Hazardous Waste Permit
- Quarterly site inspections for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any necessary repairs will be made as part of the maintenance program.
- Access controls to restrict access to authorized personnel with appropriate training on applicable requirements.

- Institutional controls are being enforced to preclude unauthorized access or intrusive activities through the SRS Site/Use Site Clearance program and SRS site security.

Costs associated with the selected remedy for Met Lab HWMF include operation and maintenance (O&M) costs of the soil cover and institutional controls. RCRA documentation does not require estimated project costs to be prepared. Therefore, a cost comparison cannot be provided in this remedy review.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at Met Lab HWMF are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional. There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment NN-1; and
- Ensured that all actions required under the RCRA Permit were implemented (i.e., quarterly inspections, annual subsidence survey reports and maintenance to the soil covers).

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, applicable or relevant and appropriate requirements (ARARs), the results of the site inspection, and subsidence monitor surveys indicates that the

remedy is functioning as intended by the IROD. The consolidation of process sewer lines within the basin and under the low permeability cover has achieved the purpose of the interim action to minimize migration of contaminants to the groundwater from the basin sediments and sediments associated with the process sewer line (WSRC 1992). Because no COCs were identified in the IROD, no evaluation of groundwater against COC standards was conducted. However, review of point-of-compliance groundwater monitoring has not identified any additional potential corrective action COCs. The effective implementation of institutional controls has prevented exposure to, or ingestion of, contaminated soils, sediments, and surface waters.

O&M of the cover system has been effective. The quarterly site inspections for the period February 2007 through May 2012 had no major findings. The routine findings were active ant mounds on the soil cover, vegetation growing on fences, in ditches and over signs. These were all addressed either on the spot or in a few month period of time. The annual subsidence monitor logs indicate the cap is performing within design tolerances.

There were no opportunities for system optimization observed during this review.

The institutional controls 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 (SRS Site Use/Site Clearance Program). No activities were observed that would have violated the institutional controls.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Two ARARs were identified in the IROD (WSRC 1992). The first, a NPDES permit modification for discharge of basin rainwater to an outfall to surface water, has been met as the construction of the cover system is completed. The second ARAR includes

SCHWMR R.61-79.265 for RCRA equivalent performance standards for the cap design. The cap was designed to meet the ARAR. Based on the review of this OU, the requirements of the ARAR (i.e. long-term minimization of migration of contaminants, function with minimum maintenance) continue to be met.

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the IROD that call into question the protectiveness of the remedy.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy for the Met Lab HWMF OU from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the Met Lab HWMF OU under CERCLA.

X. Protectiveness Statement(s)

The remedy at the Met Lab HWMF OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by maintenance of the low-permeability clay cover system with institutional controls (i.e., land use controls), environmental monitoring, and site inspections to prevent the physical exposure to contaminants and mitigate further migration of contaminants to the

groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 1992. *Interim Action Record of Decision Remedial Alternative Selection, Metallurgical Laboratory Hazardous Waste Management Facility Operable Unit (U),* WSRC-RP-92-745, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1991. *Metallurgical Laboratory Hazardous Waste Management Facility Closure Plan* WSRC-RP-92-423, Revision 5, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist, Metallurgical Laboratory HWMF Post Closure Inspection (U)*, ER-IDS-019-020, Inspection Period 2007 to 2011 (quarterly)

Various - *Met Lab Settling Basin 904-110G Subsidence Monitor Survey Logs* for the period May 2007 through May 2012

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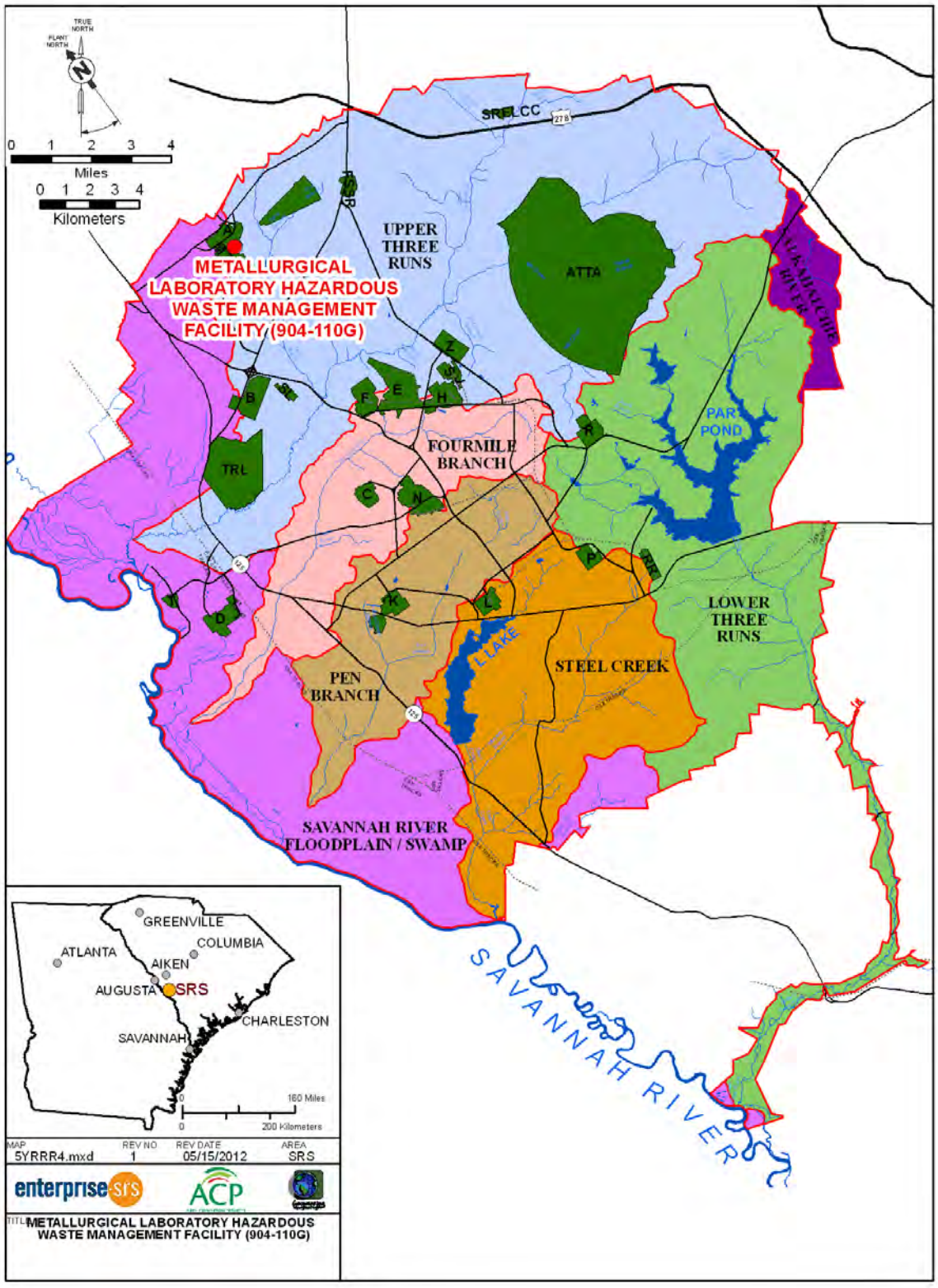


Figure NN-1. Metallurgical Laboratory HWMF OU at SRS

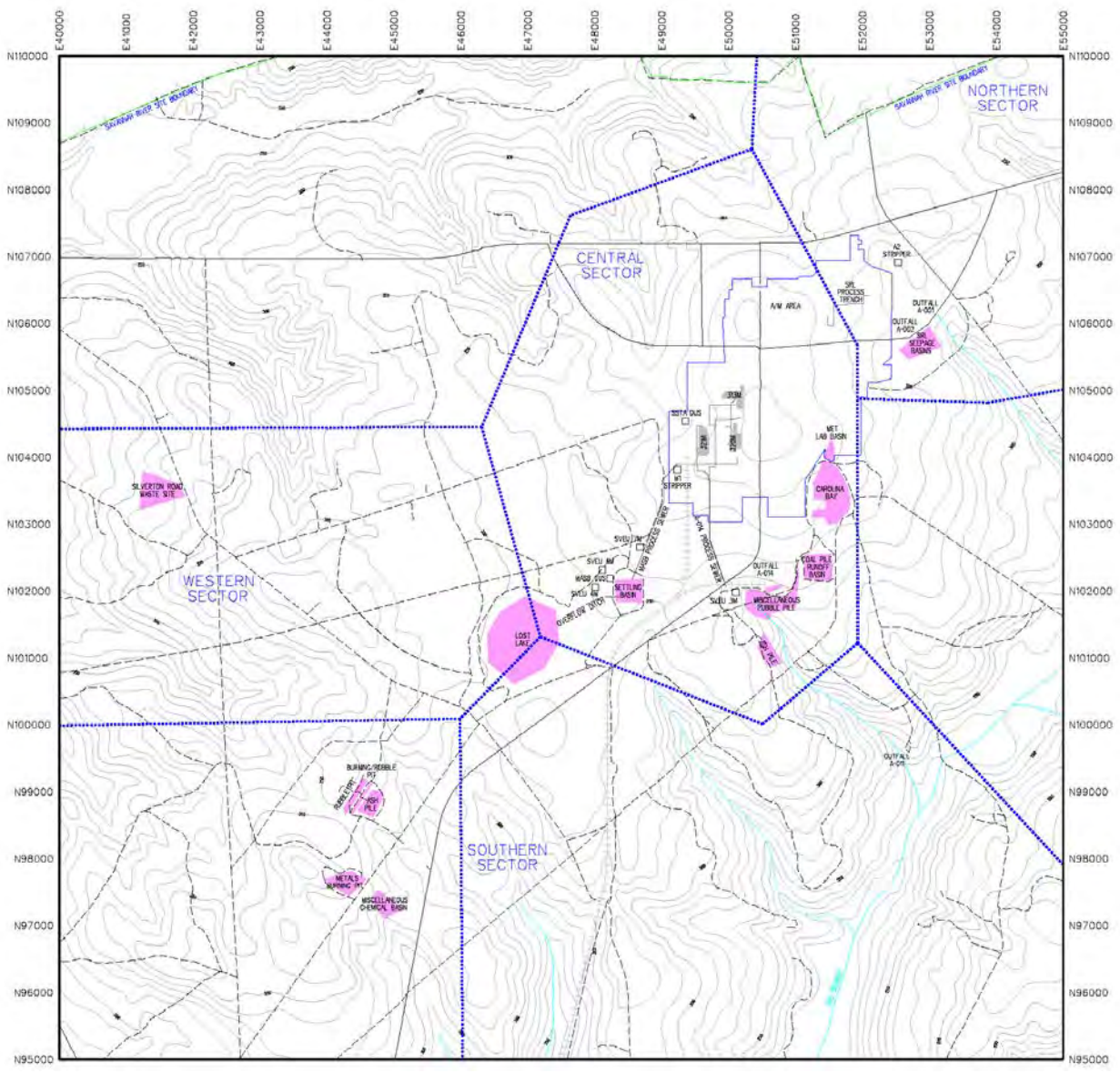


Figure NN-2. Location of the Met Lab HWMF OU within the A/M Area Groundwater Central Sector at SRS

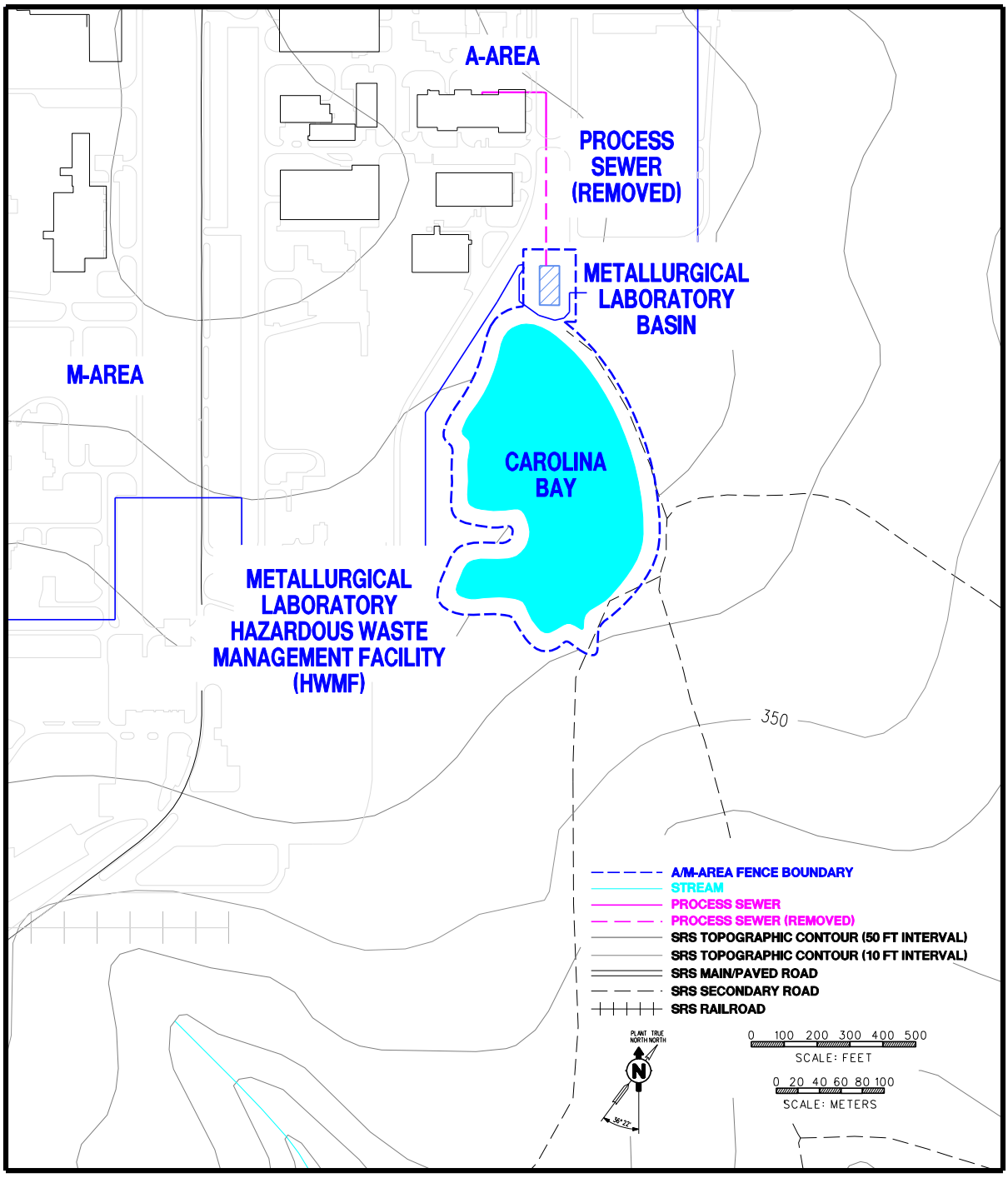


Figure NN-3. Site Layout of Met Lab HWMF OU at SRS



Figure NN-4. 2012 Photographs of the Met Lab HWMF OU Covered Basin

Table NN-1. Chronology of OU Events

Event	Date
Corrective Action Start	1991
RCRA Closure Certified	June 1991
Interim Record of Decision (IROD) Issuance	June 29, 1992
Previous Five-Year Reviews	June 30, 1997, February 12, 2004/ February 4, 2009

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Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU

I. SITE INFORMATION			
Site Name:	**Metallurgical Laboratory HWMF (904-11G) OU**	**Date of Inspection:**	**05/24/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #2**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**80°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Excavation, disposal

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, and Met Lab HWMF Field Inspection Checklist, ER-IDS-019-020*

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Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review:

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons:

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☒ N/A

Remarks: Fencing was in good condition.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition.

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walk-through

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey monuments 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 NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:_____
B. Other Site Conditions
Remarks:_____

VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress Areal extent_____ Depth_____ Remarks: Vegetation is mowed routinely._____

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

- ☐ Wet areas ☐ Location shown on site map Areal extent _____
- ☐ Ponding ☐ Location shown on site map Areal extent _____
- ☐ Seeps ☐ Location shown on site map Areal extent _____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
D. Cover Penetrations ☐ Applicable ☒ N/A
1. Gas Vents: ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
2. Gas Monitoring Probes: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
3. Monitoring Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
4. Leachate Extraction Wells: ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A Remarks:
5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A Remarks:
E. Gas Collection and Treatment ☐ Applicable ☒ N/A
1. Gas Treatment Facilities: ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs maintenance Remarks:
2. Gas Collection Wells, Manifolds, and Piping: ☐ Good condition ☐ Needs maintenance Remarks:

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☒ N/A
Remarks:_____

2. Outlet Rock Inspected: ☒ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☒ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment NN-1. Five-Year Review Site Inspection Checklist – Metallurgical Laboratory HWMF (904-11G) OU *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The remedy of stabilizing the basin contents, consolidating contaminated materials in the basin, and installing and maintaining a low permeability cap is designed to prevent physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater. The cover system is intact, long-term grasses have been fully established. The soil cover system remedy appears to be functioning as designed. Drainage channels are functioning adequately.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of quarterly site inspections and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs and fencing is good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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MIXED WASTE MANAGEMENT FACILITY OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the Mixed Waste Management Facility (643-28E) (MWMF) Operable Unit (OU). The review was conducted from July 2012 through August 2012. Contaminants have been left in place at the MWMF OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the MWMF OU is protective of human health and the environment. This report documents the results of the review.

The remedy for this unit is conducted under the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) program. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation requirements are met by the RCRA program; therefore, no further remedial action is necessary under CERCLA. Per the Record of Decision (ROD) (WSRC 1994), the remedial action will be reviewed every five years, consistent with the National Contingency Plan (NCP) requirements.

II. OU Chronology

Table OO-1 lists the chronology of site events for the MWMF OU.

III. Background

MWMF OU is listed as a RCRA Unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for SRS. The media associated with the MWMF OU is soil.

Groundwater is regulated by the SRS RCRA Part B Permit and is addressed in the MWMF Groundwater OU.

Physical Characteristics

The MWMF OU is located in the central portion of SRS between F- and H-Areas, approximately 8 km (5 mi) from the nearest site boundary (Figures OO-1 and OO-2). The MWMF is a source-specific OU within the Burial Ground Complex and within the

Upper Three Runs Watershed. The MWMF consists of 118 slit trenches, one engineered low-level trench (ELLT), and a naval core barrel mound. This facility comprises approximately 23.5 hectares (58 acres).

The slit trenches are generally 6 m (20 ft) deep and 6 m (20 ft) wide with varying lengths up to 360 m (1200 ft). The trenches were spaced approximately 3 m (10 ft) apart. The trenches were backfilled with natural soil during landfilling operations to minimize the potential for fire and airborne releases. This practice was modified in 1985 with the initiation of ELLT operation which consisted of stacking waste containerized in B-25 boxes (metal disposal containers, 1.2 m x 1.2 m x 1.8 m [4 ft x 4 ft x 6 ft] in dimension) in the trench completely before backfilling the trench. The dimensions of the ELLT are 40.2 m (134 ft) by 150 m (500 ft) by 6.6 (22 ft) deep. Approximately 9,600 B-25 boxes were placed in ELLT-1. An earthen mound was used for the disposal of naval reactor equipment.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the Savannah River Site (WSRC 1999) designates the MWMF OU as being within an industrial area. The future land use for the MWMF OU is reasonably anticipated to remain industrial with U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The MWMF operated from 1969 until March 11, 1986. During that time, this facility received low-level radioactive waste materials produced at SRS. Some of these materials are classified under RCRA as mixed waste containing both hazardous and radioactive components. Waste from SRS was disposed of in the form of job control waste and sent to the MWMF (e.g., rags, gloves and coveralls, soil, construction debris, failed equipment, spent air filters, spent lithium-aluminum targets, irradiated scrap metal, naval reactor hardware, lead shielding, waste oil, scintillation fluids, cadmium, and silver-

coated beryl saddles). The primary constituents of concern (COCs) are tritium, lead, trichloroethylene (TCE), and uranium.

Initial Response

RCRA preventive actions at the MWMF were conducted pursuant to the requirements of the RCRA per Settlement Agreement 87-27-SW.

Closure of the MWMF began in 1988, per the South Carolina Department of Health and Environmental Control (SCDHEC) approved closure plan (WSRC 1991), and was completed in December 1990. The MWMF was closed by compaction of the waste in place via dynamic compaction followed by placement of a protective low-permeability multi-layer cover system over the waste trenches to reduce rainwater contact with wastes.

The MWMF was certified closed in 1991 and was accepted by SCDHEC in April 1991 as being in compliance with RCRA requirements.

Basis for Taking Action

In 1984, SRS made an administrative decision to determine the extent of mixed waste deposited in the Low Level Radioactive Waste Disposal Facility (LLRWDF). Through researching of records and analysis of mixed wastes against RCRA regulations, SRS determined that the area within LLRWDF referred to as the MWMF contained mixed wastes.

A RCRA Closure Plan was submitted to SCDHEC in 1985 with approval in 1987. The RCRA preventive activities at the MWMF became subject to CERCLA when the entire SRS facility was placed on the National Priorities List (NPL) in December 1989. A Part B Permit Application for Post-Closure Care was submitted in November 1992.

The COCs at the MWMF OU include metals, volatile organic compounds, and radionuclides in soil. The COCs are listed in Table OO-2. No remedial goals were identified in the ROD (WSRC 1994) for these constituents.

IV. Remedial Actions

Remedy Selection

Preventative alternatives were developed for the MWMF within the RCRA closure process in 1988. As documented in the MWMF OU ROD, the RCRA ROD, the RCRA closure was selected as the final action under CERCLA. Therefore, no further action under CERCLA was necessary for the MWMF OU (WSRC 1994)

The closure design for the MWMF was consistent with requirements of: RCRA, 40 CFR 265, South Carolina Hazardous Waste Management Regulations (SCHWMR), R.6l-79.265, and USDOE Order 5820.2 Radioactive Waste Management.

The MWMF was closed according to approved Closure Plan (WSRC 1991).

The remedial action objectives (RAOs) were to prevent the physical exposure to contaminants and to mitigate further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport. The MWMF RCRA preventative action of placement of all contaminated materials under a low-permeability cap and institutional controls (i.e., Land Use Controls [LUCs]) satisfied both RAOs.

Remedy Implementation

Implementation of the selected final action remedy (i.e., the RCRA preventative action) included the following activities:

- Pre-compacting the waste by dynamic compaction to minimize future differential waste settlement;
- Backfilling after compaction to a level 1.5 m (5 ft) below the final cover elevations; and
- Placed a 23.5-hectare (58-acre) low permeability cover system over the waste trenches consisting of a layer of back fill, a 0.6-m (2-ft) layer of low-permeability compacted kaolin clay with a permeability of $1x10^{-7}$ cm/sec or less, topped with 0.6 m (2 ft) of topsoil to support a vegetative cover, cap surface drainage and

stormwater conveyance system. Later in 1994, portions of the RCRA Low-Level Radioactive Waste Disposal Facility 5.3-hectare (13-acre) geosynthetic cover system was tied into the MWMF cover system.

Figures OO-3 and OO-4 provide current photographs of the MWMF OU.

Systems Operations/Operation and Maintenance

There are no operational requirements.

The following maintenance activities are ongoing:

- Inspection and repair, as necessary, of the groundwater monitoring wells associated with the post-closure groundwater monitoring program for the MWMF.
- Quarterly site inspections for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any repairs will be made as necessary to maintain the integrity and effectiveness of the initial cover including making repairs to the surface cap as necessary to correct the effects of settling, subsidence, erosion, or other events.
- Access controls to restrict access to authorized personnel with appropriate training on applicable requirements. The survey plat and records associated with deed restriction use of the MWMF have been filed with Aiken County.
- Institutional controls (i.e. LUCs) to preclude unauthorized access or intrusive activities through the SRS Site/Use Site Clearance program and SRS site security.

Operation and maintenance (O&M) costs associated with the selected remedy for MWMF OU include costs of the soil cover inspection and maintenance, institutional controls and five-year remedy reviews. The actual O&M cost during FY07 to FY11 is $220,000. RCRA documentation does not require estimated project costs to be prepared. Therefore, actual cost data comparison to estimated cost data is not included in this remedy review.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at MWMF OU are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system and institutional controls in place while USDOE controls the OU.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment OO-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Ensured that all actions required under the RCRA Permit were implemented (i.e., quarterly inspections and maintenance to the soil covers and groundwater monitoring).

Data Review

Maintenance Inspections

A review of the routine maintenance inspections was conducted for the period 2007 through 2012. The quarterly site inspections, site maintenance (i.e., repair of erosion damage, mowing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) continue to maintain the effectiveness of response actions. The most prevalent findings during the monthly (Jan – March 2007) and quarterly (May 2007 –May 2012) site inspections are active ant mounds and vegetation/grass that needs cutting/mowing. Additionally, plugged weep holes and small cracks/chips have been noted in concrete

associated with the drainage channels. USDOE is planning to implement drainage enhancements within the next five-year remedy review cycle to ensure ongoing protectiveness. Review of the annual survey of the MWMF subsidence monitors for the period 2007 through 2011 indicate all surveyed monuments are within the design/baseline tolerances, providing evidence that the cover system integrity is intact. Inspection reports, survey reports, and maintenance data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk.

Groundwater

Fact sheets provided on the U.S. Environmental Protection Agency (USEPA) webpage regarding emerging contaminants were reviewed for applicability to this site. Due to the presence of chlorinated solvents at the MWMF, 1,4-dioxane was identified as a potential contaminant and has been sampled dating back to 1992. As shown in Figure OO-5, 1,4-dioxane has been detected in the Southwest Plume (SWP) and will be addressed as part of the MWMF Groundwater OU. It is co-mingled with the tritium plume.

The low permeability cap over the Old Radiological Waste Burial Ground (ORWBG) has reduced the tritium concentration in the SWP by approximately 40%. The groundwater is managed under the MWMF RCRA permit. It is expected that the concentration of chlorinated solvents and 1,4-dioxane will eventually be reduced due to the effects of the cap (SRNS 2012) .

The current phytoremediation/spray irrigation system operating in the SWP to address the tritium appears to be curtailing expansion of the 1,4-dioxane plume. 1,4-dioxane is prone to volatilization and photo-oxidation in air (7 to 10 hour half-life, maximum lifetime of 23 hours) in a spray irrigation setting. The remedial approach for the 1,4-dioxane will be incorporated into Revision 17 of the 2000 Part B Renewal Application for the MWMF (SRNS 2012).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The MWMF OU was inspected by SRNS and USDOE personnel on August 22,

2012 and October 17, 2012. No issues were identified for the MWMF OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection. The inspection team requested additional details on the drainage system maintenance/updates. SRS is planning to perform maintenance actions under the RCRA Permit Renewal that will improve drainage associated with the polyvinyl chloride weep holes in the side walls of the concrete drainage ditches. The projected timeframe for beginning the work is FY2014 (SRNS 2013).

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD (WSRC 1994). Placement and maintenance of a protective multi-layer cover system over the MWMF OU breaks the contaminant migration pathway to the groundwater; thus, facilitating meeting the RAOs to prevent physical exposure to the contaminants and to mitigate further migration of contaminants to the groundwater. As shown in Figure OO-6, there are multiple operating and closed facilities in close proximity to the MWMF OU. Contamination emanating from the ORWBG and other Burial Ground Complex (BGC) subunits has been identified to be commingled with contamination from the MWMF OU (WSRC 2007). The close proximity of these facilities and similarity of potential contaminants adds to the complexity of identification of the precise sources of groundwater contamination within this large area.

O&M of the cover system has, on the whole, been effective based on the review of the maintenance inspections reports presented in Section VI.

There are no opportunities for optimization.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

As the remedial work has been completed, the applicable standards, set forth in the ROD (WSRC 1994) and RCRA closure plan (WSRC 1991), have been met. All standards and To-Be-Considered values associated with groundwater will be addressed as part of the MWMF Groundwater OU.

Fact sheets provided on the USEPA webpage regarding emerging contaminants were reviewed for applicability to this site. 1,4-dioxane was identified in 1992 and was added to the Groundwater Protection Standards (GWPS) for the SWP emanating from the MWMF (WSRC 2007). SRS has been investigating various methods of potentially treating 1,4-dioxane. Options were documented in Volume VII, Revision 12 of the MWMF RCRA Permit Application (WSRC 2007). The 2000 Part B Renewal Application, Revision 17 will propose the corrective action for 1,4-dioxane. None of the other listed emerging contaminants were identified as applicable to this OU.

There have been no changes in exposure pathways, land use or contaminant characteristics. While no chemical specific soil remedial goals were set forth in the ROD (WSRC 1994) for comparison with 2012 preliminary remediation goals, the remedy has eliminated the exposure pathway associated with soils and compacted waste.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues for the MWMF OU.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for the MWMF OU.

X. Protectiveness Statement(s)

The remedy at the MWMF is protective of human health and the environment.

Exposure pathways that could result in unacceptable risk are being controlled by the low-permeability clay cover system and institutional controls (i.e., LUCs). Land use controls 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 land use restrictions via the SRS Site Use/Site Clearance Program. In addition, exposure pathways associated with the groundwater contamination are being actively monitored and/or remediated as part of the MWMF Groundwater OU.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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, 2011. *Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility and the Mixed Waste Management Facility (U)*, SRNS-RP-2011-00150, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Annual Corrective Action Report for the F-Area Hazardous Waste Management Facility, the H-Area Hazardous Waste Management Facility and the Mixed Waste Management Facility (U)*, SRNS-RP-2012-00045, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1991. *Mixed Waste Management Facility (MWMF) Closure Plan*, Revision 4, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1994. *Final Record of Decision Remedial Alternative Selection for Mixed Waste Management Facility (U),* WSRC-RP-93-1511, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2007. *2000 RCRA Part B Permit Renewal Application, Mixed Waste Management Facility Post Closure*, WSRC-IM-98-30, Volume VII, Revision 14, Washington Savannah River Company, Savannah River Site, Aiken, SC

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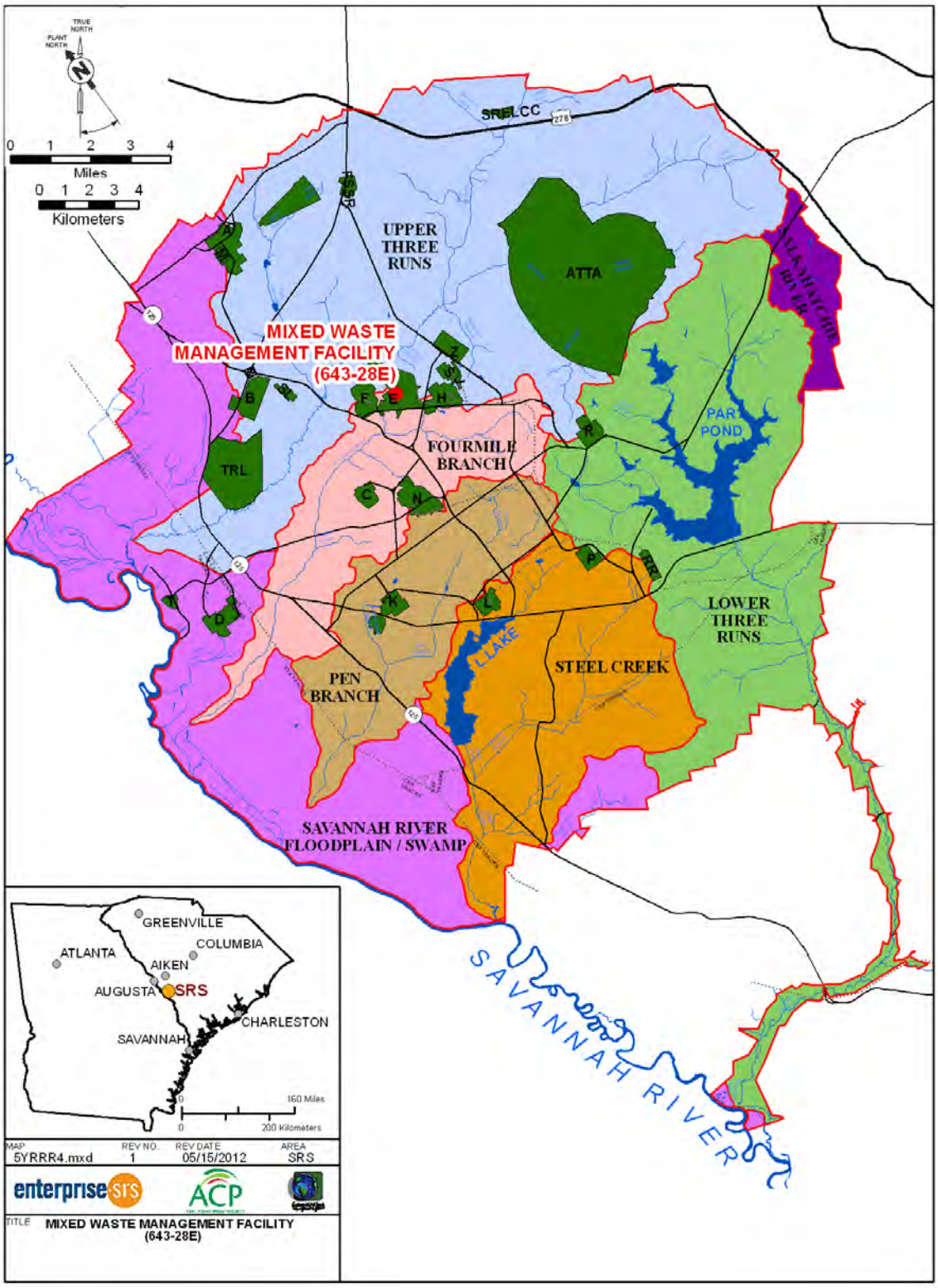


Figure OO-1. Mixed Waste Management Facility at Savannah River Site

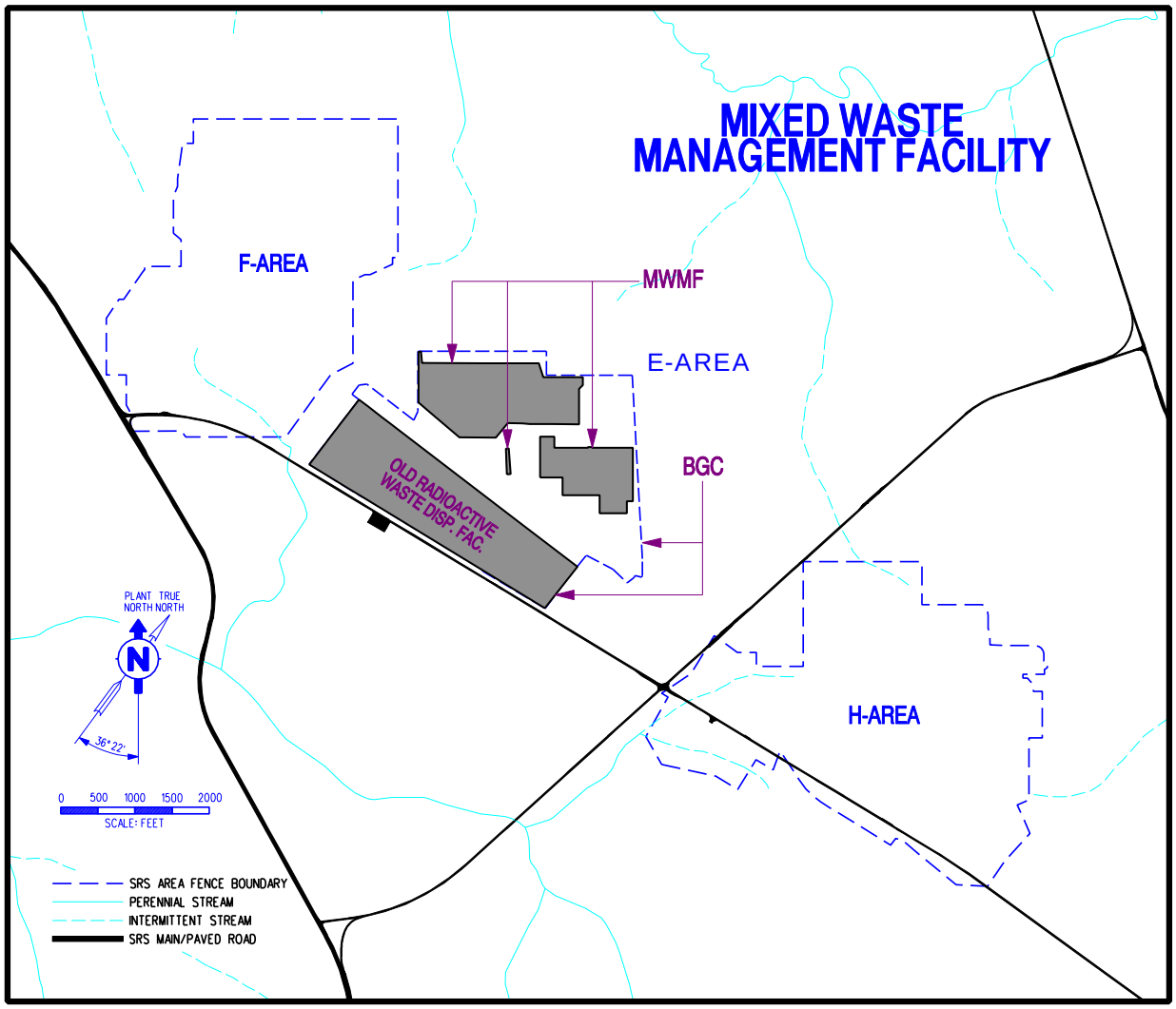


Figure OO-2. Site Layout of Mixed Waste Management Facility



Figure OO-3. Current Aerial Photograph of the MWMF (2010)



Figure OO-4. Current surface photographs of the MWMF (2012)

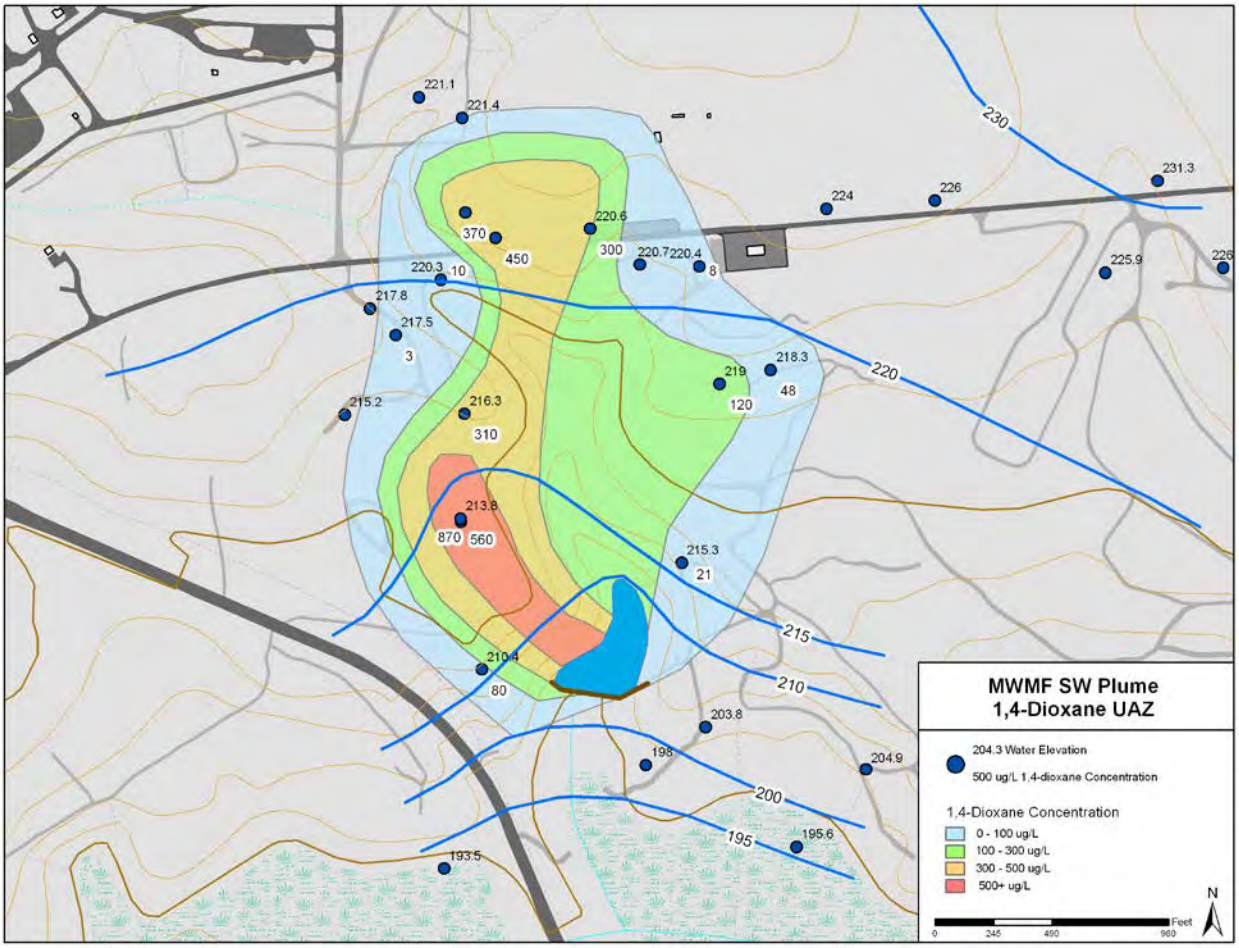


Figure OO-5. MWMF Southwest Plume 1,4-dioxane Concentrations in the Upper Aquifer Zone (SRNS 2012)

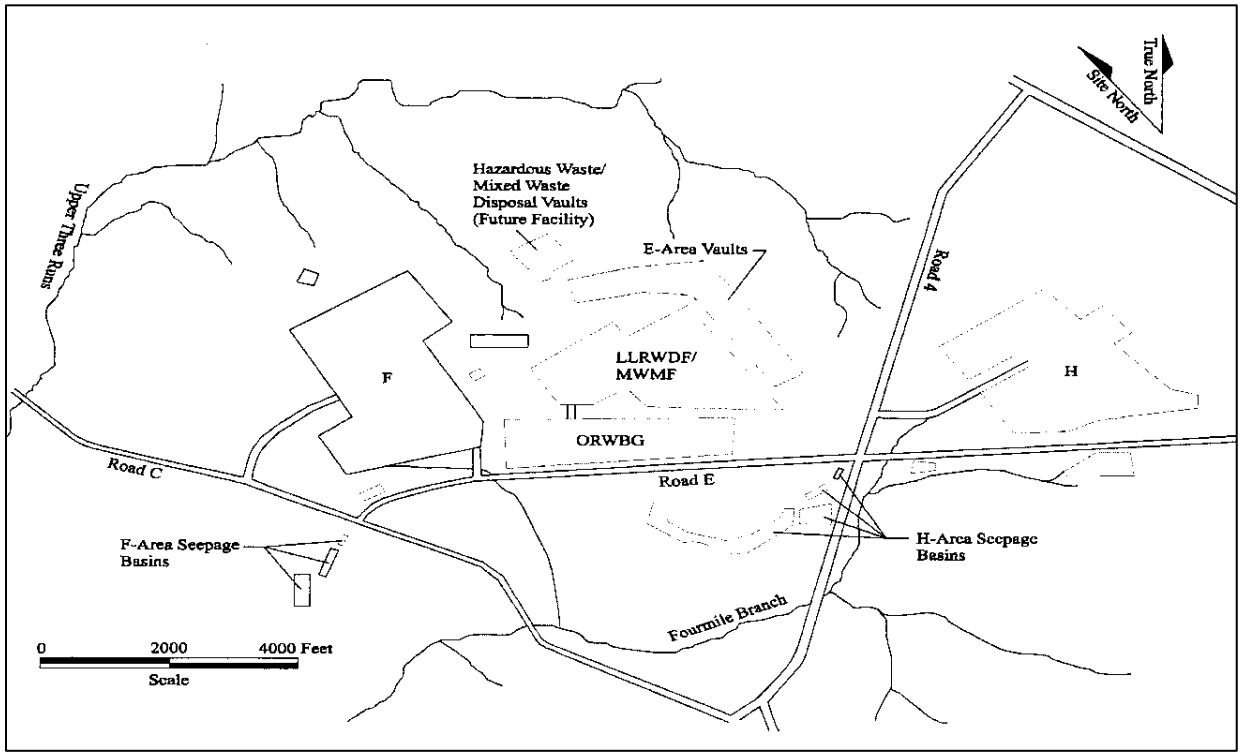


Figure OO-6. Facility Layout within the Burial Ground Complex

Table OO-1. Chronology of Site Events

Event	Date
RCRA Closure Plan Approved	December 1987
Corrective Action start	1988
RCRA Closure Certified	1991
Final ROD issuance	September 23, 1994
Previous Five-Year Reviews	June 30, 1997 / February 12, 2004 / February 4, 2009

Table OO-2. Constituents of Concern at MWMF (WSRC 1994)

Type	Constituent of Concern
Metals	Aluminum, Barium, Beryllium, Cadmium, Iron, **Lead**, Manganese, Nickel, Zinc
Organic Compounds	Chloroform, 1,1-Dichloroethane, trans-1,2-Dichloroethylene, Phenol, Tetrachloroethylene (PCE), **Trichloroethylene (TCE),** Vinyl chloride
Radionuclides	Carbon-14, **Tritium, Uranium-234/235, Uranium-238**

NOTE: Primary COCs are noted in **bold** text

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Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

I. SITE INFORMATION			
Site Name:	**Mixed Waste Management Facility (643-28E) (MWMF) OU**	**Date of Inspection:**	**08/22/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SC1890008989**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**85°F and cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Mixed Waste Management Facility (MWMF) Post Closure Inspection, ER-SOP-006,*

_____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☒ N/A

Remarks: Fences are in good condition._____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walk-through

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/17/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks:

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A
Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident
Areal extent Depth
Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent
☐ Ponding ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent
Remarks:

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VII. COVER SYSTEMS *(Continued)*

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

5. Settlement Monuments: ☒ Located ☒ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Remarks: _____

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident

Areal extent _____ Depth _____

Remarks: _____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A

☒ Vegetation does not impede flow

Areal extent _____ Type _____

Remarks: _____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent _____ Depth _____

Remarks: _____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks: _____

2. Performance Monitoring:

Type of Monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching Head Differential _____

Remarks: _____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment OO-1 Five-Year Review Site Inspection Checklist – Mixed Waste Management Facility (643-28E) (MWMF) OU

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

Remedy for this site is low-permeability soil cover system and institutional controls to prevent physical exposure to contaminants and mitigating further migration of contaminants to the groundwater. The cover system is intact, long-term grasses have been fully established. Soil cover system remedy appears to be functioning as designed. USDOE is planning to implement drainage enhancements during the next 5-year remedy review cycle to ensure ongoing protectiveness.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of quarterly site inspections and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs is good.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

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OLD F-AREA SEEPAGE BASIN OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the Old F-Area Seepage Basin (904-49G) (OFASB) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the OFASB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the OFASB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table PP-1 lists the chronology of site events for the OFASB OU.

III. Background

The OFASB OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the OFASB OU is soil. The groundwater associated with the OFASB OU is addressed as part of the General Separations Area (GSA) Western Groundwater OU (WSRC 2004).

Physical Characteristics

The OFASB is located approximately six miles from the nearest SRS boundary, as shown in Figure PP-1. The OFASB OU is located approximately 180 m (600 ft) north of F Area and at an elevation of 85.5 m (285 ft) above mean sea level (msl). The water table is approximately 22.5 m (75 ft) below ground surface (bgs). The OFASB was an unlined seepage basin (approximately 90 m [300 ft] long by 60 m [200 ft] wide and 3 m [10 ft] deep) and covers 0.53 hectares (1.3 acres). The unit includes an effluent ditchline adjacent to the basin which leads toward Upper Three Runs Creek and one process sewer line which fed the basin and has an average depth of 2.7 to 3 m (9 to 10 ft) bgs and is about 240 n (800 ft) in length.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan for the Savannah River Site (WSRC 1999) designates the OFASB OU as being within an industrial area. The future land use for the OFASB OU is reasonably anticipated to remain industrial with U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The OFASB was designed and constructed for the purpose of reducing radioactive substance concentrations in wastewater prior to discharge to Upper Three Runs Creek. The OFASB received 9- to 14-million gallons of low radioactivity wastewater between November 1954 and mid-May 1955. Wastewater included overhead condensates from evaporates, laundry wastewater, non-reactor cooling water from F and H Areas, and possibly other chemicals. After 1955, the OFASB received occasional discharges of cooling water and rainfall runoff. During a three-month period in 1969, spent nitric acid solutions used to etch depleted uranium were discharged (via tanker truck) to the basin. Wastewater disposal was discontinued after the 1969 discharge (WSRC 1995a).

An estimated 1.8 curies (Ci) of radioactivity was released to the basin during its use. Due to natural radioactive decay, an estimated inventory of less than 0.8 Ci remained in the basin as recorded in the Statement of Basis/Proposed Plan (WSRC 1996a) for this unit.

Initial Response

In 1986, a Preliminary Unit Evaluation was conducted on the OFASB and a determination was made that hazardous substances had been deposited in the unit. Therefore, the unit was targeted for a full RCRA Facility Investigation/Remedial Investigation (RFI/RI) study. Characterization data was collected and evaluated in the RFI/RI (WSRC 1995a) and the Baseline Risk Assessment (BRA) (WSRC 1995b). Figure PP-2 depicts the basin prior to any remedial activities.

Basis for Taking Action

Source area (basin) soil sampling was conducted in 1986 and groundwater monitoring had been ongoing since 1984. As part of the RFI/RI process additional source area soils were sampled along with source area sediments, soils outside the basin periphery and beneath the abandoned process sewer line leading to the basin, groundwater, surface water and sediment downgradient of the OU. These included a dry, shallow ravine north of the unit, a wetland area, the effluent ditchline, and a point in Upper Three Runs Creek.

Analytical data pertaining to the OFASB OU indicated that radionuclide-contaminated soils associated with the OFASB posed the main risk to both the future resident and industrial worker. These radionuclide risks were primarily associated with external radiation from the top 0.6 m (2 ft) of the former basin bottom soils. Major contaminants included cesium-137 and mercury. The top 0.6 m (2 ft) of the former basin bottom soils contained 53% of cesium-137 and 97% of mercury. Groundwater monitoring data also revealed that iodine-129, nitrate, strontium-90, and tritium were present in the groundwater above maximum contaminant levels (MCLs). Uranium was also detected above proposed MCLs. Although radium-228 had been decreasing over time, it has also exceeded MCLs. The groundwater plume in the water table aquifer migrated beyond the surface boundaries of the OFASB by more than 60 m (200 ft) towards Upper Three Runs Creek, which is more than 750 m (2,500 ft) to the north (WSRC 1995a, WSRC 1995b).

Based on the risk analysis, the OFASB soils posed a risk to human health. The carcinogenic risk to the potential future resident and worker was driven by exposure from direct radiation in the basin soils. These soils were contaminated with cesium-137 to a depth of 0 to 0.6 m (0 to 2 ft) and overflow ditchline soils to a depth of 0 to 0.6 m (0 to 2 ft). Carcinogenic risks to the potential future resident were also driven by exposure from ingestion of groundwater contaminated with iodine-129, tritium, strontium-90, and radium-228 in the water table aquifer. The contaminants of concern (COCs) and remedial goals (RGs) associated with the future industrial worker for the OFASB are summarized in Table PP-2.

IV. Remedial Actions

Remedy Selection

The remedial action objectives (RAOs), developed for the OFASB in the Record of Decision (ROD) (WSRC 1997), are as follows:

- Prevent external exposure to radiological constituents;
- Prevent inhalation of radiological constituents;
- Prevent ingestion of soil or produce grown in soil with radiological constituents;
- Prevent or mitigate the release of constituents of concern to the groundwater;
- Prevent or mitigate the impact to the nearest surface water receptor located at the Upper Three Runs Creek;
- Prevent or mitigate the impact to the nearest groundwater receptor located at the Upper Three Runs Creek;
- Restore the aquifer through natural groundwater mixing processes and other processes (radioactive decay) to achieve MCLs throughout the groundwater plume (groundwater mixing zone application modeling estimates that MCLs throughout the entire groundwater aquifer will be achieved in approximately 200 years); and
- Achieve State of South Carolina groundwater mixing zone objectives: a) control source to minimize addition of contaminants to the groundwater; b) establish plume monitoring and compliance wells to ensure compliance with mixing zone concentrations limits and/or maximum contaminant levels established in the groundwater mixing zone application; and c) monitor to ensure contaminated groundwater remains on SRS until MCLs are achieved throughout the plume and to ensure groundwater area or plume is decreasing in concentrations; and

Upon amendment of the ROD (WSRC 2004) the last three RAOs listed above were no longer applicable to the remedy because the groundwater component was removed from

this OU. RAOs that address groundwater will be developed as a part of the GSA Western Groundwater OU.

The amendment to the ROD (WSRC 2004) will not result in any permanent impact to the expected outcome for the OFASB OU remedial action. The groundwater monitoring activities will continue as part of the GSA Western Groundwater OU.

As stated in the ROD (WSRC 1997), the selected remedy is composed of the following remedial actions :

- Vegetation: Remove and dispose at an off unit facility
- Pipeline and Pipeline Soils: Institutional controls, which include restricting land to future industrial use, limit access to the soil through use of SRS site use and site clearance permits. Access controls will include filling or grouting the pipeline manholes and posting signage indicated the area was used for the disposal of waste material and contains buried waste. Long-term controls, if the property is ever transferred to non-federal ownership, will include the U.S. Government creating a deed that will comply with Section 120(h) of CERCLA and providing a certified survey plat.
- Soils (basin and ditchline): Remove the top 0.6 m (2 ft) of soils in the ditchline and place it in the OFASB. This would be followed by in situ stabilization of the top two feet of basin soils and the ditchline soils placed in the basin. Construct a low permeability cap over the stabilized materials. Implement institutional controls, as above.
- Groundwater: Continue existing institutional controls and monitor the extent of the groundwater contaminant plume.

In September 1998, an Explanation of Significant Differences (ESD) to the ROD was approved to change the disposal of vegetation from off-unit disposal to on-unit disposal (WSRC 1998). The vegetation would be placed within the OFASB and undergo in situ stabilization/solidification along with the basin and ditchline soils.

In June 2003, an agreement was made between USDOE, SCDHEC, and USEPA to include OFASB OU groundwater in the GSA Western GW OU. The amended ROD removed the groundwater component from the remedial action (WSRC 2004)

Remedy Implementation

Implementation of the OFASB OU remedial action included the following activities (WSRC 2001):

- Grouting manholes #2, #3 and #4 (Manhole #1 was not grouted) with 2000 psi concrete;
- Consolidating chipped vegetation (approximately 218 m^3 [285 yd^3]) with placement in clean backfill in basin;
- Consolidating the top 0.6 m (2 ft) minimum of OFASB side slopes and ditchline soils, and a 37.5-cm (15-in) vitrified clay process sewer line and its surrounding soil from manhole #4 to basin (approximately 30 m [100 ft]) with placement in the OFASB bottom;
- In situ stabilizing of approximately 7,770 m^3 (10,154 yd^3) of contaminated soil via grouting the top 0.6 m (2 ft) of basin bottom soils and consolidated soils and piping placed in the basin;
- Backfilling the basin with clean soil and chipping vegetation with compaction to grade;
- Placing a 0.7 hectare (1.8 acre) low-permeability soil cover (minimum $1x10^{-5}$ cm/sec hydraulic conductivity) over the OFASB area to minimize surface infiltration;
- Revegetating the cover system;
- Disposing of radioactive low-level secondary wastes generated during remediation activities in a waste trench adjacent to the grouted and covered OFASB basin, stabilizing the secondary waste, followed by placement of a low permeability cover system;

- Establishing a monitoring well network consisting of seven new monitoring wells to supplement the existing well network;
- Implementing institutional controls; and
- Establishing land use controls (LUCs) for 0.7 hectare (1.8 acres).

Figures 3 and 4 provide current photographs of the OFASB OU.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Semiannual site inspections and site maintenance (repair of erosion damage, cover maintenance, mowing, and warning signs); and
- LUCs including warning signs, site controls, and use restrictions via SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit. LUCs will be maintained until the identified RCOCs no longer pose a threat under the residential (unrestricted) land use scenario.

The operation and maintenance (O&M) cost associated with the selected remedy for the OFASB OU includes the semiannual inspections and maintenance of the cover and institutional controls. The ROD (WSRC 1997) estimated O&M cost has a present worth of $500,000 discounted at 7% per year for 30 years. The actual O&M cost since the remedial action was completed in FY01 until FY11 is $134,684. The actual O&M costs (Table PP-3) are as expected.

V. Progress Since Last Review

The previous protectiveness statement concluded that because the remedial actions at OFASB OU are protective, the site is protective of human health and the environment. The grouting and soil cover remedy at OFASB OU is protective of human health and the environment for soil contamination and prevents external exposure to radiological

contaminants. LUCs (site use/site clearance and security measures) are in place and ensure the protectiveness of the remedy.

VI. Five-Year Review Process

The following tasks were performed as part of the five-year review process:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Evaluated and confirmed the implemented remedial action (in-situ stabilization and soil cover system) is operating effectively;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment PP-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls;
- Performed a data review; and
- Reviewed changes in standards and to-be-considered (TBC) guidance.

Data Review

Review of the groundwater data (WSRC 2007, WSRC 2008, SRNS 2009, SRNS 2010, and SRNS 2011) indicate exceedances of MCLs for several contaminants in the FNB well series that are monitored as part of the GSA Western Groundwater OU. As represented by the tritium plume (Figure PP-5), contamination exists upgradient of the OFASB. It is likely that multiple facilities are contributing to the groundwater plumes near the OFASB. Volatile organic carbons (VOCs), gross alpha, nonvolatile beta, nitrate, iodine-129, strontium-90 and tritium have been measured at levels greater than MCLs during the period 2007 through 2011. While most were at concentrations slightly greater than their respective MCL, iodine-129, strontium-90 and tritium were several times their respective MCL with maximum values of 13.5 pCi/L, 30.2 pCi/L, and 43.2 pCi/ml, respectively. Review of the plume maps generated as part of the GSA Western Groundwater OU annual reporting (WSRC 2007, WSRC 2008, SRNS 2009, SRNS 2010, and SRNS 2011) suggests that the OFASB is only one of several potential sources contributing to these contaminant plumes (Figure PP-5). Time trends of iodine-129,

strontium-90, and tritium over the period 2000 through June 2012 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 PP-6). 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 9/30/2004. 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 PP-7). As the half-life for iodine-129 is 1.57×10^7 years, decay has no impact on the time trend of this contaminant. Thus, the 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.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the OFASB OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The OFASB OU was inspected by SRNS and USDOE personnel on July 3, 2012 and October 17, 2012. No issues were identified for the OFASB OU during this inspection and interviews.

On January 15, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements (ARARs), 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 semiannual inspection reports for the period 2007 through 2011 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.

An opportunity for system optimization was identified during this review. Based on the lack of findings during the semiannual site inspections and the effectiveness of institutional controls in preventing human activity at this OU, it is recommended that the inspection frequency be reduced from semi-annual to annual.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still Valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

As the remedial work has been completed, the action-specific, location-specific, and chemical-specific ARARs have been met. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. While there have been some minor changes in the USEPA preliminary remedial goals (PRGs), 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.

Due to the widespread usage of chlorinated solvents at SRS and the use of 1,4-doxane as a stabilizer in chlorinated solvents, paint strippers, greases, and waxes, SRS began sampling for this constituent at the OFASB as part of the GSA Western Groundwater OU groundwater evaluation in 2010. Fifty-one records were reviewed over the period 2010 through February 2012 representing five sampling events of five monitoring wells, three seepline piezometers, and two surface water sampling locations. All results were non-detects, which provides evidence that 1,4-dioxane is not a COC for the OFASB.

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

Recommendations and follow-up actions concerning OFASB OU are listed in Table PP-4.

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 (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

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2009. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, 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, March 2013, 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

WSRC, 2007. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Scoping Summary for the General Separations Area Western Groundwater Operable Unit (U)*, ERD-EN-2005-0127, Washington 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 2007 through 2011 (semiannually)

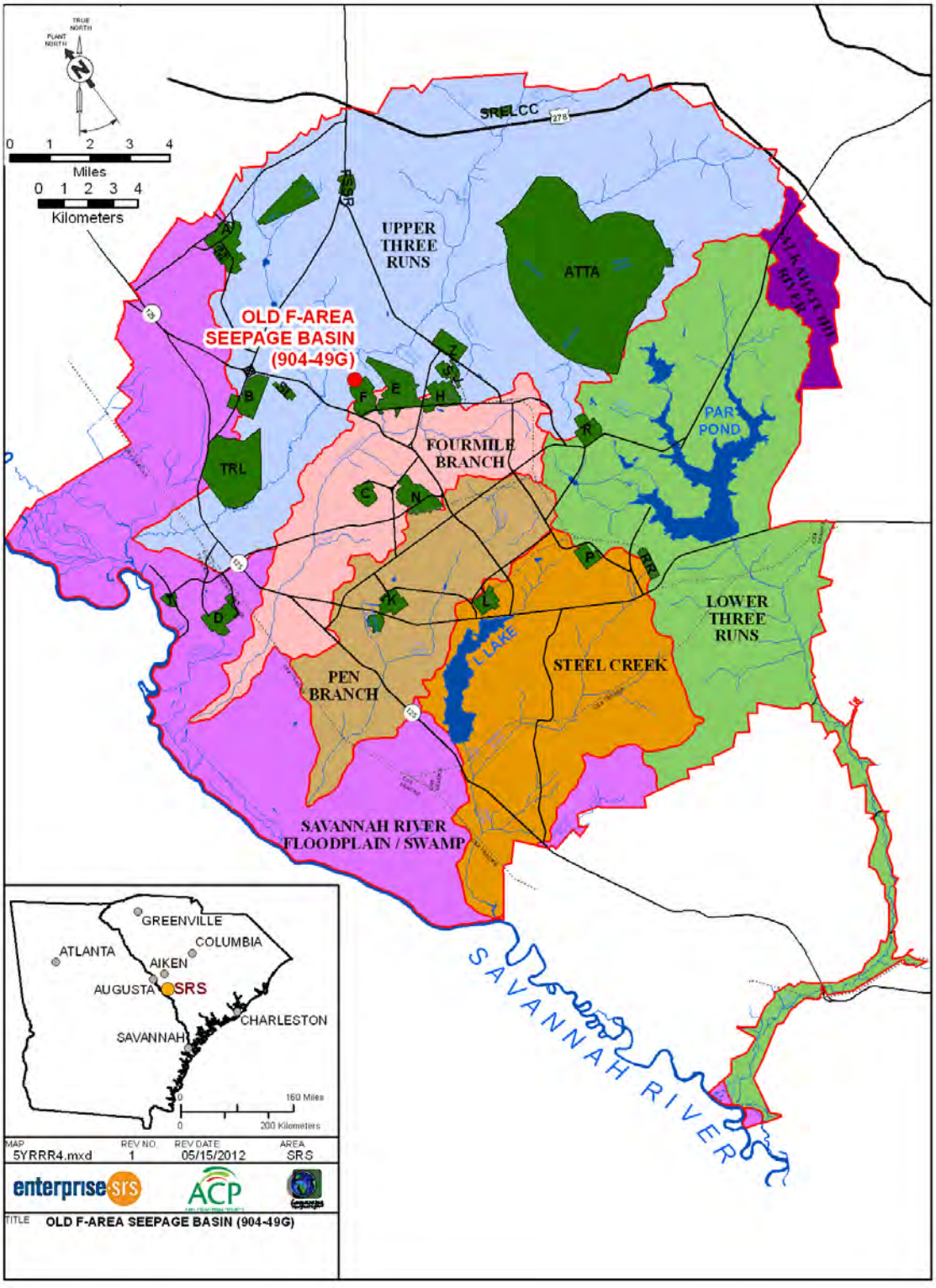


Figure PP-1. Location of the Old F-Area Seepage Basin at SRS



Figure PP-2. OFASB OU Prior to Remediation



Figure PP-3. 2010 Aerial Photograph of the OFASB OU (post-closure)



Figure PP-4. 2012 On-Unit Photograph of OFASB OU

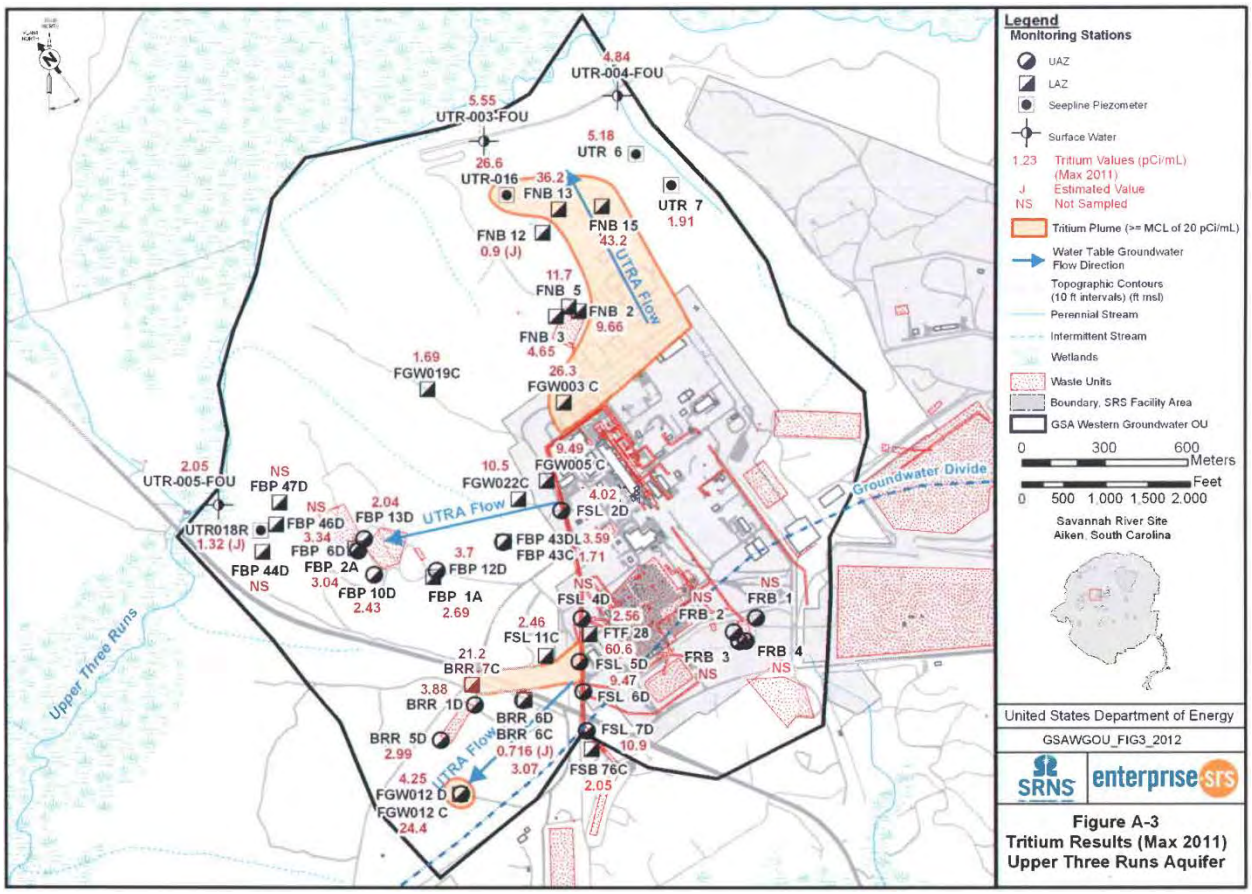


Figure PP-5. Tritium Plume Map for the Western GSA Groundwater Operation Unit – 2011 (SRNS 2012)

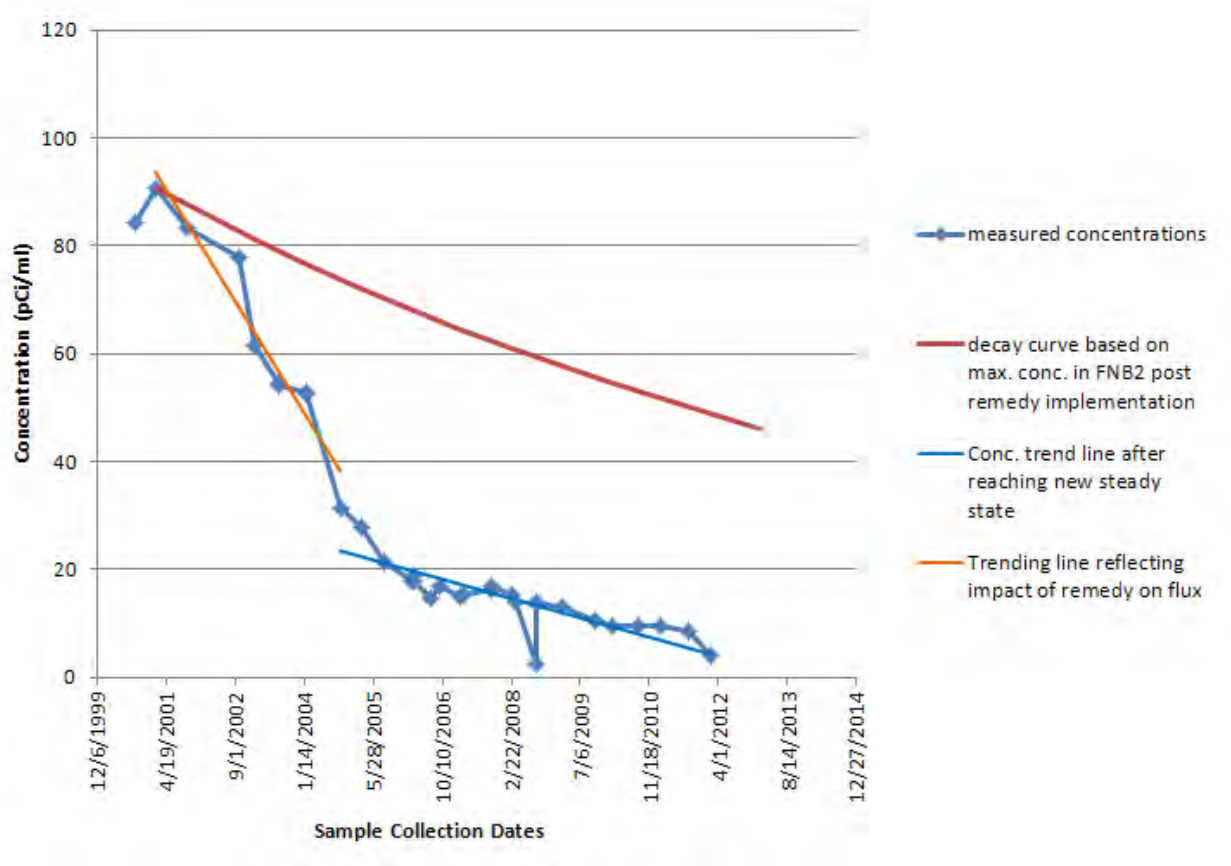


Figure PP-6. Effect of Remedy on Release of Tritium from the OFASB

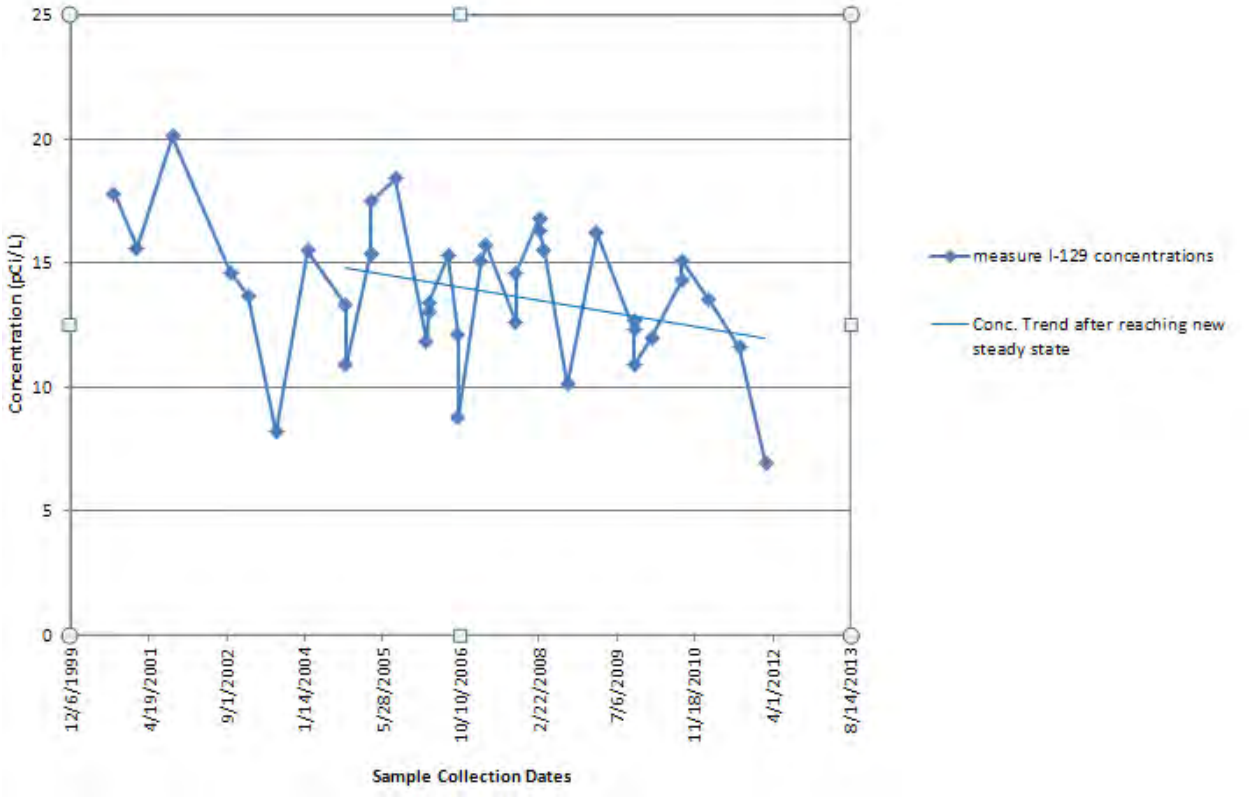


Figure PP-7. Effect of Remedy on Release of Iodine-129 from the OFASB

Table PP-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	July 1993 / February 13, 1996
Final ROD Issuance	June 19, 1997
ESD Approved	September 15, 1998
Remedial Action Start/Complete	September 10, 1998/ November 17, 2000
Decision to manage groundwater as a part of GSA Western Groundwater OU	August 2002
ROD Amendment Issuance	November 15, 2004
Previous Five-Year Reviews	June 30, 1997 / February 12, 2004 / February 4, 2009

Table PP-2. COCs and RGs for $1x10^{-6}$ Risk to Future Industrial Worker (WSRC 1996b)

Subunit	Medium	Exposure Pathway	COC	Original RG
Process Sewer	Soil	NA	NA	NA
Seepage Basin	Soil	Direct Radiation	Cesium-137	4.2E-02 ρCi/g
			Potassium-40	0.15 ρCi/g
			Americium-241	7.51 ρCi/g
			Cobalt-60[a]	9.7 ρCi/g
			Europium-154[b]	2.0E-02 ρCi/g
			Niobiuim-95[c]	3.2E-02 ρCi/g
			Radium-228[d]	2.9E-02 ρCi/g
Effluent Ditch	Soil	Direct Radiation	Cesium-137	4.2E-02 ρCi/g
Groundwater	Water	Ingestion	Iodine-129	0.84 ρCi/L

WSRC 1996b
a - The half-life of cobalt-60 is 5.27 years. As of 2011, approximately 91% of the cobalt-60 has decayed.
b - The half-life of europium-154 is 8.8 years. As of 2011, approximately 75% of the europium -154 has decayed.
c - The half-life of niobium-95 is 35.15 days. As of 2011, niobium -95 is decayed.
d - The half-life of radium-228 is 5.75 years. As of 2011, approximately 89% of the radium -228 has decayed.

Table PP-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	7,000	7,900	4,200	4,400	3,800	27,300
Total ROD Estimated Direct O&M Costs	19,000	4,000	4,000	4,000	4,000	35,000

Table PP-4. Recommendations and Followup Actions

Issues	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Optimization for Inspections	Request change to the inspection frequency from semi-annual to annual via USDOE letter to the USEPA and SCDHEC within 45 days of final regulatory approval of the Fourth Five Year Remedy Review Report	USDOE	USEPA/ SCDHEC	9/30/2014	N	N

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU

I. SITE INFORMATION			
Site Name:	**Old F-Area Seepage Basin (904-49G) OU**	**Date of Inspection:**	**07/03/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #16**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**86°F and Sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other In-situ grouting of basin bottom soils and basin side slopes, ditchline soils and piping placed in basin bottom.

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: Annual site inspections are performed per SRS procedure ER-SOP-019, *Waste Unit Inspection and Maintenance*, and ER-IDS-019-008, *Field Inspection Checklist for the OFASB*.

_____

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Field Walkdown

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/17/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks: MOX facility is under construction outside but near the Old F-Area Seepage Basin OU

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress

Areal extent Depth

Remarks:

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent Depth

Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

- ☐ Wet areas ☐ Location shown on site map Areal extent
- ☐ Ponding ☐ Location shown on site map Areal extent
- ☐ Seeps ☐ Location shown on site map Areal extent
- ☐ Soft subgrade ☐ Location shown on site map Areal extent

Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent

Remarks:

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment PP-1. Five-Year Review Site Inspection Checklist – Old F-Area Seepage Basin (904-49G) OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Remedy for this site is: (1) In-situ grouting of basin bottom soils and basin side slopes, ditchline soils and piping placed in basin bottom; (2) backfill of the basin with clean soil with compaction to grade; (3) low-permeability soil cover system; (4) institutional controls. The cover system is intact, long-term grasses have been fully established. The in-situ grouting and soil cover system remedy appears to be functioning as designed. Drainage channel function adequately.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of semi-annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the grass and vegetative cover and warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Optimization opportunities are provided in Table PP-4 of the OU specific report

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PAR POND (685-G) (INCLUDING THE PRE-COOLER PONDS AND CANALS)

I. Introduction

This report is the fourth five-year review for the PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals), hereafter referred to as PAR Pond. The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the PAR Pond at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the PAR Pond is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table QQ-1 lists the chronology of site events for the PAR Pond.

III. Background

The PAR Pond is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the PAR Pond unit is sediment and soil. PAR Pond is part of the Lower Three Runs Integrator Operable Unit (LTR IOU).

Physical Characteristics

PAR Pond is a 1,072 hectares (2,640 acre) man-made reservoir located east of R Area and northeast of P Area (Figure QQ-1). The eastern most shore is approximately 1.6 km (1 mi) from the eastern SRS boundary. The PAR Pond consists of the PAR Pond reservoir, the series of pre-cooler ponds and canals, and the Lower Three Runs Creek (Figure QQ-2). The portion of the Lower Three Runs Creek that is bounded by a narrowed SRS boundary and the wetlands associated with that portion of the LTR IOU are sometimes referred to as the tail portion of the LTR IOU.

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River* (WSRC 1999) designates PAR Pond as being outside of a designated site industrial area. However, according to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for the PAR Pond unit is reasonably anticipated to be industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

PAR Pond was built in 1958 to create a reservoir for augmenting the cooling water requirements of both P- and R-Reactors, which began operations in 1953 and 1954, respectively. It served this purpose of being a heat exchange/cooling reservoir for P Reactor until 1988. Between 1954 and 1964, releases in the form of process leaks, purges, and makeup cooling water have contaminated PAR Pond with cesium-137 and other radioactive and nonradioactive contaminants (i.e., mercury). Approximately 222 curies of cesium-137 were released from R-Reactor into PAR Pond or Lower Three Runs Creek (before the creation of the reservoir). All radioactive isotope releases ceased following the shutdown of R-Reactor in 1964. No measurable cesium-137 was released into PAR Pond from P-Reactor. Since most of the radionuclide releases to PAR Pond (direct or indirect) occurred during the 1950 to 1960 era, and the half-life of cesium-137 is approximately 30 years, more than half of this radionuclide has decayed. The estimated inventory of cesium-137 associated with all sediments within the PAR Pond reservoir in 1993 was approximately 43 curies, of which 9 curies were present in the 544 hectares (1,340 acres) of sediments that were exposed when PAR Pond was drawdown in 1991 to repair the Par Pond Dam. The remaining 68 curies of cesium-137 inventory in the PAR Pond system was located in the sediments of the pre-cooler canal/pond system and Lower Three Runs Creek (WSRC 1995).

Initial Response

During an inspection of the PAR Pond Dam in March 1991, a small surface depression was noted on the downstream face. Based on the inspection report, the USDOE ordered

a detailed structural investigation into the cause of the depression and simultaneously initiated a precautionary drawdown of the reservoir. From June through September 1991, the level of PAR Pond was lowered from 60 to 54.3 m (200 to 181 ft) mean sea level (msl). The 54.3-m (181-ft) level was chosen to reduce the risk and consequences of potential flooding in downstream communities in the unlikely event of a dam failure. Lowering the surface water level elevation of PAR Pond resulted in a reduction of the reservoir's surface area and volume by approximately 50 and 65 percent, respectively. However, the drawdown resulted in the exposure of 544 hectares 1,340 acres) of sediments contaminated with cesium-137 and mercury.

In 1995, USDOE prepared an Environmental Assessment for the proposed natural fluctuation of water level in PAR Pond and reduced water flow in Steel Creek below L-Lake at the Savannah River Site (USDOE 1995). Based on the analysis in the Environmental Assessment, USDOE determined that the proposed natural fluctuations of water levels in PAR Pond and reduced water flow in Steel Creek below L-Lake did not constituent a Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement was not required and USDOE issued a Finding of No Significant Impact (FONSI) on August 29, 1995 (USDOE 2009).

A CERCLA Interim Action Record of Decision (IROD) was issued in 1995 that selected an interim remedy to maintain the PAR Pond reservoir level to the original 60 m (200 ft) level following repair of the PAR Pond Dam (WSRC 1995).

Basis for Taking Action

PAR Pond Reservoir

A limited evaluation of human health and environmental risks was conducted for exposure to the contaminated sediments in the PAR Pond reservoir that are exposed when the water level was lowered to 54.3 m (181 ft) msl (from full level of 60 m [200 ft] msl) (WSRC 1995). Sixteen nonradioactive constituents and four radionuclides were identified in the sediments. Based on the qualitative risk assessment, carcinogenic risks for the current land use scenario (i.e., on-unit worker) indicated that external exposure to cesium-137 contaminated sediment to the on-unit worker was $4x10^{-5}$, exceeding the

target risk of $1x10^{-6}$. The carcinogenic risk to the hypothetical future resident was calculated to be above $1x10^{-4}$. No non-carcinogenic human health effects were identified.

Because ecological effects are not immediately manifested with system changes, the ecological evaluation was based on the conditions at the time of the evaluation, which was representative of the full pool scenario. Selected terrestrial and aquatic animal species were identified with the potential to experience ecological effects from exposure to cesium-137 and mercury. Results of the limited risk assessment indicated that cesium-137 and mercury levels in the exposed sediments could potentially threaten the ecological receptors that inhabit the PAR Pond shoreline with maintenance of the reservoir at the 54.3-m (181-ft) msl water level. However, little or no effects to either terrestrial or aquatic vegetation were expected to occur. If enhanced mercury loading into PAR Pond were to occur, there is the potential threat to selected aquatic receptor species and the PAR Pond ecosystem.

LTR IOU (Middle and Lower Tail Portions)

Data from characterization efforts conducted during the period 2006 through early 2012 identified an unacceptable risk to human health for the adolescent trespasser receptor from external exposure to cesium-137 in the tail portion of the Lower Three Runs Creek (i.e., LTR IOU) (WSRC 2007, SRNS 2012b). Historically, there has been evidence of trespasser activity along the lower subunit of LTR IOU, as this section of the creek is less than 0.4 km (0.25 mi) wide at some points along an approximately 20.8 m (13 mi) stretch, and is crossed by several public access points (i.e., bridges, railroads, utility rights of way) and bounded by private property. Prior activities have included installation of fencing and signage to deter trespassing. While this appeared to be effective as no recent signs of trespassing were noted during the 2009 and 2010 characterization efforts, USDOE initiated a time critical removal action to remove cesium-137 contaminated sediment along three transects (Figure QQ-5). Following the removal action, residual cesiums-137 contamination remained at levels that did not allow unrestricted land use and additional land use controls (LUCs) were needed in the Lower Three Runs tail portion to control and restrict public and trespasser access. An Explanation of Significant Difference (ESD) (SRNS 2012a) to the IROD (WSRC 1995)

incorporated additional LUCs in the form of signage and fencing for the lower and middle sections of the LTR IOU.

IV. Remedial Actions

Remedy Selection

An IROD for PAR Pond (WSRC 1995) was issued in 1995 to address potential exposure to contaminated sediments that were exposed following water level drawdown of the PAR Pond reservoir as needed for repair of the PAR Pond dam. Cesium-137 and mercury were identified as chemicals of concern (COCs) in exposed sediments although the concentrations and extent of contamination were not fully assessed at the time the IROD was signed (WSRC 1995). Ecological studies indicated little or no effects are expected to both terrestrial and aquatic receptors from cesium-137. However, mercury exposure may pose a potential threat to the aquatic community and to sensitive species which prey on mercury-contaminated fish (WSRC 1992). The interim remedial action objective (RAO) for the PAR Pond reservoir identified in the IROD is as follows:

- Prevent exposure of the on-unit worker and ecological receptors to approximately 544 hectares (1,340 acres) of contaminated sediments that were exposed as a result of reservoir drawdown in the PAR Pond reservoir (WSRC 1995)

The selected interim remedy in the IROD was to refill and maintain the PAR Pond reservoir level to the original 60 m (200 ft) level following repair of the PAR Pond Dam. The following controls were identified in the IROD as part of the remedy:

- Engineering Controls - Controlled pumping to and discharge from PAR Pond to maintain the water level.

- Institutional Controls – Implement existing SRS access controls.

This interim remedy was to prevent exposure of contaminated shoreline sediments until a National Environmental Protection Act (NEPA) evaluation could be conducted that would assess the environmental impacts from reduced flow to the Lower Three Runs Creek, fluctuating reservoir water levels, and the discontinuance of pumping river water into the reservoir (WSRC 1995). The EIS for the *Shutdown of the River Water System at*

the SRS (USDOE 1997) was used as the basis for the selection of the No Action alternative for the *Shutdown of the River Water System at the Savannah River Site Record of Decision,* issued in 1998, that documented continued operation of the river water system using a 5,000 gallon/minute (gpm) pump allowing PAR Pond reservoir water levels to continue to fluctuate naturally between 58.5 and 60 m (195 and 200 ft) msl. Under severe drought conditions, and if necessary, the River Water System could be used to maintain PAR Pond water levels (USDOE 1998).

During 2009 and 2010, an extensive characterization of the LTR IOU was undertaken as part of the American Recovery and Reinvestment Act. This investigation included sampling within the LTR IOU (i.e., canals, pre-cooler ponds, and stream channel/floodplain). The results indicated an unacceptable risk ($> 1x10^{-4}$) to an adolescent trespasser receptor from exposure to contaminated sediments/soils in the middle and lower tail sections of the Lower Three Runs Creek (Figure QQ-3).

An ESD to the PAR Pond IROD was issued in 2012 to address exposure to cesium-137 contaminated sediments in middle and lower (tail) portions of the LTR IOU below the PAR Pond Dam (SRNS 2012a). The ESD did not alter the existing interim remedial action decision for the PAR Pond reservoir, but provided additional LUCs to prevent exposure to contaminated sediments that migrated to the Lower Three Runs Creek below the PAR Pond Dam. The RAO for the middle and lower tail portions of the LTR IOU is as follows:

- Prevent exposure of the adolescent trespasser to contaminated sediment/soil in the middle and lower tail portions of the LTR IOU (SRNS 2012a).

Remedy Implementation

The selected interim remedy met the RAO for the PAR Pond reservoir by implementing the following activities:

- Covering 544 hectares (1,340 acres) of exposed sediments with water by refilling the PAR Pond reservoir through:
    - Forced refilling (i.e., pumping water) of PAR Pond. Pumping started on February 1, 1995 and ranged from 60,000 to 160,000 gallons per minute (gpm) as described

in the IROD (WSRC 1995). During the refill, 90 to 95% of the refilling occurred through the PAR Pond pump house and only 5 to 10% of the total water added went through the P Canal. Flow through the canal did not exceed 50,000 gpm. Resuspension of sediments was minimized. A minimum flow of 10 cfs was maintained to Lower Three Runs Creek during the refill. During the refill, the 0.6-m (2-ft) per week level increase was maintained for dam stability and testing purposes. PAR Pond overflowed the spillway on March 15, 1995, indicating the water level had reached full pool. The refilling was considered complete with the topping of the spillway.

- Reconfiguring the PAR Pond pump house to its normal operating configuration following the refill of the PAR Pond reservoir to full pool.
- Establishing a pool level monitoring program to maintain surface water elevation at prescribed level, following the refill of the PAR Pond reservoir to full pool.
- Implementing existing SRS site access controls, which are in already place, to prevent unauthorized entry to SRS and PAR Pond.

- A Time Critical Removal Action for cesium-137 contaminated sediments in the middle and lower tail portions of the LTR IOU was initiated in June 2012 as described in the ESD (SRNS 2012a) (Figure QQ-4). This action consisted of:
  - Excavating cesium-137 contaminated sediment/soil in the middle and lower subunits of the Lower Three Runs Creek and floodplain that exceed the $1x10^{-4}$ risk (23.7 pCi/g) for the adolescent trespasser. Three transect areas were identified for excavation. Approximately 0.4 hectares (1 acre) of sediment/soil was excavated per transect and disposed of in an approved disposal facility (Figure QQ-5).
  - Implementing LUCs upon completion of the Time Critical Removal Action to include approximately 11.2 km (7 mi) of additional fencing and warning signs at approximately 1,000 locations along the perimeter of the lower LTR IOU. This is to prevent inadvertent and unauthorized access to areas within this IOU where residual contamination remains.

System Operations/Operation and Maintenance

The following system operational requirements are ongoing:

- Pumping, when required, to maintain the PAR Pond reservoir at the 58.5 +/- 0.3 m (195+/- 1-ft) level. The specified water level is required for as long as the contaminated sediments remain a threat to human health or the environment.

The following maintenance activities are ongoing:

- Monitoring water level in the PAR Pond reservoir to verify the level is within the range of 58.5 +/- 0.3 m (195+/- 1-ft) msl;
- Inspection and maintenance of signs and fences in lower LTR IOU subunit; and
- LUCs are being enforced through the SRS Site/Use Site Clearance program and SRS site security to preclude unauthorized access.

The annual operation and maintenance (O&M) cost associated with maintaining the water level in the PAR Pond reservoir was estimated in the IROD (WSRC 1995) to be $360,000. This figure varies based on annual rainfall. The FYR cost every fifth year and pumping costs extended over a 30-year period at a discount rate of 5% would be approximately $5,800,000. The cost is an incremental estimated cost (part of the total cost) associated with the operation of the Site Cooling Water Distribution System that maintains water to PAR Pond and L Lake. The River Water System will remain regardless of the final action chosen for PAR Pond. Therefore, SRS could still incur the cost associated with the operation of the pumps. However, during the five-year remedy review period, pumping has not been required. The actual O&M cost since the PAR Pond reservoir was refilled to 58.5 m (195 ft) msl through FY2011 is $38,500, which is lower than estimated because no pumping has been required.

The Time Critical Removal Action, off-site disposal of contaminated sediment/soils, and LUCs for the middle and lower tail portions of the LTR IOU are estimated to cost approximately $12,800,000 (SRNS 2012a). Because these events occurred recently in 2012, a comparison of the actual costs to the estimated costs is not available.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at PAR Pond are protective, the site is protective of human health and the environment. Exposure pathways that could result in unacceptable risks are controlled through a maintained cover system (i.e. water levels in PAR Pond) and site access controls in place to prevent unauthorized entry to SRS and PAR Pond. There were no recommendations or follow-up actions from the last 5-year review.

Since the previous five-year review, a Time Critical Removal Action and additional LUCs were implemented for the middle and lower tail portions of the LTR IOU. These actions did not alter the existing interim remedial action decision for the PAR Pond reservoir.

VI. Five Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Review;
- Confirmed implementation of the time critical removal action;
- Reviewed PAR Pond reservoir data;
- Inspected PAR Pond, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment QQ-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standard and to-be-considered guidance

Data Review

The interim action remedy of refilling and maintaining the PAR Pond reservoir level at a minimum of 58.5 m (195 ft) msl is effective at preventing exposure to contaminated shoreline sediments. The periodic monitoring of pool levels indicate that the minimum pool level has not dropped below the minimum level required by the *Shutdown of the River Water System at the Savannah River Site ROD* (USDOE 1998). Water levels are measured twice weekly. A review of the data from January 2007 through June 11, 2012

indicates a pool level minimum of 59.4 m (197.85 ft) msl on September 20, 2011 and a pool level high of 60 m (200.2 ft) msl on March 31, 2011.

The Time Critical Removal Action and implementation of LUCs (i.e., signage and fencing) in the middle and lower tail portions of the LTR IOU was completed in August 2012. There is no additional information or data to review at this time.

Summary of Inspections and Interviews

Interviews were conducted with James Wood, O&M staff member, on August 8, 2012 at the PAR Pond OU and with Richard Swygart, O&M Site Manager, on August 29, 2012 at the O&M organization offices. The PAR Pond OU was inspected by SRNS and USDOE personnel on August 8, 2012 and August 21, 2012. No issues were identified for the PAR Pond OU during this inspection and interviews.

On January 30, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, Applicable or Relevant and Appropriate Requirements (ARARs), risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the IROD (WSRC 1995), as modified by the ESD (WSRC 2005). The refill and maintenance of the PAR Pond reservoir to a minimum water level of 58.5 m (195 ft) msl meets the RAO to prevent exposure to approximately 544 hectares (1,340 acres) of sediments that were exposed as a result of reservoir drawdown in PAR Pond. The O&M activities of maintaining the PAR Pond reservoir water level at 58.5 m (195 ft) msl and access controls continue to be effective. SRS site access controls prevent unauthorized entry to the SRS and PAR Pond.

The removal of cesium-137 contaminated soils in the middle and lower tail portions of the LTR IOU met the time critical removal action goal of 12 pCi/g. This will be documented in a Removal Action Report that is scheduled for submittal in early fiscal year 2013. Since the time critical removal action and implementation of additional LUCs

were completed in August 2012, the O&M activities have not been initiated to allow for review. The fencing and signage at the unit are intact and in good repair.

The LUCs that are in place include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that limit access, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

There were no opportunities for system optimization observed during this review.

Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of final remedy selection are still valid. There have been no changes in standards or physical conditions of the PAR Pond unit that would affect the protectiveness of the remedy.

The IROD (WSRC 1995) identified no chemical-specific or action-specific ARARs. The location-specific ARAR that was identified is the Endangered Species Act (16 USC 1531 et seq.). The Endangered Species Act was applicable to the bald eagle and American alligator because these predator species utilize the reservoir and could be adversely affected by increased loading of contaminated sediments from runoff into the basin and by preying on terrestrial animals living on exposed contaminated sediment. The selected interim remedy to maintain the minimum water level at 58.5 m (195 ft) msl eliminated exposure to contaminated sediments due to the shielding provided by the overlying surface water and eliminated accumulation of contaminated sediments caused by surface runoff.

Fact sheets provided on the US EPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this unit.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No new information has come to light that could affect the protectiveness of the remedy.

VIII. Issues

While there are no issues related to current site conditions or activities that currently prevent the remedy from being protective, it should be recognized the actions at this unit are interim (PAR Pond) and include early removal actions (Lower Three Runs Creek).

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for this unit.

X. Protectiveness Statement(s)

The interim remedy at PAR Pond is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are controlled by maintaining a minimum water level in PAR Pond to cover contaminated sediments and LUCs implemented in the middle and lower tail portion of the LTR IOU. LUCs in the middle and lower tail portion include additional fencing and warning signs at approximately 1,000 locations along the perimeter of the lower LTR IOU. In addition, site controls are in place and include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain PAR Pond for industrial use only, and warning signs and land use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2009. *Period Report 3 for the Lower Three Runs Integrator Operable Unit (U)*, SRNS-RP-2009-00763, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2012a. *Explanation of Significant Differences (ESD) for the Revision 0 Interim Action Record of Decision Remedial Alternative Selection: PAR Pond Unit(U) – Lower Three Runs Integrator Operable Unit Trail Portion (Middle and Lower Subunits) (U)*, SRNS-RP-2012-00121, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012b. *Period Report 4 for the Lower Three Runs Integrator Operable Unit (U)*, SRNS-RP-2011-01535, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

USDOE, 1995. *Environmental Assessment for the Natural Fluctuation of Water Level in PAR Pond and Reduced Water Flow in Steel Creek below L-Lake at the Savannah River Site*, DOE/EA-1070, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 1997. *Final Environmental Impact Statement, Shutdown of the River Water System at the Savannah River Site, Aiken, South Carolina*, DOE/EIS-0268, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 1998. *Record of Decision, Shutdown of the River Water System at the Savannah River Site, Savannah River Operations Office, Aiken, South Carolina*, DOE/EIS-0268 (January 1998) 63 FR 4236, Filed 1-27-98, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 2009. *Revised Finding of No Significant Impact for the Natural Fluctuation of Water Level in Par Pond and Reduced Water Flow in Steel Creek below L Lake at the Savannah River Site*, January 2009, Department of Energy, Savannah River Operations Office, Aiken, SC

WSRC, 1992. *Baseline Risk Assessment Using Existing Data for Par Pond*, WSRC-RP-91-1197, Revision 1, prepared for Westinghouse Savannah River Company by Oak Ridge National Laboratory, Martin Marietta Energy Systems, Inc., Oak Ridge, TN.

WSRC, 1995. *Interim Action Record of Decision Remedial Alternative Selection for the PAR Pond Unit (685-G) (U)*, WSRC-RP-93-1549, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2007. *Lower Three Runs IOU Early Action Fact Sheet*, WSRC-RP-2007-4043, Washington Savannah River Company, Savannah River Site, Aiken, SC.

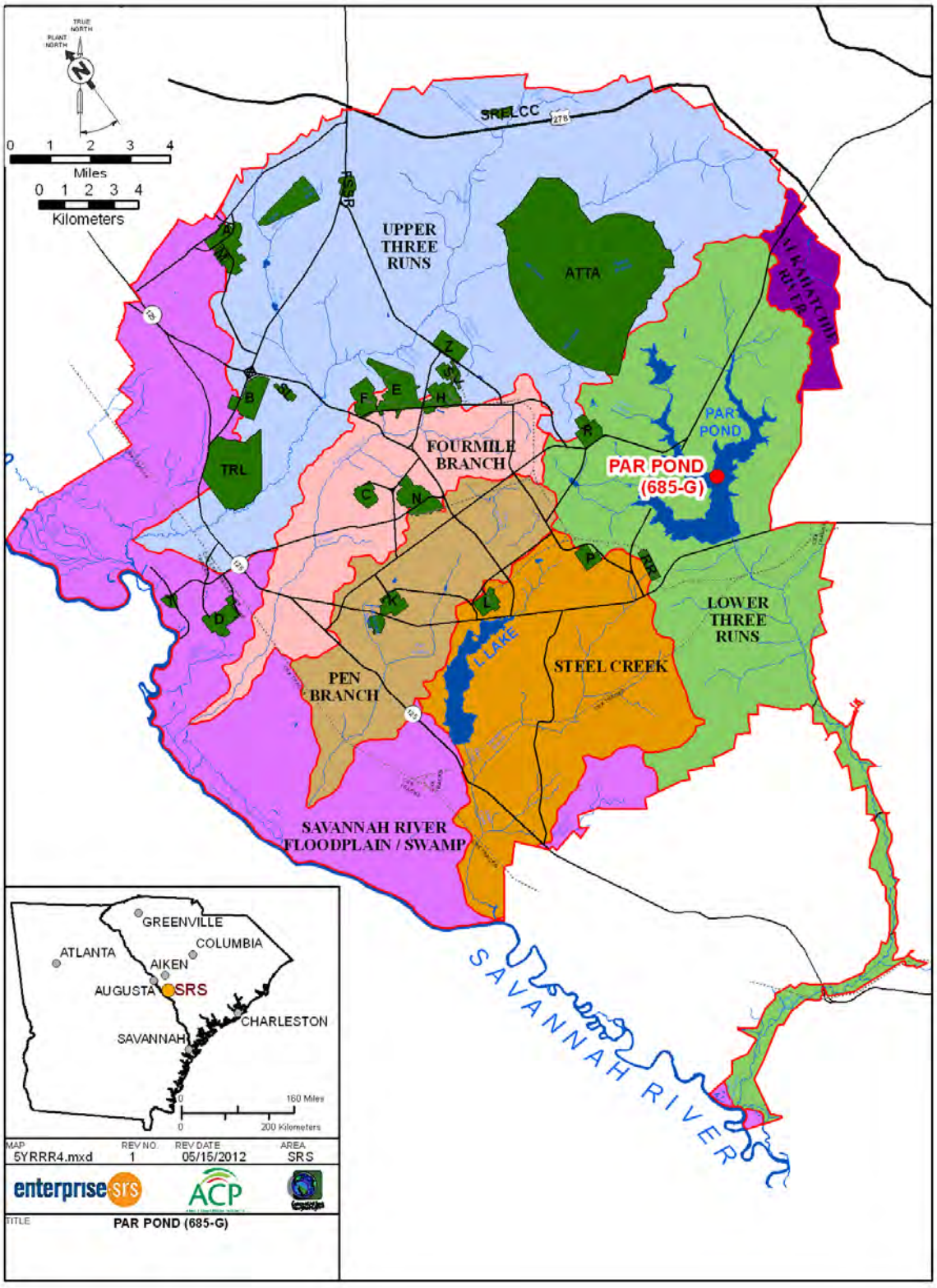


Figure QQ-1. Location of PAR Pond at SRS

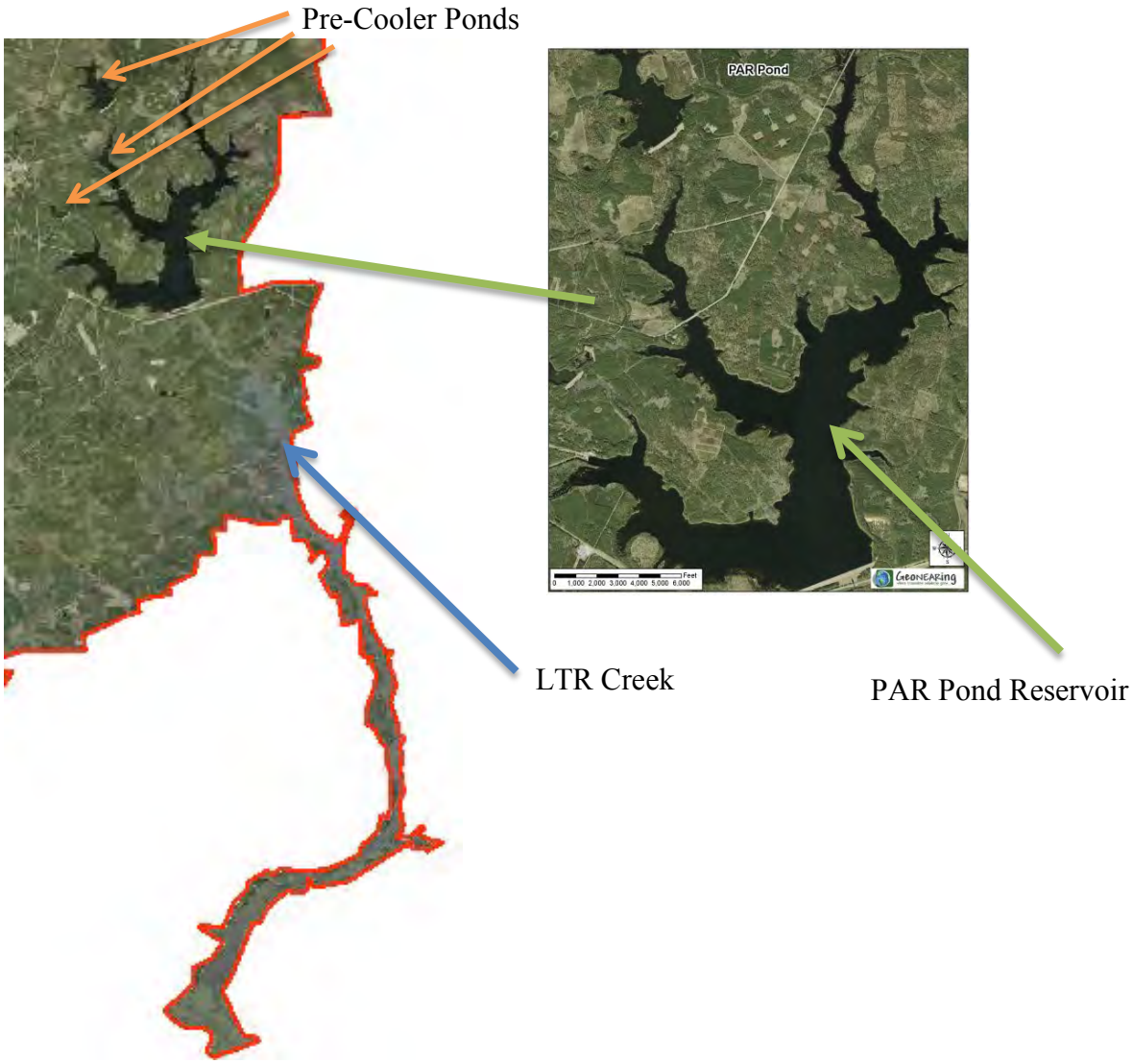


Figure QQ-2. Aerial Photos of the Lower Three Runs Integrator IOU (left) and of PAR Pond (right), (photos 2010)

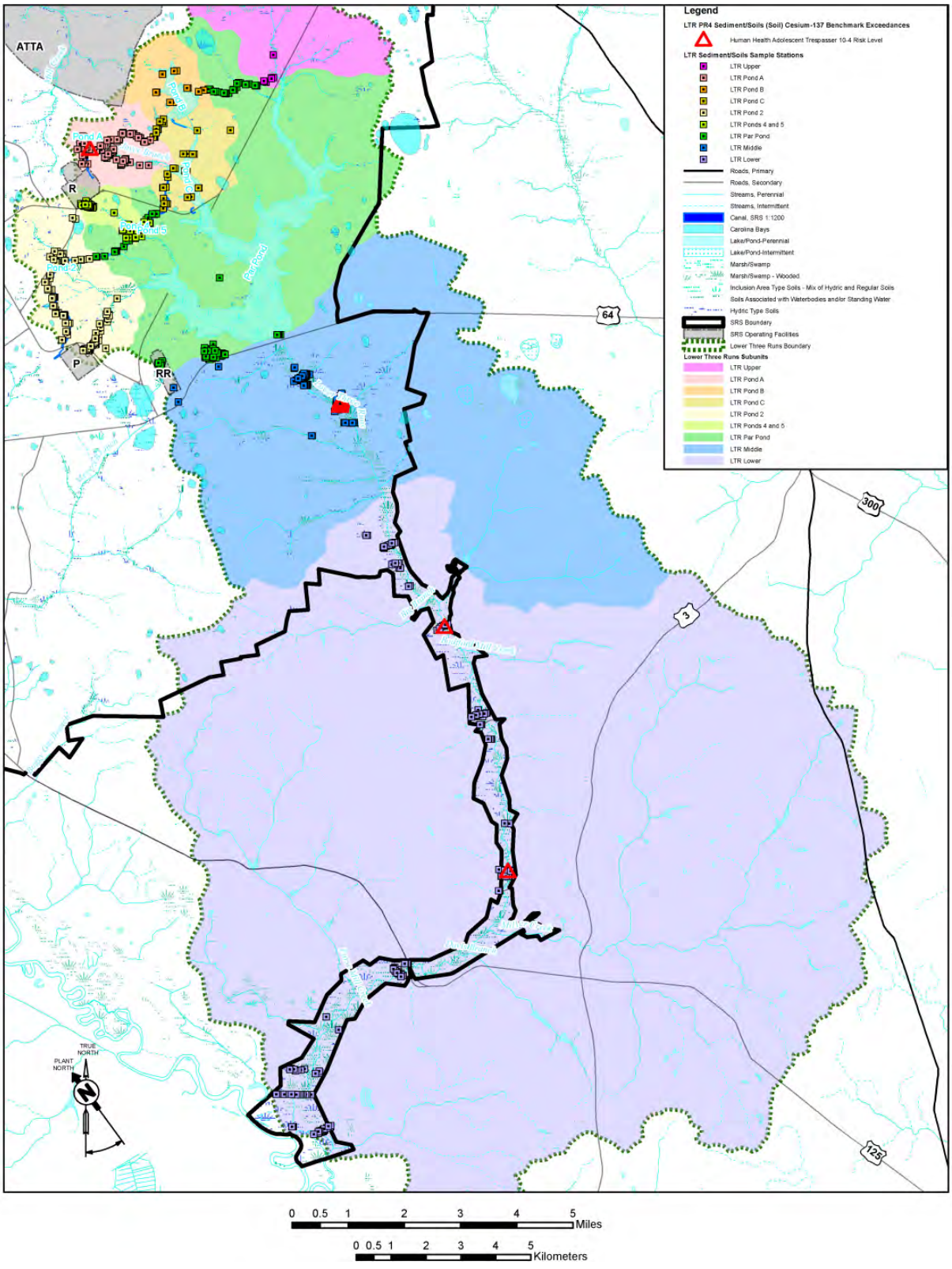


Figure QQ-3. Human Health Risk Exceedances (>1x10^{-4}) for Adolescent Trespasser

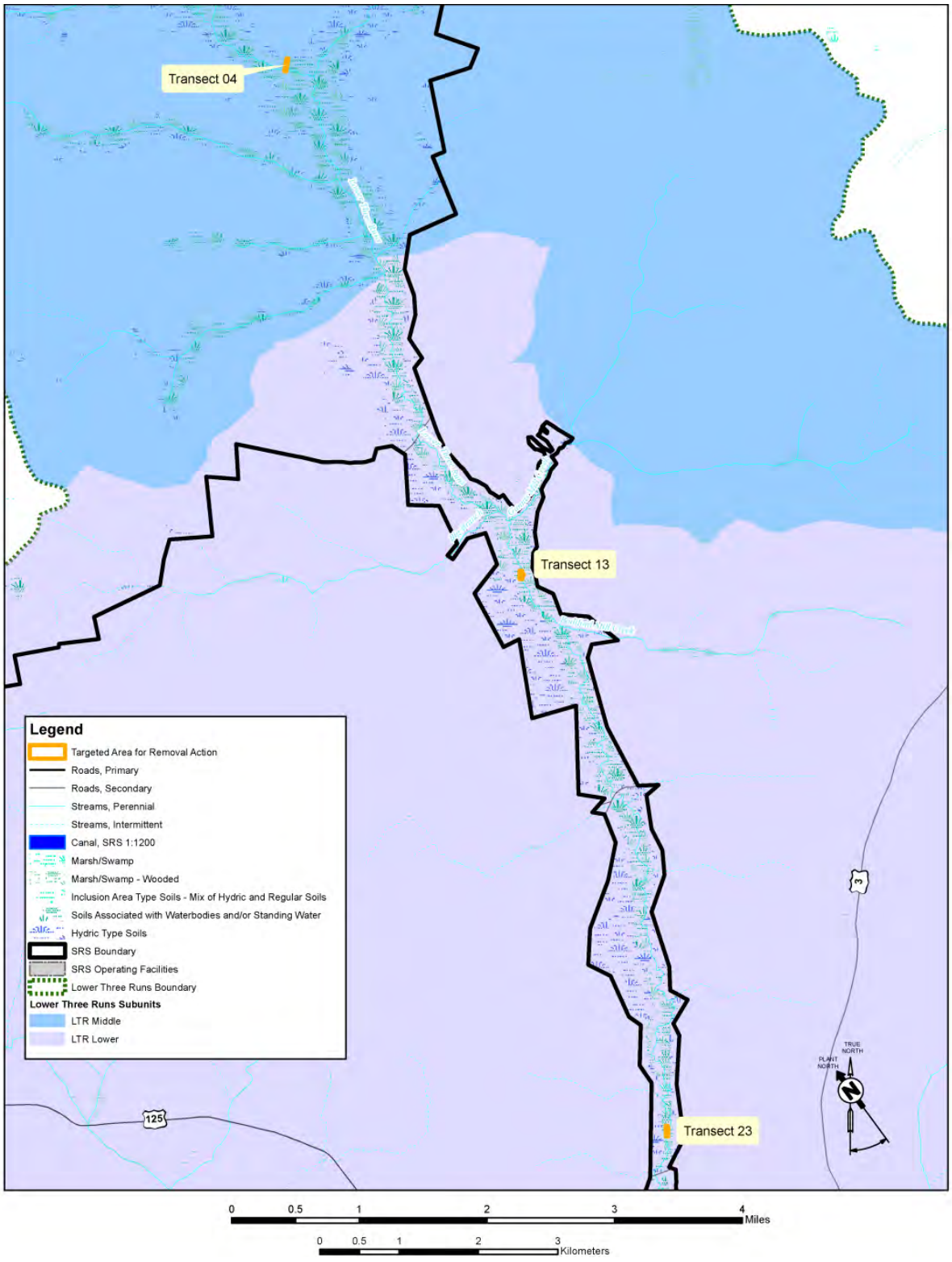


Figure QQ-4. Targeted Areas for Time Critical Removal Action based on adolescent trespasser scenario for cesium-137.



Figure QQ-5. Photographs from the 2012 Time Critical Removal Action in Lower Three Runs IOU Tail Portion

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Table QQ-1. Chronology of PAR Pond Unit Events

Event	Date
Interim ROD (IROD)- PAR Pond Issuance	February 16, 1995
Interim Remedial Action Start/Complete	February 1,1995 – March 15, 2001
ROD - Shutdown of River Water System	January 1998
Finding of No Significant Impact – PAR Pond	January 2009
ESD for Rev. 0 IROD PAR Pond Issuance	September 13, 2012
Previous Five-Year Reviews	June 30, 1997 / February 12, 2004 / February 4, 2009

Table QQ-2. O&M Costs – Actual versus Estimated

	FY07	FY08	FY09	FY10	FY11	5-Yr Total
Actual O&M Cost	4,400	4,800	1,700	400	400	38,500
ROD Estimated O&M Cost	23,450	23,450	23,450	23,450	23,450	117,250

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Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals)

I. SITE INFORMATION			
Site Name:	**PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals)**	**Date of Inspection:**	**08/08/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #35**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**93°F and Sunny**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Fill pond to full pool and maintain water level at 195 feet msl

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** Richard Swygart (Name) Infrastructure &Maintenance Engineer (Title) 8/29/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-557-4695
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** James Wood (Name) Infrastructure and Maintenance Staff (Title) 08/08/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-557-4615
   Problems/Suggestions: ☐ Report Attached

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☐ As-Built Drawings	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: Water level measurements are taken twice a week and recorded. These are up to date and readily available.

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(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.) Field walkdown

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Candice Freeman (Name) | Federal Project Director (Title) | 8/21/12 (Date) | 803-952-8365 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision document have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

PAR Pond is in an Interim ROD, ICs are not applicable at this time. The ESD for the removal action at the LTR Tail did incorporate ICs for the LTR Tail. The removal action implementation/construction was completed August 2012. The warning and no trespassing signs were installed as part of the action. Inspections and maintenance had not been initiated during this 5 year review period.

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: PAR Pond: Survey wooden stakes were located. Several had been damaged due to control burn in the area. LTR Tail: Signage has been installed and is 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 QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(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:_____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident

Areal extent_____ Depth_____

Remarks:_____

2. Cracks: ☐ Location shown on site map ☐ Cracking not evident

Lengths_____ Widths_____ Depths_____

Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident

Areal extent_____ Depth_____

Remarks:_____

4. Holes: ☐ Location shown on site map ☐ Holes not evident

Areal extent_____ Depth_____

Remarks:_____

5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress

Areal extent_____ Depth_____

Remarks:_____

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A
Remarks:

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident
Areal extent Depth
Remarks:

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent
☐ Ponding ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent
Remarks:

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment QQ-1. Five-Year Review Site Inspection Checklist – PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy of refilling PAR pond to 195 ft msl to submerge the exposed sediments prevents external exposure to radionuclides, ingestion of and dermal contact with sediments, and inhalation of airborne sediments. All observations indicate that the remedy is effective at eliminating exposure to the contaminated sediments. The removal action associated with the LTR Tail was implemented and completed in 2012. Signage is in place per the LUCs.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of maintaining PAR pond level at 195 ft msl and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities) have been implemented. The O&M procedures are adequately maintaining the pool level and the condition of the warning signs is good. Due to August 2012 completion of removal action for the LTR Tail, the O&M activities did not begin in this five year review cycle. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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P-AREA BURNING/RUBBLE PIT (131-P) (PBRP) OPERABLE UNIT

I. Introduction

This report is the second five-year review for the P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the PBRP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the PBRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table RR-1 lists the chronology of site events for the PBRP OU.

III. Background

The PBRP OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for the Savannah River Site (SRS). The media of concern is soil and groundwater.

Physical Characteristics

The PBRP OU is located in the central portion of the SRS in Barnwell County more than 8.0 km (5 mi) from the site boundary and is approximately 244 m (800 ft) west of the P-Area perimeter fence (Figure RR-1). The PBRP OU is located within the Steel Creek watershed approximately 68 m (223 ft) north of Steel Creek. The OU consists of five subunits: PBRP, a small drainage ditch near PBRP, a seepline located along an embankment of Steel Creek, a segment of Steel Creek adjacent to the OU, and groundwater in the water table aquifer (Figure RR-2). Characteristics of each subunit are described below:

- PBRP subunit is a single, inactive burial pit approximately 61 m (200 ft) long by 9 m (30 ft) wide. The depth of the pit ranges from 2.4 m (8 ft) below ground surface (bgs) in the western end to 3.4 m (11 ft) bgs in the eastern end.

- The ditch subunit is approximately 23 m (75 ft) to the southwest of PBRP. It is 0.3 m (1 ft) to .6 m (2 ft) deep and may, at times, receive surface water runoff from the vicinity of the western end of PBRP. Surface water occasionally collects in the ditch, but in general the ditch is dry.

- The seepline subunit is present on a terrace approximately 3 m (10 ft) above Steel Creek. The area identified as the seepline is approximately 3 m (10 ft) wide and 61 m (200 ft) long. Surface water is locally present at the seepline for much of the year. However, the seepline is not a significant source of surface water, as most of the seepline area has surface water only after heavy rainfall events. The seepline often dries up completely in the summer.

- The segment of Steel Creek subunit is approximately 68 m (223 ft) south of PBRP. There is a narrow (<7.6 m [25 ft] wide) floodplain along Steel Creek. Steel Creek is a discharge point for the water table aquifer southwest of PBRP.

- The groundwater subunit is the water table aquifer, which is the "upper" aquifer zone of the Upper Three Runs aquifer and is composed of interbedded sands, silts, and clays. The top of the water table is approximately 10.7 m (35 ft) bgs. The upper aquifer zone is approximately 17.4 m (57 ft) thick; it extends from the water table to a locally continuous clay layer (the "tan clay") at a depth of approximately 24.4 m (80 ft) bgs. The general groundwater flow direction is to the southwest where it outcrops to Steel Creek.

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates PBRP OU as being outside of a site industrial zone. However, according to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of

the SRS land should be prohibited. The future land use for the PBRP OU is reasonably anticipated to be industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The following summarizes the contamination at the PBRP OU subunits:

- PBRP subunit - From 1951 to 1973, the PBRP was used for periodic burning of combustible materials. Disposal records of individual burials were not kept for this unit; however, information obtained from historical records and from characterization of similar burning/rubble pits at SRS indicates that materials such as wood, cardboard, paper, plastics, rubber, rags, oils, and organic liquids of unknown origins were disposed of in the pit and burned on a monthly basis. In 1973, burning in open pits was discontinued at SRS, and a soil layer was placed over the pit contents. The pit continued to receive inert debris such as construction materials until 1978 when the pit reached capacity.

- Ditch subunit - No waste was placed in the ditch. The ditch was assessed to determine potential impacts from PBRP runoff and erosion.

- Seepline subunit - No waste was placed along the seepline. The seepline was assessed to determine potential impacts from PBRP leaching and seepage.

- Segment of Steel Creek and groundwater subunits - No waste associated with PBRP was placed in Steel Creek. Prior to 1997, cooling water, process sewer water, and stormwater runoff from P-Area were discharged to Steel Creek at a location upgradient of PBRP. In addition, groundwater in the water table aquifer under P-Area discharges to Steel Creek. Consequently, Steel Creek has been contaminated by upgradient sources in P-Area unrelated to the PBRP OU. All process/cooling water discharges were discontinued in February 1997.

Initial Response

When the PBRP reached capacity in 1978, the debris was covered with approximately 1.2 m (4 ft) of clean soil to grade. Seven groundwater monitoring wells were installed in 1983. No removal actions have been performed at the unit.

The ditch, seepline, a segment of Steel Creek, and the groundwater subunits were assessed as part of this OU to determine if there had been an impact from PBRP from runoff and/or erosion, leaching, or seepage.

Basis for Taking Action

The potential exposure to or ingestion of contaminated soil and groundwater poses a potential increased risk of cancer to human receptors and is the basis for taking action at the PBRP OU.

Based on the RFI/RI/BRA report, the PBRP soil poses a threat to human health as it is contaminated with polycyclic aromatic hydrocarbons (PAHs) as listed in Table RR-2. Nine constituents at PBRP present a contaminant migration (CM) (i.e., leachability) threat to groundwater. These CM Refined Constituents of Concern (RCOCs) include antimony, chromium, copper, nickel, zinc, dibenzofuran, tetrachloroethylene (PCE), trichloroethylene (TCE), and Aroclor 1242 (a polychlorinated biphenyl [PCB]). These constituents were predicted to exceed MCLs or Risk Based Calculations (RBCs) within 1,000 years. Soils around the perimeter of the pit are generally uncontaminated. The volume of contaminated soil is 2,678 m^3 (3,500 yd^3) per the Record of Decision (ROD) (WSRC 2002). There are no RCRA listed or characteristic wastes and no principal threat source material at this OU.

Groundwater also poses a threat to human health. Groundwater was determined to be contaminated with 1,1-dichloroethene (1,1-DCE) and TCE above the maximum contaminant levels (MCLs) of 7 µg/L and 5 µg/L, respectively.

The small drainage ditch near PBRP, the seepline located along an embankment of Steel Creek, and the segment of Steel Creek adjacent to the OU were determined to not be impacted by PBRP (there are no RCOCs). Although Steel Creek is contaminated, the

contamination did not originate from PBRP, but from an unrelated upgradient source in P-Area; contamination in Steel Creek is being addressed separately under the Integrator Operable Unit (IOU) program.

IV. Remedial Actions

Remedy Selection

In 2002, a final ROD was issued to address the soil and groundwater contamination at PBRP (WSRC 2002). As stated in the ROD, the remedial action objectives (RAOs) are as follows:

- Protect current workers from the exposure to benzo[a]pyrene in surface soil at concentrations that exceed 53.3 mg/kg
- Protect hypothetical future industrial workers from exposure to benzo[a]anthracene (2.56 mg/kg), benzo[a]pyrene (0.256 mg/kg), benzo[b]fluoranthene (2.56 mg/kg), benzo[k]fluoranthene (25.6 mg/kg), dibenzo[a,h]anthracene (0.256 mg/kg), and indeno[1,2,3-c,d]pyrene in surface and subsurface soils at concentrations that exceed target risk levels.
- Protect hypothetical future industrial workers from exposure to 1,1-DCE (7.0 µg/L) and TCE (5.0 µg/L) in groundwater at concentrations that exceed MCLs.
- Protect groundwater resources from contaminant migration of antimony (4.588 mg/kg), chromium (35.22 mg/kg), copper (40.8 mg/kg), nickel (11.432 mg/kg), zinc (1,110 mg/kg), dibenzofuran (0.195 mg/kg), PCE (0.00338 mg/kg), TCE (0.00153 mg/kg), and PCB-1242 (0.00843 mg/kg) in PBRP soil that would impact the groundwater above MCLs or RBCs.

As stated in the ROD, the selected remedial actions for the PBRP OU are as follows:

- Engineered cover system with BaroBalls™;
- Institutional controls (i.e., LUCs);
- Natural Biodegradation; and

- Continued monitoring and reporting of the water table aquifer.

Remedy Implementation

The implementation of the final remedial action included the following activities:

- Constructing an engineered cover system (e.g., native soil cover with a hydraulic conductivity of approximately $1x10^{-5}$ cm/sec) over PBRP to (1) prevent exposure to contaminants in surface soil, (2) reduce rainwater infiltration and resulting leaching, and (3) slow the rate of contaminant migration through the soil to groundwater so that there is more time for natural processes such as biodegradation to reduce the leachability risk;
- Installing four passive soil venting wells (BaroBall™) to allow volatile organic compounds (VOCs) in the soil to vent to the atmosphere instead of leaching to groundwater;
- Monitoring the groundwater quality to confirm that a discernible groundwater plume above MCLs does not develop; and
- Implementing land use controls (LUCs) (i.e., site maintenance, warning signs, and institutional controls) to prevent unauthorized intrusion into the buried contamination.

System Operations/Operation and Maintenance

Active operations at the PBRP OU are now complete.

- The vapor phase monitoring of the BaroBall™ wells (PSV-10, -11, -12, -13) was discontinued in 2006 as concentrations dropped to below the remedial goal (RG) of 10 parts per million vapors. The wells were left in place to continue passive operation until groundwater objectives are met. The location of the BaroBall™ wells is shown on Figure RR-3.

The following maintenance activities are ongoing:

- Groundwater monitoring for three wells (PRP 5, PRP 6, and PRP 7) (Figure RR-3). Sampling will continue until MCLs have been attained for three consecutive years.

The results were reported via annual Environmental Monitoring Reports (EMRs) since 2004. Starting in 2008, the monitoring results for PBRP OU were combined with the KBRP/KRP OU and LBRP/LRP OU monitoring reports in to a single abbreviated annual groundwater data summary, with full detailed reports every five years (WSRC 2008). The first five year detailed report was submitted in June 2012 (SRNS 2012).

- Annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit).

The operation and maintenance (O&M) cost associated with the selected remedy has a ROD estimated present worth cost of $188,000 discounted at 7% per year for 30 years. The actual O&M cost since the remedial action was completed in FY05 through FY11 is $215,000. The actual O&M costs (Table RR-3) are as expected.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedy of a soil cover at the PBRP OU with institutional controls (i.e. LUCs) and groundwater monitoring are protective of human health and the environment.

Operation of the BaroBall™ wells was effective at removing VOC contamination from the vadose zone as vapor concentrations have diminished.

Since the previous review in 2007, an agreement with U.S. Environmental Protection Agency (USEPA), South Carolina Department of Health and Environmental Services (SCDHEC), and USDOE was reached in 2008 to combine the reports for KBRP, LBRP, and PBRP into an annual groundwater monitoring data summary letter with a detailed groundwater report every fifth year beginning June 2012 (WSRC 2008).

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;
- Reviewed the groundwater monitoring data by comparing it to MCLs (Table RR-4 and Figure RR-6);
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment RR-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Annual groundwater reports or data summaries have been submitted for the PBRP OU since 2003 and were thoroughly reviewed for this Five-Year Remedy Review. The latest 2012 report includes time-series plots of 1,1-DCE and TCE at each station, a plume map, and a comprehensive review of the monitoring activities and monitoring results (SRNS 2012).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012, and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The PBRP OU was inspected by SRNS and USDOE personnel on August 1, 2012. No issues were identified for the PBRP OU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The closure of the PBRP by placing and maintaining a protective cover along with institutional controls is protecting current and hypothetical future industrial workers from PAHs in the soil.

- LUCs are continuing to prevent human exposure to contaminated groundwater. The Land Use Control Implementation Plan for PBRP OU, included as Appendix E of the Post-Construction Report, governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2004). All LUC objectives are being met.

- The cover system and operation of the Baroball™ wells are mitigating further migration of CM RCOCs to the groundwater. Groundwater monitoring data indicates the integrity of the cover is intact as metal and PCB CM RCOC contaminant levels are below RGs and VOC concentrations are decreasing. The 2011 groundwater data is summarized in Table RR-4. Times series plots of TCE are provided in Figure RR-6.

As of 2011, the 1,1-DCE groundwater concentrations have been decreasing over the past three years as concentrations have declined to 10.2 µg/L, from the 2004 maximum of 34.8 µg/L. Contamination above the 7.0 µg/L MCL is only present in one well, PRP 6. As of 2011, TCE and PCE concentrations have been below the 5.0 µg/L MCL for at least the past three years. The background well, PRP 5, remains non-detect for all VOC analyses. Figure RR-3 shows the location of the wells with listed contaminant concentrations, the 1,1-DCE plume, and potentiometric surface at PBRP.

The above remedial activities are meeting the RGs established for the PBRP OU, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. The MCLs for the currently monitored RCOCs (Table RR-4) have remained the same since the remedies were implemented. There have been no changes in standards or physical conditions of the PBRP OU that would affect the protectiveness of the remedy.

Due to the presence of chlorinated solvents at the site, there is a potential that 1,4-dioxane may also exist because it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. The presence of 1,4-dioxane is not likely to change the protectiveness of the remedial action that includes LUCs (at a minimum) which consequently renders the exposure pathway to human receptors incomplete. An evaluation of the effectiveness of the remedy is premature until such time that a formal MCL is established.

SRS has performed a historical review of groundwater data at the PBRP OU. 1,4-Dioxane has only been analyzed twice throughout its history. Both samples were collected in 2006 and were non-detect. The 4Q2013 sampling at PBRP OU will include the analysis of 1,4-dioxane. The 1,4-dioxane results will be reported in the subsequent annual Groundwater Monitoring Data Summary that will be submitted in June 2014, as well as summarized in the next Five-Year Remedy Review. Based on the results, the USEPA, SCDHEC, and USDOE will decide whether 1,4-dioxane should be permanently added to the list of monitored constituents.

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

Issues related to the PBRP OU are presented in Table RR-5.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions for the PBRP OU are presented in Table RR-6.

X. Protectiveness Statement(s)

The remedy at the PBRP 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 the ingestion of, contaminated soil and groundwater. All threats to contaminated soil at the PBRP OU have been addressed through implementation of the soil cover, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the PBRP OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2012. *K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G)(KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-3L, and 131-2L)(LBRP), and P-Area Burning/Rubble Pit (131-P)(PBRP) Operable Units (OUs) Detailed Combined Groundwater Monitoring Report (U)*, SRNS-RP-2012-00200, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2001. *RFI/RI/BRA for the P-Area Burning/Rubble Pit (131-P) (U)*, WSRC-RP-98-4174, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Record of Decision Remedial Alternative Selection for the P-Area Burning/Rubble Pit (131-P) (U)*, WSRC-RP-2000-4197, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Post-Construction Report for the P-Area Burning/Rubble Pit (131-P) (U)*, WSRC-RP-2004-4051, Revision 1, Westinghouse, Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Proposal to Standardize Sampling and Reporting Requirements of Groundwater Data for P, L, and K Area Burning/Rubble Pit Operable Units*, ACP-08-133, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - *Inspection Data Sheets – Field Inspection Checklist P-Area Burning/Rubble Pits (U)*, ER-IDS-019-030, Inspection period 2007 through 2011 (annually)

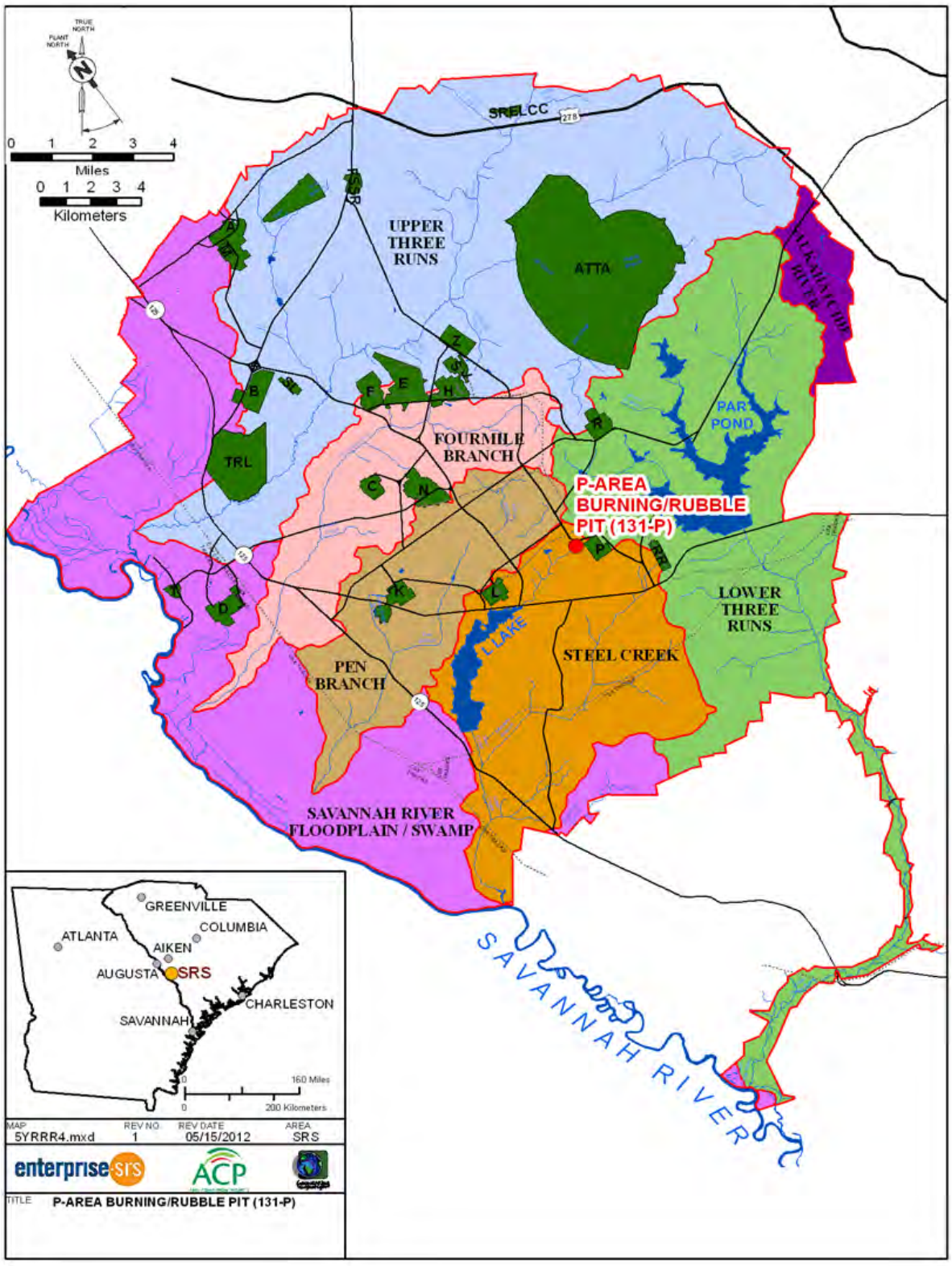


Figure RR-1. Location of the PBRP OU at SRS

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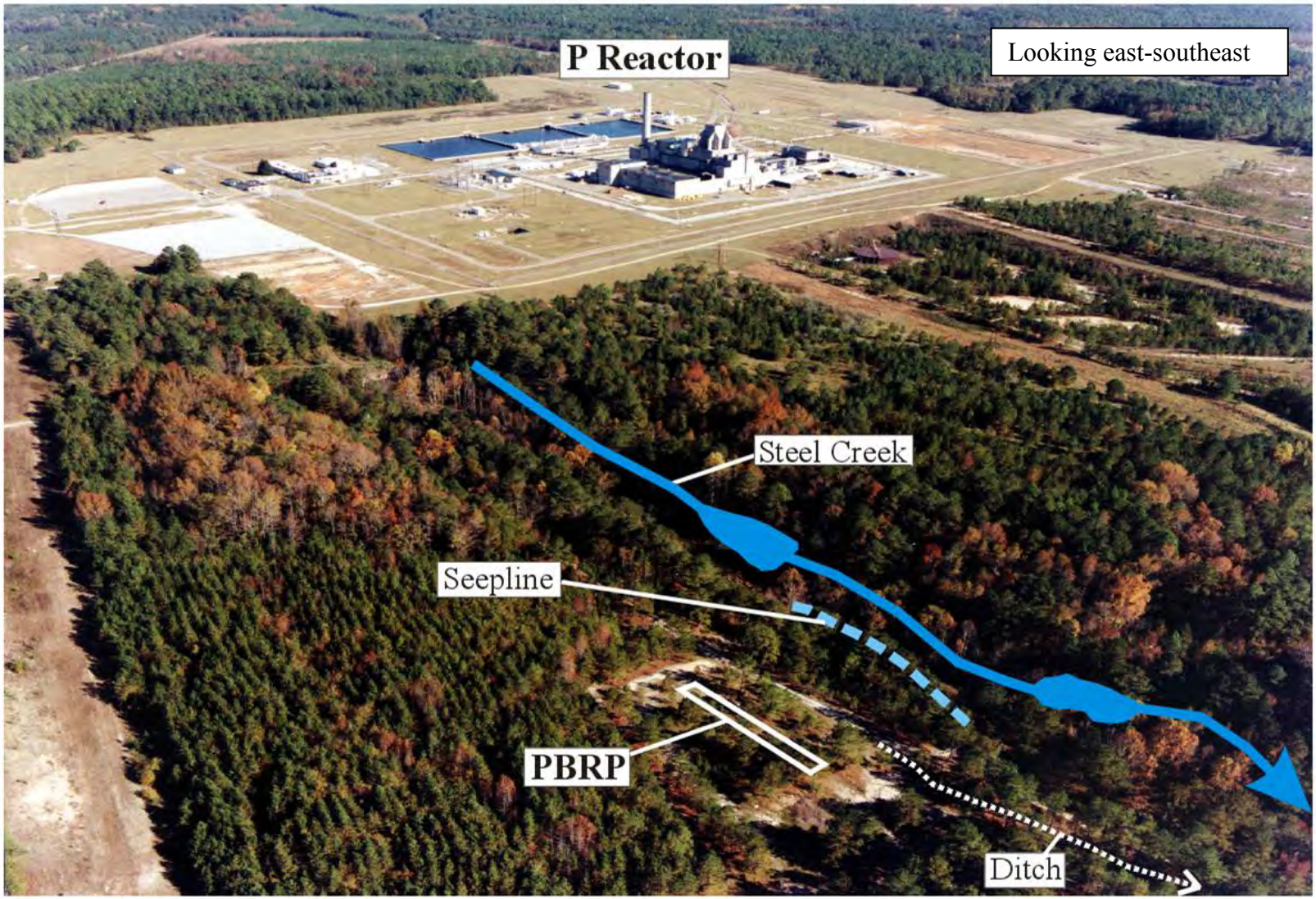


Figure RR-2. Layout of the PBRP OU

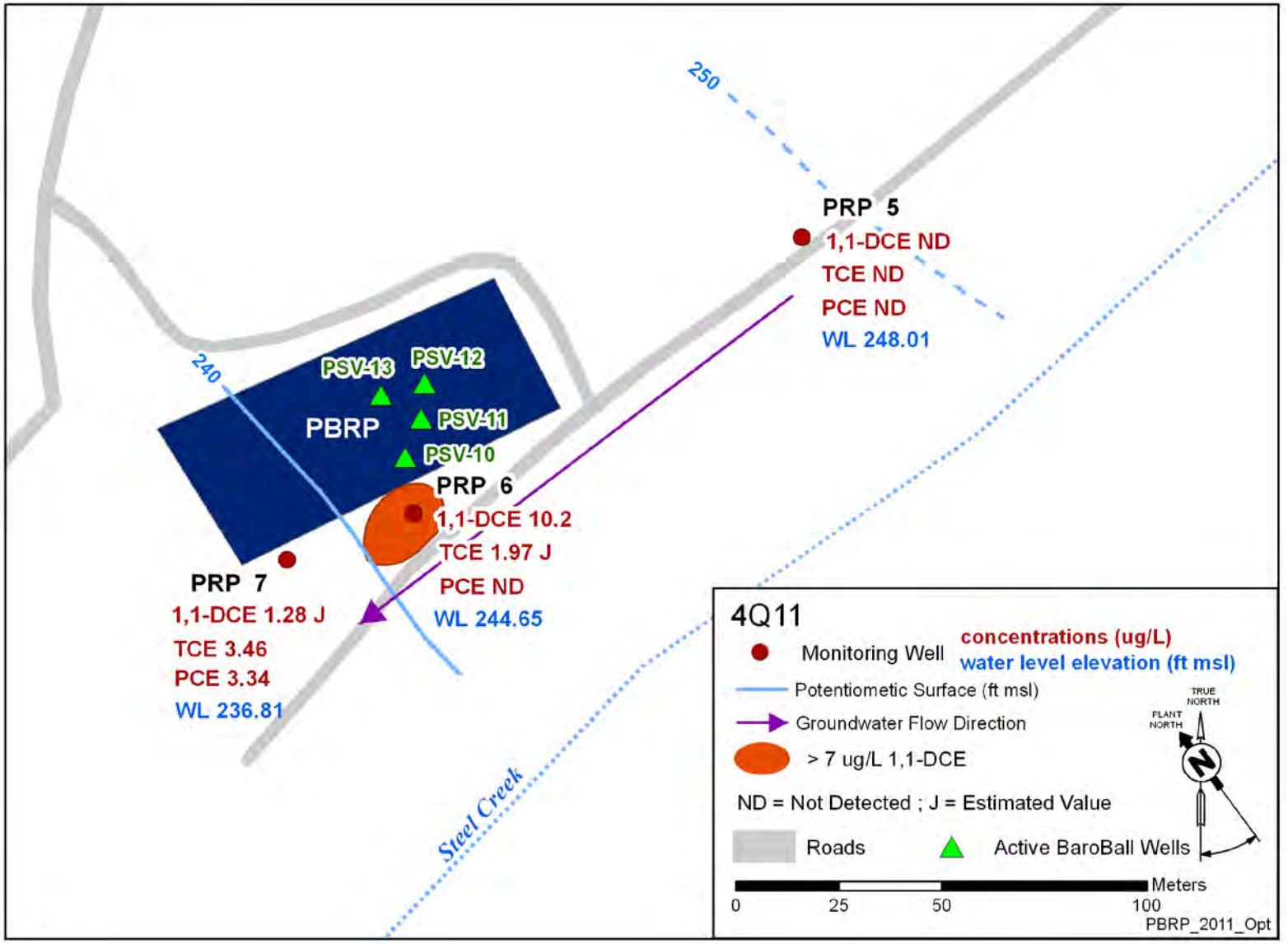


Figure RR-3. 2011 1,1-DCE Plume and Potentiometric Surface at PBRP

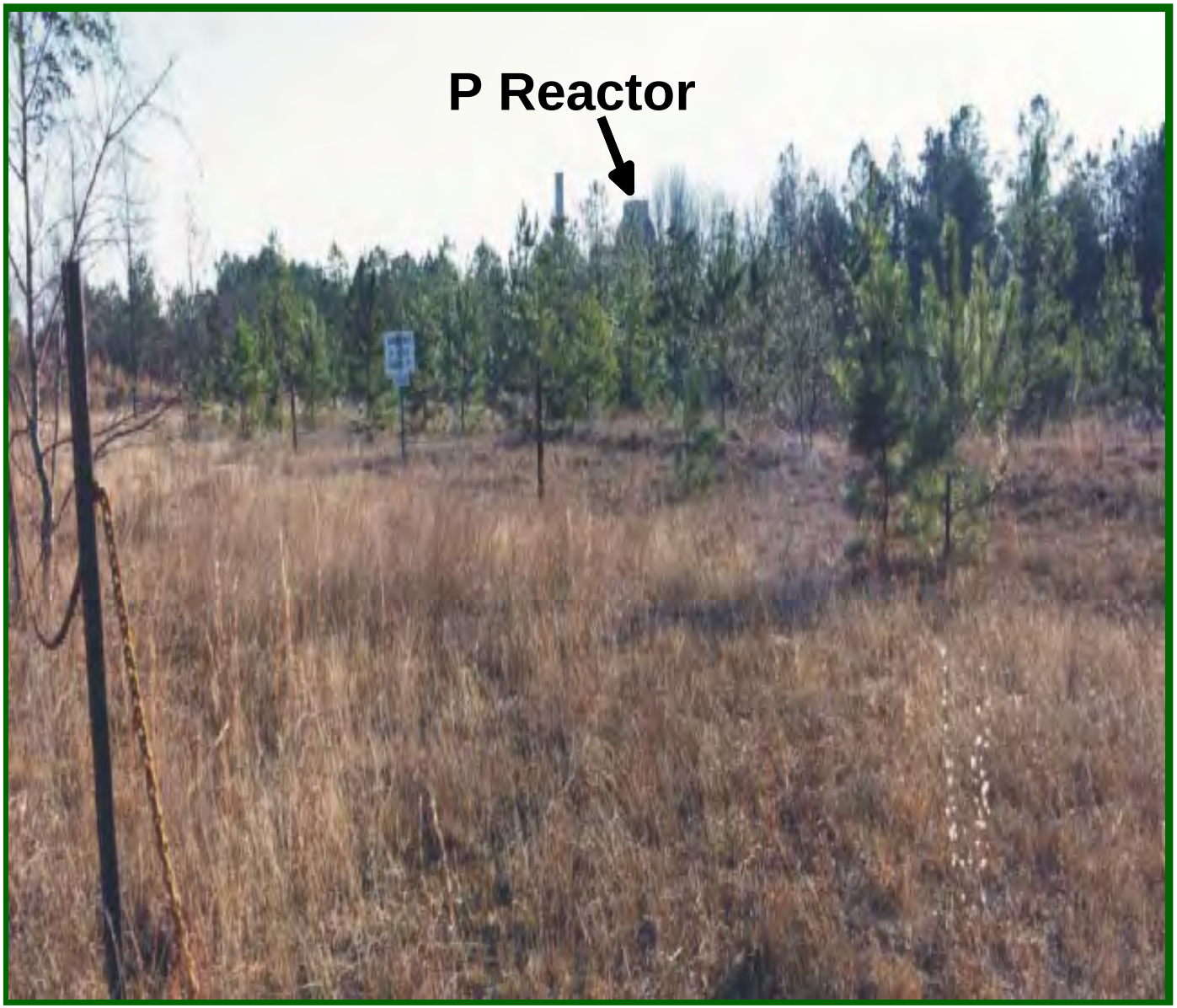
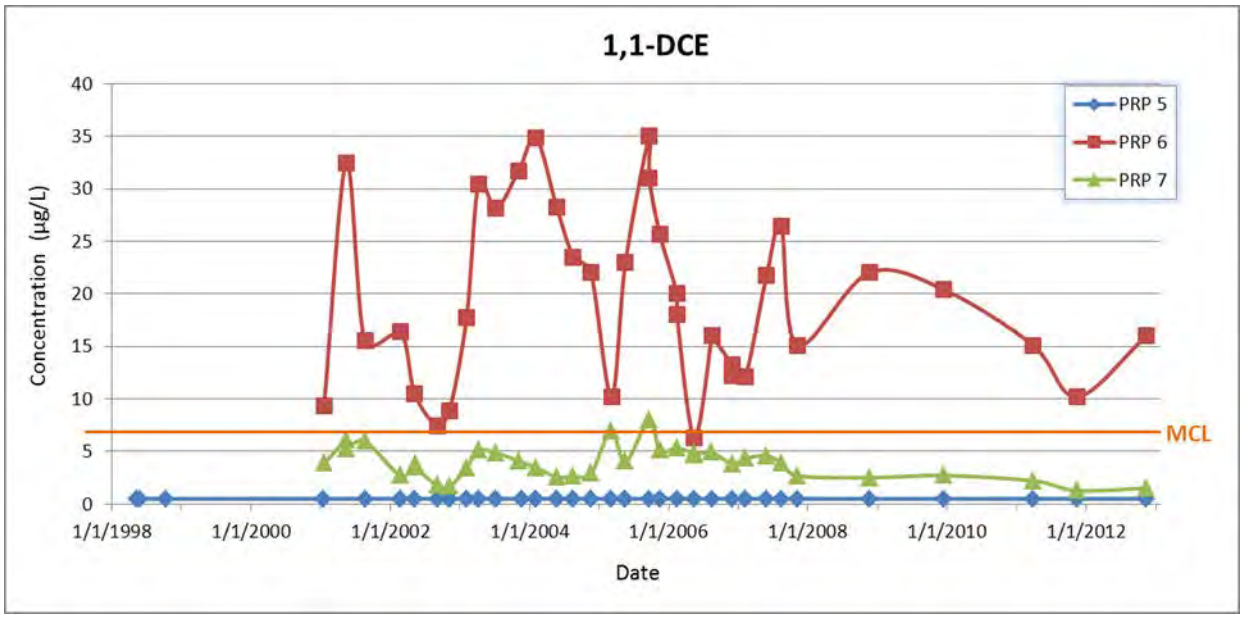
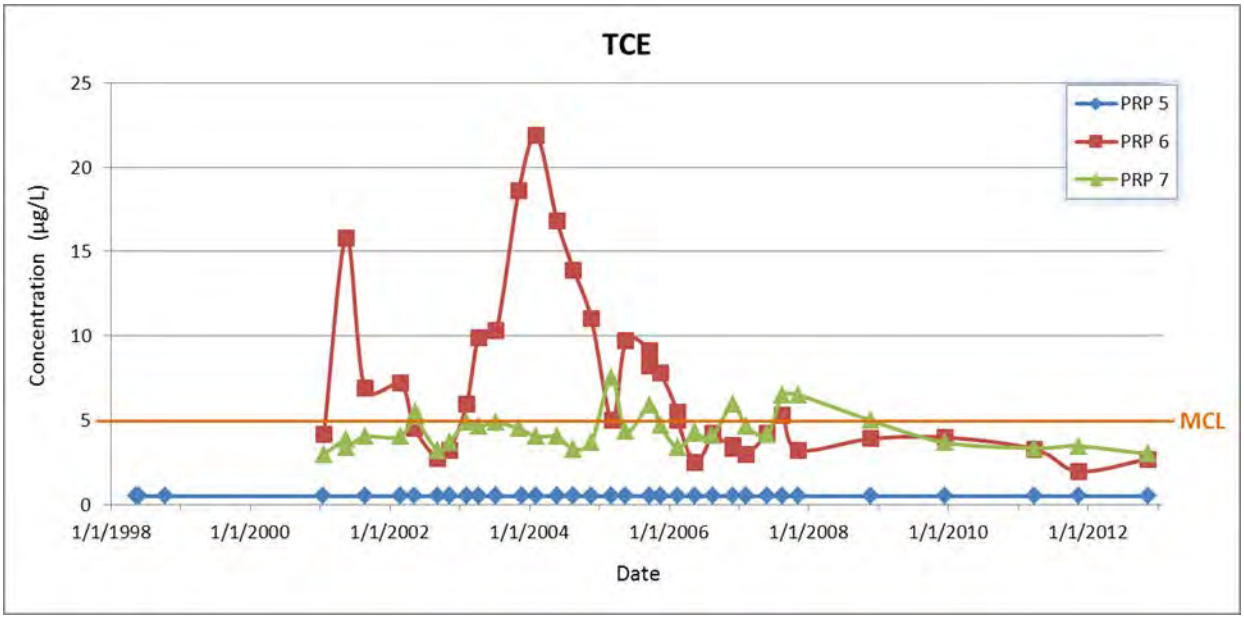


Figure RR-4. Photo of PBRP Before Remediation Activities (December 1987)



Figure RR-5. Photo of PBRP Currently (2012)





Non-detects are plotted as 0.5 µg/L (PRP 5 values)

Figure RR-6. Time-series plots of 1,1-DCE and TCE at wells PRP 5, PRP 6, and PRP 7

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Table RR-1. Chronology of OU Events

Event	Date
RFI/RI Start/Complete	1997 / May 21 ,2001
Record of Decision (ROD) Issuance	July 21, 2003
Remedial Action Construction (RA) Start/Complete	November 14, 2003/ June 8, 2004
RA Operations Start / Complete	February 24, 2004 / Ongoing
Previous Five-Year Review	February 4, 2009

Table RR-2. PBRP RCOCs by Medium and Subunit with Final Remedial Goals

Medium (Units)	RCOC	ARAR RGO	CM RGO	HH RGO	Bkgd 95th percentile	Final RG
Soil - PAHs (mg/kg)	Benzo[a]anthracene			2.56	NA	2.56
	Benzo[a]pyrene			0.256	NA	0.256
	Benzo[b]fluoranthene			2.56	NA	2.56
	Benzo[k]fluoranthene			25.6	NA	25.6
	Chrysene			256	NA	256
	Dibenzo[a,h]anthracene			0.256	NA	0.256
	Fluoranthene			2670	NA	2670
	Indeno[1,2,3-c,d] pyrene			2.56	NA	2.56
	Phenanthrene			3270	NA	3270
	Pyrene			2000	NA	2000
Soil – CM COC (mg/kg)	Antimony		0.259		4.588	4.588
	Chromium		2.80		35.22	35.22
	Copper		40.8		NA	40.8
	Nickel		2.05		11.432	11.432
	Zinc		1110		20.475	1110
	Tetrachloroethylene (PCE)		0.00338		NA	0.00338
	Trichloroethylene (TCE)		0.00153		NA	0.00153
	PCB-1242		0.00843		NA	0.00843
	Dibenzofuran		0.195		NA	0.195
Groundwater (µg/L)	1,1-Dichloroethylene	7.0		0.477	NA	7.0
	Trichloroethylene	5.0		26.0	NA	5.0

Table RR-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	53,800	19,600	17,000	9,700	8,900	108,900
Total ROD Estimated Direct O&M Costs	57,946	17,600	17,600	17,600	17,600	128,346

Table RR-4. Comparison of RGs and Groundwater Monitoring Data from 2011

RCOC	RG (MCL) (µg/L)	2011 Maximum Concentration (µg/L)	Well with Maximum Concentration
1,1-DCE*	7.0	**10.2**	PRP 6
TCE*	5.0	3.46	PRP 7
PCE	5.0	3.34	PRP 7
Antimony	6.0	Non Detect	N/A
Chromium	100	4.3	PRP 7
Copper	1,300	27	PRP 6
Nickel	1,800	6	PRP 7
Zinc	11,000	25	PRP 6
PCB-1242	0.034	Non Detect	N/A
Dibenzofuran	N/A	Non Detect	N/A

*Time-series plots of 1,1-DCE and TCE are available in Figure RR-6.

Table RR-5. Issues Identified for PBRP OU

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1,4-Dioxane has been identified as being a potential contaminant at PBRP OU based on its possible association with other solvents that are present at PBRP OU. However, there is a lack of groundwater data to dismiss 1,4-dioxane as being present at levels which would be harmful to human health or the environment.	N	N

Table RR-6. Recommendations and Follow-up Actions for PBRP OU

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date*	Affects Protectiveness? (Y/N)	
					Current	Future
1,4-Dioxane has not been monitored recently in the PBRP OU wells.	1,4-Dioxane will be monitored in all of the PBRP OU wells during the 4Q2013 sampling event. The data results will be presented in the subsequent annual Groundwater Monitoring Data Summary that will be submitted in June 2014, as well as in the next Five-Year Review. Based on the results, the Core Team will decide whether or not 1,4-dioxane will need to be permanently added to the list of monitored constituents.	USDOE	SCDHEC/ USEPA	June 2014	N	N

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Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit

I. SITE INFORMATION			
Site Name:	**P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit**	**Date of Inspection:**	**08/08/2012**
Location and Region	**SRS, USEPA Region 4**	**CERCLIS OU:**	**#59**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**92°F and clear**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Natural Biodegradation, Baroball™; Groundwater monitoring

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for P-Area Burning/Rubble Pit,* ER-IDS-019-030._____

_____

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

1. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

2. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

3. 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:

4. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

5. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

7. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

9. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) 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: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/15/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) 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:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress

Areal extent Depth

Remarks: Vegetation is mowed routinely.

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

- ☐ Wet areas ☐ Location shown on site map Areal extent _____
- ☐ Ponding ☐ Location shown on site map Areal extent _____
- ☐ Seeps ☐ Location shown on site map Areal extent _____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Remarks: _____

_____

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident

Areal extent _____ Depth _____

Remarks: _____

_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A

☒ Vegetation does not impede flow

Areal extent _____ Type _____

Remarks: _____

_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent _____ Depth _____

Remarks: _____

_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A

Remarks: _____

_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks: _____

_____

2. Performance Monitoring:

Type of Monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching Head Differential _____

Remarks: _____

_____

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A	
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A	
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____	
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____	
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A	
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____	
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____	

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____

Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance

Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks:_____

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: Soil Vapor Extraction System via Barolball™ _____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks: _____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks: _____

Attachment RR-1. Five-Year Review Site Inspection Checklist – P-Area Burning/Rubble Pit (PRBP) (131-P) Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The PBRP consists of two subunits that warrant remediation: PBRP and groundwater. The remedy for the PBRP is Engineered Cover System with Baroball™, Natural Biodegradation, and Institutional Controls. The selected remedy for groundwater is Continued Monitoring and Reporting to verify that a discernible plume above maximum contaminant levels (MCLs) does not develop. The remedy, engineered cover system, is functioning as indicated by the post construction well sampling data that shows no change in groundwater concentrations. The soil cover and institutional controls are providing access controls.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining PBRP and the condition of its warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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P-AREA OPERABLE UNIT

I. Introduction

This report is the first five-year review for the P-Area Operable Unit (PAOU). The review was conducted from July 2012 through September 2012. This report documents the results of the review. Contaminants have been left in place at PAOU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at PAOU is protective of human health and the environment.

II. OU Chronology

Table SS-1 lists the chronology of events for the PAOU.

III. Background

The PAOU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media of concern is surface soil, vadose zone soil, rail bed materials, metal components, concrete, and sediment. Groundwater is addressed separately under the P-Area Groundwater OU.

Physical Characteristics

The PAOU is located in south-central SRS approximately 4.0 km (2.5 mi) east-southeast of the geographical center of SRS and about 6.4 km (4 mi) west of the nearest site boundary (Figure SS-1). PAOU is approximately 50 hectares (126 acres) (including the P-Area Ash Basin and Outfall P-007). It is located in an upland area between Steel Creek and Lower Three Runs watersheds and has a flat to gently rolling topography. Figures SS-2 and SS-3 show before (2000) remediation and after (2010) remedial activities photos of P Area. PAOU is approximately 96 m (315 ft) above mean sea level (msl).

The PAOU is comprised of the following subunits (Figure SS-4):

- P-Reactor Building (105-P) and its Ancillary Structures including Engine House (108-lP) and Engine House (108-2P) with Standby Pumphouse (191-P);
- Disposition of Water in the P-Reactor Disassembly Basin (no building number [NBN]);
- Potential Release from the P-Area Reactor Cooling Water System (186/190-P);
- Potential Release from the P-Area Disassembly Basin (105-P);
- Process Sewer Lines As Abandoned (NBN) (PSLs); including the Spill on 03/15/79 of 5000 gallons of Contaminated Water; and various components of the PSLs including Process Water Storage Tank (106-P), Process Water Storage Basin (109-P); Cooling Water Effluent Sump (107-P/107-1P), outfalls, manholes, and miscellaneous weirs and boxes; sumps, etc.;
- P-Area Reactor Area Cask Car Railroad Tracks As Abandoned (NBN);
- All railroad tracks within the P-Area fence;
- High Contamination Area (HCA) associated with the P-Area Cask Car Railroad Tracks;
- P-Area Ash Basin (including Outfall P-007) (188-P);
- Slab Associated with Containment Tank within Emergency Cooling Water Retention Basin (904-86G);
- Slab Associated with Pipe Fabrication Shop Building (717-9P);
- Slab Associated with Radiological Zone Storage Building (710-P);
- Slab and Sumps Associated with No. 2&5 Basin Deionizers Pad (105-1P);
- Potential Source Area (PSA) 1 - Emergency Cooling Water Retention Basin (904-86G);
- PSA 2 - Area around the Cooling Water Effluent Sump (107-P/107-1P);
- PSA 3A - Area near the Northern end of the P-Reactor Building (105-P);

- PSA 3B - Area West of the Administrative/Maintenance Slab;
- PSA 4 - Area East of the P-Reactor Building (105-P);
- PSA 5 - Two localized areas in the Southwestern part of P Area; and
- Outfall P02.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates PAOU as being within the site industrial area. The future land use for PAOU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

In February 1954, P-Reactor began operations. It was taken off-line for maintenance and safety upgrades in 1987, placed in warm standby in 1988, and placed in shutdown status in 1991. In 1993, P-Reactor was placed in cold shutdown with no capability of restart. The primary sources of radioactive contamination in P Area are activation products, fission products, and tritium, the majority of which were the consequence of P-Reactor operations. Spills, leaks, accidental releases, or simply the operation itself resulted in releases of hazardous and/or radioactive substances.

Initial Response

No initial response actions were taken at the PAOU prior to issuance of the EAROD (WSRC 2008a), which is described in Section IV.

Basis for Taking Action

The nature and extent of contamination in soil, sediment, gravel, and ash at the PAOU were characterized from 2005 through 2007. A comprehensive approach was implemented to address potential impact to human and ecological receptors at the PAOU. Overall, soil-gas samples were collected from 69 locations, groundwater samples were

collected from 139 locations, soil samples were collected from 116 locations, gravel samples were collected from eight locations, and ash samples were collected from 19 locations.

Results from the past characterization activities (WSRC 2008b) and recent monitoring have demonstrated that radiological and volatile organic contaminants are exceeding PAOU remedial goals (RGs) at specific subunits. PAOU subunits for which refined contaminants of concern (COCs) were determined for human health include: HCA associated with the P-Area Cask Car Railroad Tracks, P-Reactor Building (105-P) Complex, and P-Area Ash Basin (including Outfall P-007) (188-P) (Table SS-2). Additionally, COCs were qualitatively identified for the P-Area PSLs based on the potential for fixed contamination within the lines. Each of the above subunits, including the P-Area PSLs, has been addressed by early remedial actions or Non-Time Critical removal actions. Risks from these subunits are discussed below. The remedial goals (RGs) for the PAOU are listed in Table SS-2.

- The early remedial action (soil removal to 1 pCi/g cesium-137) has been completed for the HCA associated with the P-Area Cask Car Railroad Tracks subunit. Additionally, this subunit will be managed with the land use controls (LUCs) selected for the entire PAOU to prevent unrestricted use.

- The early remedial action the P-Reactor Building (105-P) Complex has been completed and radioactive contaminants have been left in place. Additionally, this subunit will be managed with the LUCs selected for the entire PAOU to prevent unrestricted use.

- The removal action for the P-Area PSLs has been completed and radioactive contaminants have been left in place. The subunit requires land use controls (LUCs) selected for the entire PAOU to prevent unrestricted use.

- A contaminant migration analysis was performed to identify contaminant migration COCs (WSRC 2008b). The results of the contaminant migration evaluation identified contaminant migrations COCs for: P-Reactor Building (105-P) Complex, PSA 3A, and PSA 3B.

- A principle threat source material (PTSM) evaluation for the PAOU subunits determined refined COCs for: HCA associated with the P-Area Cask Car Railroad Tracks and P-Reactor Building (105-P) Complex. The radioactive inventory located in the P-Reactor Building (105-P) has been estimated to be 2.40×10^5 Ci (WSRC 2008b). Cumulative risk for the P-Reactor Building (105-P) Complex was estimated at 2.19×10^4.

IV. Remedial Actions

An area-based remedial strategy has been implemented in P Area, excluding prior remedial decisions for the P-Area Reactor Seepage Basins and the P-Area Burning/Rubble Pits in their respective Records of Decisions (RODs).

In 2009, the USDOE decided to proceed with removal actions to support accelerated remediation of the remainder of the PAOU under the American Recovery and Reinvestment Act of 2009. The removal actions included the details of ISD for the P-Reactor Complex, as described in the ESD to the EAROD (SRNS 2009a), and the Non-Time Critical (NTC) removal actions for the P-Area PSLs (SRNS 2009c), and the P-Area Ash Basin (including Outfall P-007) (SRNS 2009b).

The following remedial and removal actions are considered to be the final actions for these subunits (WSRC 2008a, SRNS 2009a, SRNS 2009b, SRNS 2009c):

- PSA 3A - Area near the Northern end of the P-Reactor Building (105-P) – Soil Vapor Extraction (SVE) with Fracturing and Chemical Oxidation Injection;
- PSA 3B - Area West of the Administrative/Maintenance Slab - SVE.
- HCA associated with the P-Area Cask Car Railroad Tracks - Excavate/Remove and Cover;
- P-Area Ash Basin (including Outfall P-007) (188-P) - Remove, Consolidate, Cover;
- P-Area PSLs; including the spill on 03/15/79 of 5,500 Gallons of Contaminated Water; and various components of the PSLs including Process Water Storage Tank (106-P), Process Water Storage Basin (109-P), Cooling Water Effluent Sump

(107-P/107-1P) outfalls, and manholes, miscellaneous weirs and boxes; sumps, etc. - Plugging, Grouting, Equipment Removal;

- Disposition of Water in the P-Reactor Disassembly Basin - Forced Evaporation; and
- P-Reactor Building (105-P) and its Ancillary Structures including Engine House (108-1P), Engine House (108-2P) with Standby Pumphouse (191-P) - ISD.

The following subunits require institutional controls (LUCs) only because of their close proximity to the P-Reactor (105-P) Reactor Building and being located within the industrial zone (SRNS 2010d):

- Potential Release from the P-Area Reactor Cooling Water System (186/190-P);
- Potential Release from the P-Area Disassembly Basin (105-P);
- P-Area Reactor Area Cask Car Railroad Tracks As Abandoned (NBN);
- All railroad tracks within the P-Area fence;
- Slab Associated with Pipe Fabrication Shop Building (717-9P);
- Slab Associated with Radiological Zone Storage Building (710-P);
- Slab and Sumps Associated with No. 2&5 Basin Deionizers Pad (105-1P);
- PSA 2 - Area around the Cooling Water Effluent Sump (107-P/107-1P);
- PSA 4 - Area East of the P-Reactor Building (105-P);
- PSA 5 - Two localized areas in the Southwestern part of P Area; and

The following subunits required no action since it had been determined that these subunits pose no impact to human health or the environment based on an unrestricted land use scenario:

- Slab Associated with Containment Tank within Emergency Cooling Water Retention Basin (904-86G);
- Potential Source Area (PSA) 1 - Emergency Cooling Water Retention Basin (904-86G); and

- Outfall P02.

Remedy Selection

As stated in the ROD (SRNS 2010d), the Remedial Action Objectives (RAOs) for the PAOU are as follows:

- Eliminate or control all routes of exposure to residual radioactive or chemical contamination posing risks exceeding 10E-06 to the industrial worker or the resident in media or structures associated with the P-Reactor Building (105-P) Complex including the water in the P-Reactor Disassembly Basin, the HCA associated with the P-Area Cask Car Railroad Tracks, the P-Area PSLs, PSA 3Aand 3B, and the P-Area Ash Basin (including Outfall P-007) (188-P);
- Prevent exposure of potential contamination in media or structures to a residential receptor associated with the following subunits:
  - Potential Release from the Reactor Cooling Water System (186/190-P);
  - Potential Release from the P-Reactor Disassembly Basin (105-P);
  - P-Area Reactor Area Cask Car Railroad Tracks As Abandoned (NBN);
  - All Railroad Tracks within the P-Area Fence;
  - Slab Associated with Pipe Fabrication Shop Building (717-9P);
  - Slab Associated with Radiological Zone Storage Building (710-P);
  - Slab and Sumps Associated with No. 2&5 Basin Deionizers Pad (105-1P);
  - PSA 2 - Area around the Cooling Water Effluent Sump (107-P/107-1P);
  - PSA 4 - Area East of the P-Reactor Building (105-P); and
  - PSA 5 - Two localized areas in the Southwestern part of P Area.

The remedial actions selected to meet the RAOs and the threshold criteria to provide overall protection of human health and the environment and comply with Applicable or Relevant and Appropriate Requirements (ARARs) for the PAOU is as follows:

- P-Reactor Building Complex – ISD End State;
- PSA-3A Volatile Organic Carbon (VOC) Source Area – SVE with soil fracturing and chemical oxidation;
- PSA-3B VOC Source Area – Conventional SVE;
- HCA at the Cask Car Railroad Tracks – Excavation and Disposal of contaminated media; and
- Land Use Controls (LUCs) to maintain industrial land use.

The following LUC objectives are necessary to ensure protectiveness of the remedy:

- Restrict unauthorized worker access and prevent contact, removal, or excavation of contaminated waste, pipelines, equipment, and buildings;
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds;
- Maintain the integrity of any current or future remedial or monitoring system, such as SVE systems, soil covers, or groundwater monitoring wells; and
- Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion.

Remedy Implementation

The selected remedies met the RAOs at PAOU based on successful completion of the early action RAs and NTC removal actions, as listed below:

- Installed ten SVE wells using MicroBlowers™ and BaroBalls™, enhanced with soil fracturing and chemical oxidation at PSA 3A to treat 1 acre at a depth of 20-50 ft below ground surface (bgs);
- Installed five SVE wells using MicroBlowers™ and BaroBalls™ at PSA 3B to treat 0.5 acre at a depth of 20-50 ft bgs;

- Removed 54 m^3 (70 yd^3) of contaminated media at the Cask Car Railroad Tracks HCA by excavating to a depth of 45 cm (18 in) and transporting to the E-Area Slit Trenches for disposal and then backfilling excavated areas with clean soil to grade;
- Excavated 6,116 m^3 (8,000 yd^3) of soil and ash containing concentrations of cesium-137 greater than 10 ρCi/g at the Outfall P-007 and transported the soil and the ash to the E-Area Low-Level Waste Facility for disposal;
- Placed a 0.6 m (2-ft) thick soil cover over Outfall P-007 (approximately 4.5 acres) and P-Area Ash Basin (13.7 acres) consisting 0.5 m (1.67 ft) of common fill and 10 cm (4 in) of topsoil layers;
- Dewatered P-Area PSLs (lines/structures); Isolated/plugged contaminated process sewer and storm water lines; Grouted accessible openings to grade including structures, manholes, catch basins, inlet pipes, outfalls, and other miscellaneous access points; Installed concrete plugs in openings and/or placed concrete covers over entire structures, where required; Removed equipment associated with the P-Area PSLs external to the P-Reactor Building (105-P); and sealed/plugged outfalls;
- ISD of the P-Reactor Building (105-P) Complex included:
  - Leaving the P-Reactor Building (105-P) Complex (Process, Purification, and Assembly Areas) and the Actuator Tower in place;
  - Installing ten evaporators to treat the P-Reactor Disassembly Basin water;
  - Demolishing the above-grade structure of the Disassembly Area to grade-level;
  - Grouting the below grade portions of the P-Reactor Building (105-P) including Disassembly Basin and the Purification Area (112,706 yd^3 total) to stabilize contaminants;
  - Removing the stack above the plus 16.8-m (55-ft) elevations;
  - Constructing a new partial roof over the shield door slots to prevent rainwater ingress;

- Grouting the Reactor Vessel in place (118 yd^3) and placing a 1.2-m (4-ft) thick constructed concrete cover over the Reactor Vessel; cover is sloped to allow water runoff in the event of future rainwater ingress;
- Leaving the Process Room, an above-grade structure, in its current state; and
- Placing a sloped concrete cover over the grouted Disassembly Basin;

- 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
- LUCs were placed on the 50 hectares (126 acres) comprising the PAOU and include the following:
  - For the near term, signs would be posted to alert on-site workers to the presence of hazardous substances and to prevent unauthorized entry and unrestricted uses:
  - Access controls and use restrictions for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefings of health and safety requirements;
  - SRS access controls to prevent exposure to trespassers, as described in the 2000 RCRA Part B Permit Renewal Application, Volume I, Section F.1, which describes the security procedures and equipment, 24-hour surveillance system, artificial or natural barriers, control entry systems, and warning signs in place at the SRS boundary; and
  - In the long term, if the property or any portion thereof, is ever transferred from DOE, notice of the type and quantity of any hazardous substances that were known to have stored (for more than one year), released, or disposed of on the property will be provided. In addition, if the property or any portion thereof, is every transferred by deed, the U.S. Government will satisfy the requirements of CERCLA 120(h)(3) to include a description of the remedial action taken, a covenant, and an access clause.

System Operations/Operation and Maintenance

Currently, there are no systems in operation at the PAOU: Operations are complete for two systems: 1) the ten evaporators, which treated 15.1 million liters (4 million gallons) of Disassembly Basin water; and 2) PSA-3A and PSA-3B SVEs because the RGs have been met.

The following maintenance activities are ongoing:

- Monitoring of groundwater adjacent to the P-Reactor Reactor Building (105-P) per the PAOU Effectiveness Monitoring Plan (EMP) (SRNS 2010c); and
- Annual site inspections that include:
  - The roof structure of the P-Reactor Building (105-P) to ensure that it is functioning properly. Herbicides will be applied as necessary to prevent the growth of woody vegetation on the roof structure;
  - The doors into the P-Reactor Building (105-P) to ensure they remain sealed;
  - The Disassembly Basin cover to ensure that excessive deterioration has not occurred and no woody vegetation is growing on the cover;
  - The P-Area Ash Basin (188-P) cover to verify that significant erosion has not occurred (60 cm [2 ft] thickness maintained), to ensure that no woody vegetation is growing on the cover, and to confirm that no burrowing or mounding animals are present;
  - The PAOU to ensure that are no unauthorized excavations, digging, or construction activities have occurred within the LUC boundaries; and
  - Inspection and maintenance of access control warning signs.

The operation and maintenance (O&M) costs associated with the selected remedy for PAOU was estimated to have a present worth cost of $1,529,041. The actual O&M cost since FY2010 is $351,000, which is not significantly different that the estimated costs in the ROD. Table SS-3 shows the annual comparison of O&M actual and ROD estimated costs.

V. Progress Since Last Review

This is the first five-year review. Therefore, there is no previous protectiveness statement.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, References;
- Confirmed the implementation of the Remedial Actions;
- Reviewed SVE performance data and evaluated the effectiveness of the system;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment SS-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 effectiveness of the SVE systems at PSA 3A and 3B was evaluated in the *Performance Evaluation Report for the P-Area Operable Unit Potential Source Areas 3A and 3B Subunits* (SRNS 2013). Groundwater monitoring data collected per the PAOU EMP (SRNS 2010c) was evaluated to assess the effectiveness of the ISD portion of the remedy.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 25, 2012 at the PAOU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The PAOU was inspected by SRNS and DOE SR personnel on October 15, 2012. No issues were identified for the PAOU during this inspection and interviews.

On January 16, 2013, a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by DOE SR and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedies selected from the PAOU are functioning as expected as described below:

PSA 3A and 3B

The MicroBlower™ and passive BaroBall™ systems at PSA 3A and 3B have operated successfully and are recommended for completion. Based on the soil sampling results, vadose zone soil concentrations are below the RG (0.53 mg/L) for trichloroethylene (TCE) and tetrachloroethylene (PCE). The results of the sampling are documented in the *Performance Evaluation Report for the P-Area Operable Unit Potential Source Areas 3A and 3B Subunits* (SRNS 2013).

High Contamination Area (HCA) at the P-Area Cask Car Railroad Tracks

The removal action was completed and met the RAOs (SRNS 2012). 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 pCi/g, consolidating soil and ash into the P-Area Ash Basin, and installing of a 0.6-m (2-ft) thick soil cover over P-Area Ash Basin and Outfall P-007 to prevent exposure of the industrial worker to carcinogenic risk exceeding $1.0E\text{-}^{6}$. 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 $1.0x10^{-6}$. 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 2012a) prevent exposure to the industrial worker to carcinogenic risks exceeding $1.0x10^{-6}$, 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 SS-5). Because the time frame for groundwater impacts (if any) is over 1,000 years, groundwater sampling will occur every five years to support the remedy review analysis.

Based on the results of the sampling event from March 2012 (Table SS-4), only tritium (8 samples) and lead (1 sample) were detected. The concentration of lead (1.48 µg/L) is below the maximum contaminant limit (MCL) (15 µg/L), as listed in the EMP (SRNS 2010c). Only three of the eight tritium samples had concentrations exceeding the MCL (20 pCi/ml) with the maximum concentration being 66.5 pCi/ml. These results are consistent with prior results that indicate tritium is present in the groundwater in the vicinity of the 105-P.

The annual site inspection confirmed that the roof structure and the Disassembly Basin covers are functioning properly, the doors are sealed, the P-Area Ash Basin cover is in good condition, and the LUCs are preventing human health exposure (Attachment SS-1).

Overall Technical Assessment

The early remedial actions, removal actions, and final remedial action are meeting the RGOs 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 standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

With regard to the CCRT and P-007 subunits, more stringent 2012 PRGs/RSLs do 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 subunit. 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 impact SVE operations in PSA 3A and PSA 3B vadose zones. Finally, more stringent PRGs/RSLs would not impact the LUCs that are in place to prevent exposure to contaminated media at the PAOU.

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

The next five-year review is scheduled for no later than January 2019.

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

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, March 2013, 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 begin in 2012 (annually)

Various – Inspection Data Sheets - *Field Inspection Checklist for P-Area Operable Unit*, ER-IDS-019-066, Inspections begin in 2012 (annually)

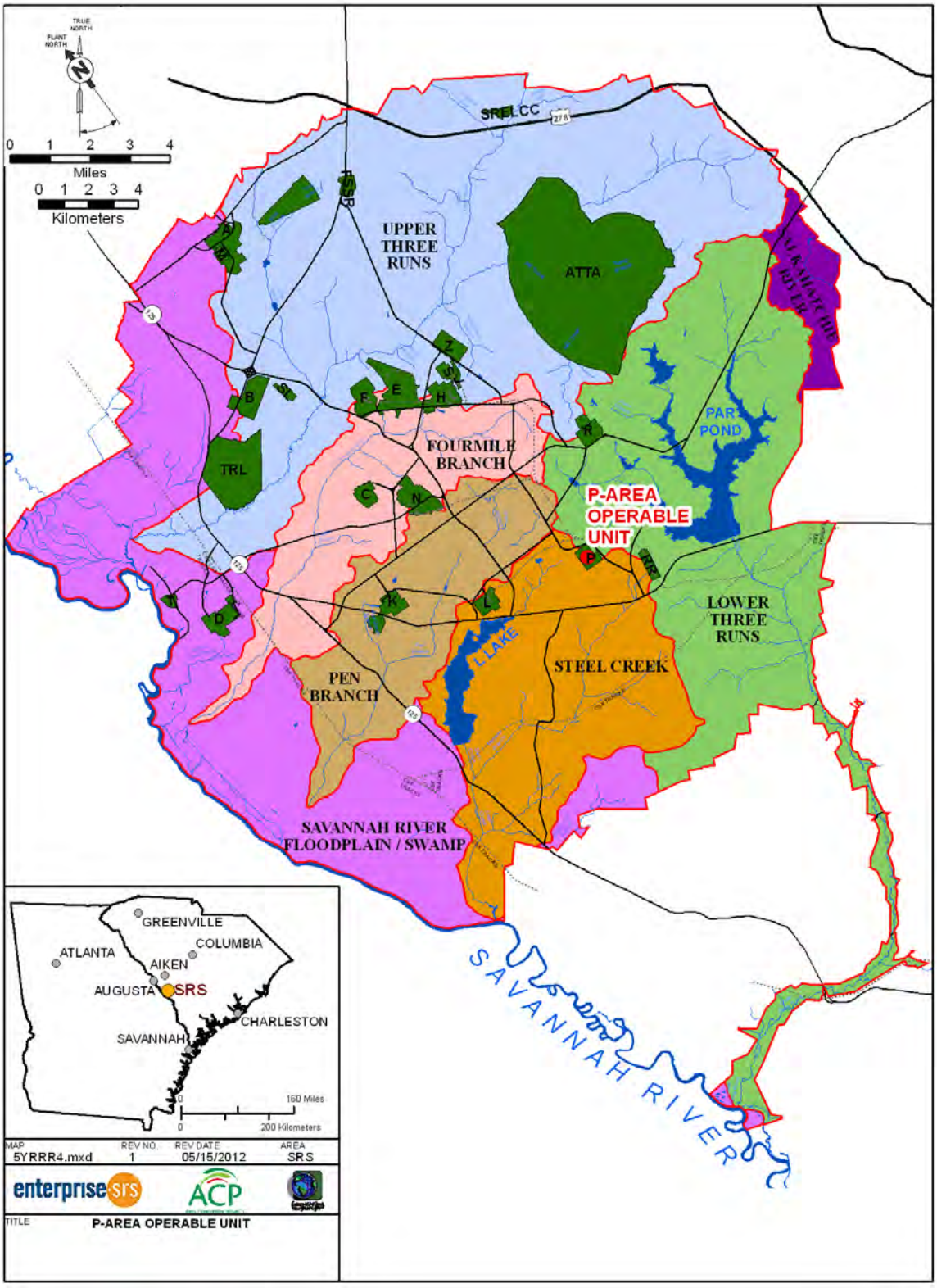


Figure SS-1. Location of PAOU at Savannah River Site



Figure SS-2. Photo of PAOU Before Remediation Activities (2000)



Figure SS-3. Current Photo of PAOU (2011)

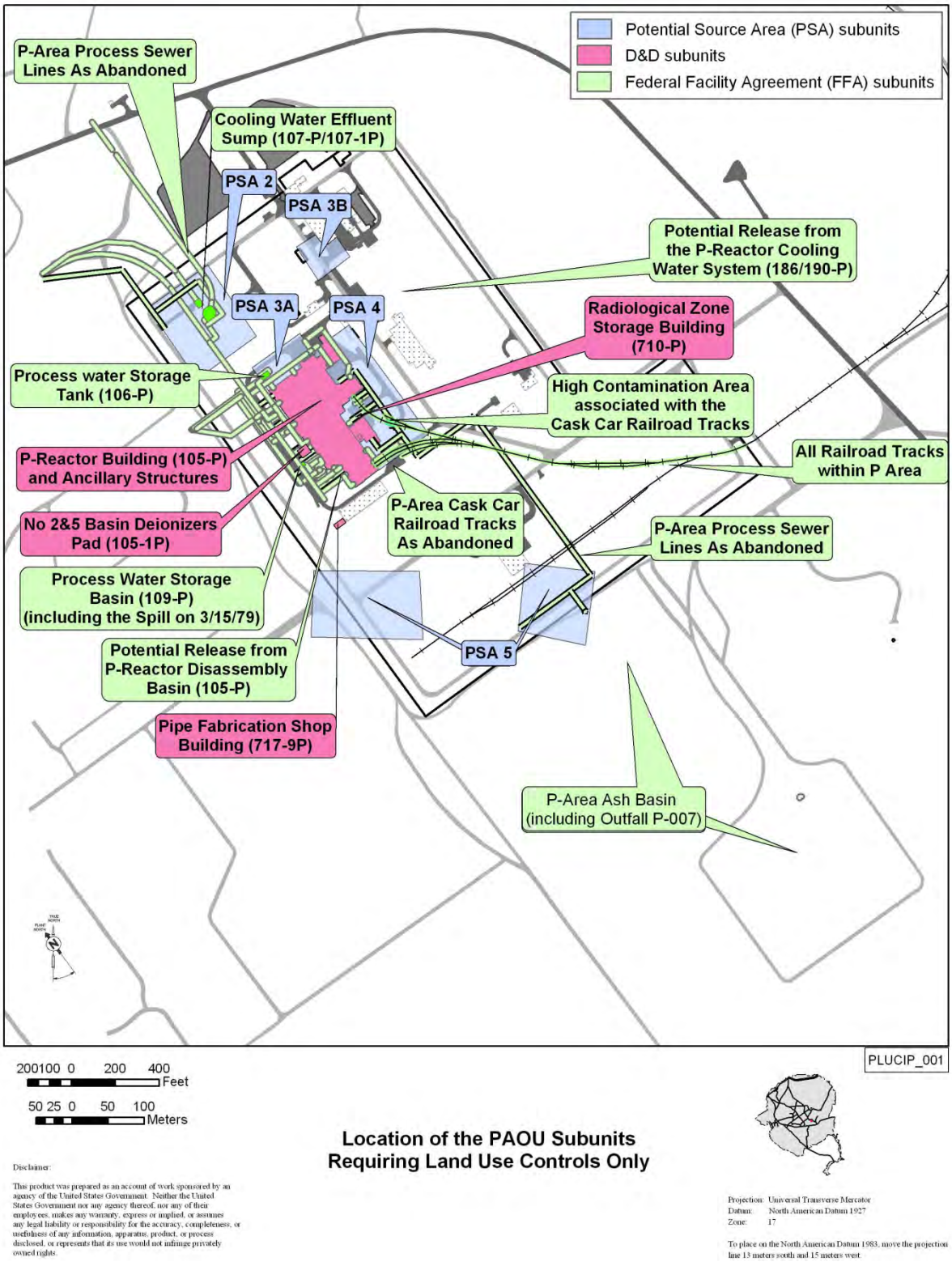
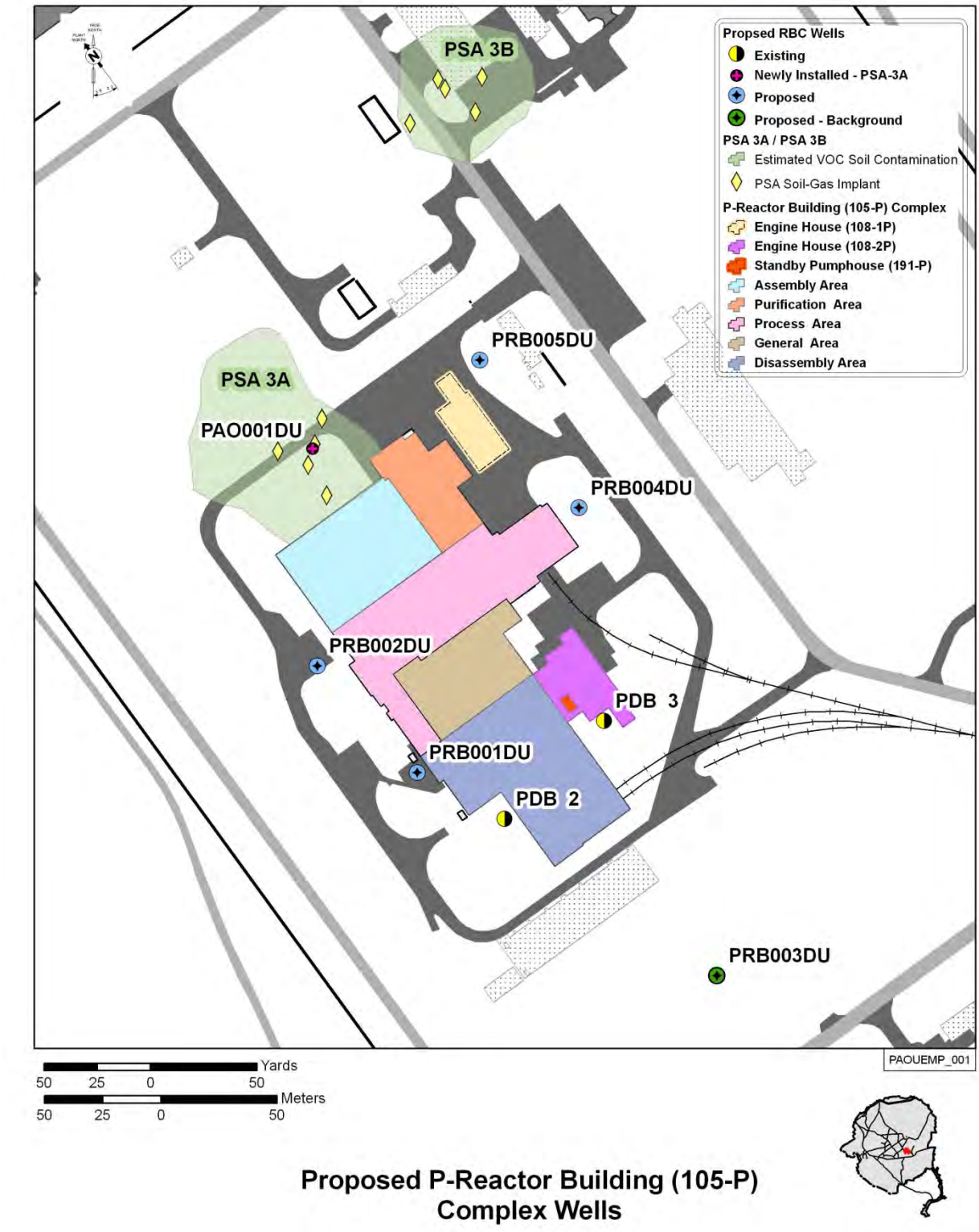


Figure SS-4. Location of PAOU Subunits



Proposed P-Reactor Building (105-P) Complex Wells

Figure SS-5. Location of Groundwater Wells Monitoring the P-Reactor Building (105-P)

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Table SS-1. Chronology of OU Events

Event	Date
Early Action Record of Decision (EAROD) Issuance	January 29, 2009
Explanation of Significant Difference (ESD) Issuance	October 27, 2009
Early Action Construction Start/Complete – PSAs, CCRT, PSLs, P-Area Ash Basin, P-Reactor Building (105-P)	November 24, 2009 / August 19, 2011
Early Action Operations Start / Complete – PSA	November 3, 2010 / May 15, 2013
Record of Decision (ROD) Issuance	July 22, 2010
Final Remedial Action Construction Start / Finish	November 29, 2010 / September 16, 2011
Previous Five-Year Reviews	None

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Table SS-2. PAOU RCOCs

Waste Unit	RCOC	Units	Type of RCOC				RG
			PTSM	HH	ECO	CM	
P-Area Ash Basin (including Outfall P-007) (ash/soil media)	Arsenic	mg/kg		X			8.20E+00
	Potassium-40	pCi/g		X			3.30E+00
	Cesium-137 (+D)	pCi/g	X	X			1.00E+00[1]
	Cobalt-60	pCi/g		X			5.96+E-02
	Radium-226 (+D)	pCi/g		X			1.20E+00
	Radium-228 (+D)	pCi/g		X			2.20E+00
	Thorium-228 (+D)	pCi/g		X			2.20E+00
	Uranium-238 (+D)	pCi/g		X			1.79E+00
PSA-3A - Area Near Northern End of Reactor Building (soil media)	Trichloroethylene	mg/kg				X	5.30E-01
PSA-3B - Area West of Administration/ Maintenance Slab (soil media)	Tetrachloroethylene	mg/kg				X	5.30E-01
High Contamination Area (HCA) Associated with the P-Area Reactor Cask Car Railroad Tracks as Abandoned (gravel/soil media)	Cesium-137 (+D)	pCi/g	X	X			1.00E+00
	Cobalt-60	pCi/g		X			5.96E-02
105-P Reactor Vessel (metal media)	Barium-133	pCi/g	X	X			3.06E-01
	Carbon-14	pCi/g		X		X	8.83E+03
	Cobalt-60	pCi/g	X	X			6.02E-02
	Europium-152	pCi/g	X	X			7.37E-02
	Europium-154	pCi/g		X			8.58E-02
	Iron-155	pCi/g		X			2.21E+05
	Molybdenum-93	pCi/g		X		X	8.47E+02
	Nickel-59	pCi/g		X		X	1.23E+05
	Nickel-63	pCi/g	X	X			5.55E+04
	Niobium-94	pCi/g		X			3.00E-02
	Potassium-40	pCi/g		X		X	2.74E-01
	Technetium-99	pCi/g				X	
Reactor Building (105-P) and Ancillary Structures (concrete media)	Aroclor 1254	pCi/g		X			7.44E+00
	Cesium-137 (+D)	pCi/g	X	X			1.13E-01
	Cobalt-60	pCi/g	X	X			6.02E-02
	Strontium-90 (+D)	pCi/g		X			1.43E+01
	Uranium-238 (+D)	pCi/g		X			1.90E+00

Table SS-2. Remedial Goal Options for the PAOU *(continued)*

Waste Unit	RCOC	Units	Type of RCOC				RG
			PTSM	HH	ECO	CM	
105-P Disassembly Basin[1] (sediment media)	Americium-241	pCi/g	X	X			5.71E+00
	Americium-243 (+D)	pCi/g	X	X			3.41E-01
	Antimony-125 (+D)	pCi/g	X	X			7.50E-01
	Carbon-14			X		X	1.23E+03
	Curium-243/244	pCi/g	X	X			6.74E-01
	Curium-245	pCi/g	X	X			8.70E-01
	Cobalt-60	pCi/g	X	X			5.96E-02
	Cesium-137 (+D)	pCi/g	X	X			1.12E-01
	Europium-152	pCi/g	X	X			7.31E-02
	Europium-154	pCi/g	X	X			8.50E-02
	Tritium	pCi/g	X	X			4.23E+00
	Potassium-40	pCi/g	X	X		X	2.71E-01
	Molybdenum-93					X	
	Sodium-22	pCi/g	X	X			1.40E-01
	Niobium-94	pCi/g	X	X			2.97E-02
	Nickel-59					X	
	Nickel-63			X		X	5.55E+03
	Plutonium-238	pCi/g	X	X			1.66E+01
	Plutonium -239/240	pCi/g	X	X			1.45E+01
	Radium-228 (+D)	pCi/g	X	X			1.49E-01
	Thorium-228 (+D)	pCi/g	X	X			2.52E-01
	Strontium-90 (+D)	pCi/g	X	X			1.07E+01
	Uranium	mg/kg	X	X			2.04E+02

1 - Only the major risk drivers (i.e., risk > 1E-03) for the Disassembly Basin are identified in this table, unless they are also considered CM COCs. Several other radiological constituents have a risk < 1E-03 but > 1E-06.

.

Table SS-3. O&M Costs – Actual versus Estimated

	FY07	FY08	FY09	FY10	FY11	5-Yr Total
Actual O&M Cost	N/A	N/A	N/A	46,000	305,000	351,000
ROD Estimated O&M Cost	N/A	2,000	2,000	322,000	241,000	567,000

Table SS-4. PAOU ISD Well Data

Well Name	Analyte	Result	Unit	Collection Date
PDB 2	Tritium	3.02E+01	pCi/mL	03/06/12
PDB 3	Lead	1.48E+00	µg/L	03/06/12
PDB 3	Tritium	8.33E+00	pCi/mL	03/06/12
PAO001DU	Tritium	2.14E+00	pCi/mL	03/06/12
PRB001DU	Tritium	2.50E+01	pCi/mL	03/06/12
PRB002DU	Tritium	6.65E+01	pCi/mL	03/06/12
PRB003DU	Tritium	1.27E+00	pCi/mL	03/07/12
PRB004DU	Tritium	1.62E+01	pCi/mL	03/07/12
PRB005DU	Tritium	1.02E+00	pCi/mL	03/07/12

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Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit

I. SITE INFORMATION			
Site Name:	**P-Area Operable Unit**	**Date of Inspection:**	**08/08/2012**
Location and Region	**SRS, USEPA Region 4**	**CERCLIS #:**	**#94**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**93°F and clear**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other ISD by grouting, SVE

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for P-Area Ash Basin and P-007 Outfall*, ER-IDS-019-061, and *Field Inspection Checklist for P-Area Operable Unit*, ER-IDS-019-066

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-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 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☒ Air Discharge Permit	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☒ Air	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-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
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area 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: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/15/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 SS-1. Five-Year Review Site Inspection Checklist – P-Area 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:_____

VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☒ Applicable ☐ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: Passive SVE systems are in service_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☒ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment SS-1. Five-Year Review Site Inspection Checklist – P-Area Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this site is ISD, SVE, Cover system, and land use controls to eliminate or control all routes of exposure to residual radioactive or chemical contamination. All systems appear to be functioning as expected.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining PAOU and the condition of its warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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P-AREA REACTOR SEEPAGE BASINS (904-61G, 904-62G, AND 904-63G) (PRSB) OPERABLE UNIT

I. Introduction

This is the second five-year remedy review for the P-Area Reactor Seepage Basins (904-61G, 904-62G, and 904-63G) (PRSB) Operable Unit (OU). This review was conducted from April 2012 through June 2012. Contaminants have been left in place at the PRSB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the PRSB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table TT-1 lists the chronology of site events for the PRSB OU.

III. Background

PRSB OU is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with this OU is soil.

Physical Characteristics

The PRSB OU is located in the central portion of Savannah River Site (SRS) west of P Area (Figure TT-1). The ground slopes southwestward toward Steel Creek, approximately 2,500 feet (ft) to SRS west. Figure TT-2 presents a plan view of the basins. Figures TT-3, TT-4, and TT-5 provide photographs of the OU in 2004-2005, 2010 and 2012, respectively. Three unlined (earthen) basins comprise the PRSB OU. Basin 1 (904-61G) is L-shaped and was constructed with approximate outside dimensions of 633.3 x 15 m (211 x 50 ft) in the north-south direction and 76.2 m (254 ft) in the east-west direction, at a depth of 3.9 to 5.1 m (13 to 17 ft) below ground surface (bgs). Basin 2 (904-62G) was constructed with approximate outside dimensions of 633.3 x 21 m

(211 x 70 ft) at a depth of 2.4 m (8 ft) bgs. Basin 3 (604-63G) was constructed with approximate outside dimensions of 102 x 21 m (340 x 70 ft) at a depth of 2.7 m (9 ft) bgs.

Two inactive process sewer lines (IPSLs) extend from the P-Reactor Disassembly Basin to the eastern end of Basin 1. Both IPSLs are 7.5 cm (3 in) in diameter, approximately 198 m (660 ft) in length, with one having been constructed of high-density polyethylene (HDPE) and the other constructed of carbon steel.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a) designates PRSB OU as being within the site industrial support area. The future land use for PRSB OU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The basins were constructed in 1957. From 1957 until 1970 and from 1978 until 1991, the IPSLs conveyed low-level radioactive purge water from the P-Reactor Disassembly Basin to the PRSBs. Historical records indicate that the original IPSL leaked in an area east of Basin 1, contaminating the soils in a 4.5 x 9 m (15 x 30 ft) area. A second line was installed as a replacement; however, the contaminated soils at the original leak site were not removed during this installation.

Cascade overflow pipes connect Basin 1 to Basin 2 and Basin 2 to Basin 3. The cascade overflow pipes are 30 cm (12 in) in diameter and are made of corrugated steel. Flow between the basins was via the cascade overflow pipes positioned near the top of the basin walls.

The PRSBs were used from 1957 to 1970 to dispose of low-level radioactive process purge water from the P-Reactor Disassembly Basin. In 1963, disassembly basin wastewater was deionized and filtered prior to discharge, which reduced radioactivity and removed solids and sludges. The seepage basins were not used from 1971 to 1977 and the disassembly basin purge water was mixed with large volumes of heat exchanger

cooling water and discharged to area streams. General maintenance was performed on the P-Reactor Disassembly Basin, and purge water discharges to the seepage basins resumed in 1978. The PRSBs did not receive wastewater after P-Reactor was shut down for repairs in 1991.

During the entire operation of the PRSBs, it is estimated that 70,000 curies (Ci) of tritium, 4.74 Ci of strontium-90, 19.5 Ci of cesium-137, and 0.835 Ci of other beta-gamma emitters were released to the PRSBs.

Initial Response

No initial response actions were taken at the PRSB OU prior to issuance of the Plug-in Record of Decision, which is described in Section IV.

Basis for Taking Action

The Plug-In ROD states that constituents of concern (COCs) will be established in the Technical Evaluation Report (TER) for each unit based primarily on principal threat source material (PTSM) criteria, and also considering the conceptual site model (CSM), and comparison against the human health and contaminant migration remedial goals (RGs) established in this ROD (WSRC 1999b). Review of the TER (WSRC 2003a) for the PRSB OU did not identify an explicit description of COCs. Cesium-137 was identified as the main contributor to the PTSM at all locations within the OU with PTSM. In addition, cobalt-60 was a contributor to the PTSM in basin 1. Two contaminants, arsenic and strontium-90, were identified as having the potential to leach from soils to the groundwater if no action were taken (WSRC 2003a). Upon placement of the low permeability soil cover, no residual contaminants are predicted to leach to groundwater from the PRSB OU.

The basis for taking action at the PRSB OU, as documented in the TER (WSRC 2003a) and summarized in the ESD (WSRC 2003b) for this OU, are:

- The seepage basin soils present a significant potential external exposure risk from radionuclides (cesium-137 and cobalt-60) to future industrial workers

- Strontium-90 and arsenic present in the basin soils could leach and impact the groundwater above maximum contaminant levels (MCLs).

Thus, cesium-137 and cobalt-60 are considered human health COCs, and strontium-90 and arsenic are considered contaminant migration COCs. PTSM was identified in the soils of Basins 1 and 2 to depths below the basin base of 5.7 m (19 ft) and 1.2 m (4 ft), respectively. PTSM is identified as media that poses a cancer risk to the future industrial worker equal to or greater than $1x10^{-3}$. Evaluation of Basin 3 identified no PTSM. Evaluation of the soil contamination area/underground radiological materials area (SCA/URMA) soils identified PTSM to depths below ground surface of 2.1 m (7 ft).The P-Area groundwater has been identified as a separate OU and is, therefore, considered outside the scope of the PRSB OU remedial action. It will be addressed as part of the P-Area Groundwater OU (WSRC 2003b)

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 in current industrial areas. In situ stabilization of radiologically contaminated soil that represents PTSM 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 January 19, 2000 (WSRC 1999) and issued for public notice on January 19, 2000. The process streamlined the normal CERCLA documentation process for units that were similar and met the criteria defined in the plug-in ROD. In lieu of Proposed Plan and ROD documents, an Explanation of Significant Difference (ESD) (WSRC 2003b) was issued in October 2003. The approved ESD is the document that amends the approved plug-in ROD to include the PRSB OU based on the results of the TER (WSRC 2003a).

Per the plug-in ROD (WSRC 1999b), the following remedial action objectives were established for PRSB OU Basins 1, 2 and 3 and are as follows:

- Prevent human exposure to highly contaminated basin soils (PTSM) by performing stabilization treatment to the extent practicable and filling the basins. Reduce risks to the future worker from surface soils (0 to 0.3 m [0 to 1 ft]) outside the basin by establishing remedial goals (RGs) for COCs at concentrations equivalent to 1×10^{-6} for carcinogens and a hazard quotient of 1 for noncarcinogens or background (where background levels of COCs exceed 1×10^{-6}).

- Prevent the release of COCs in soil to groundwater beneath the unit above MCLs or risk-based concentrations (when MCLs are not available).

- Protect the ecological receptors indigenous to the area by preventing or limiting contact with contaminated basin soils and pipelines, and preventing the plant and animals from bringing contaminants up towards the surface.

Because the PRSB OU met all plug-in ROD criteria, the remedy of in situ stabilization with a low permeability membrane cover system was the selected remedy for the PRSB OUs. The selected remedy consisted of five components:

- Consolidation of contaminated soil into Basins 1 and 2.

- Grouting and excavation of the IPSLs with placement in Basin 1.

- Solidification/Stabilization (S/S) of Basins 1 and 2. The S/S component of the remedy was not applicable to Basin 3 since PTSM level contamination was not detected in that basin.

- Installation of a low-permeability geosynthetic closure cover.

- Land use controls (LUCs) (institutional controls) to prevent disturbance of the cover system and excavation of PTSM.

As defined in the Plug-in ROD (WSRC 1999b), the primary LUC objectives necessary to ensure protectiveness include the following:

- Prevent contact, removal, or excavation of buried waste or pipelines; and
- Preclude residential or agricultural use of the area.

Remedy Implementation

Implementation of the selected remedy included the following:

- Consolidated 30.6 m^3 (40 yd^3) of contaminated soil by excavating the SCA/URMA area and any contaminated soils encountered during removal of the IPSLs, and transporting the excavated soils to Basins 1 and 2 for disposal and inclusion with the S/S treatment.
- Consolidated the IPSLs by grouting, excavating, and transporting to Basin 1 for disposal to stabilize any potential contamination left inside the process pipelines and to prevent access by small animals.
- Consolidated contaminated soil (842 m^3 [1,100 yd^3]) and debris (459 m^3 [600 yd^3]) from the L-Area Hot Shop into Basin 3.
- In situ S/S of 5661 m^3 (7,400 yd^3) of PTSM by grouting Basins 1 and 2. Basin 1 soils were grouted to a depth of 3 m (10 ft) at the eastern end of the basin, with the grout decreasing to 0.6 m (2 ft) at the southern leg of the basin. Operational difficulties made grouting beyond a depth of 3 m (10 ft) impracticable. The untreated PTSM, which extends to a depth of 5.7 m (19 ft), resides in a low permeability clay that retards contaminant mobility. The geosynthetic closure cover system and the S/S grouted soils above the untreated PTSM will prevent access and exposure to the untreated PTSM. Basin 2 soils were grouted to a depth of 1.2 m (4 ft) below the basin bottom.
- Installed a 0.93-hectare (2.3-acre) low-permeability geosynthetic closure cover over all three of the basins to prevent human exposure to the contaminated basin soils and to reduce water infiltration. The low permeability geosynthetic closure cover system has a lower permeability than the surrounding soils. To protect potential receptors,

the minimum cover thickness from the waste is at least 1.8 m (6 ft) as measured through the low permeability geosynthetic closure cover.

- Established LUCs for 1.23 hectares (3.13 acres) (WSRC 2006) to include the following:
  - SRS boundary security gates to prevent exposure to intruders;
  - Visible warning signs located at the most probable access points requiring contact of the custodian prior to entry to the OU;
  - Site controls and land use restrictions via the Site Use/Site Clearance Program to prevent excavation in the area of the pipeline or cover system and restrict invasive and permanent installation activities at the CRSB OU ; and
  - Evaluation of the need for deed notification/restrictions if the property is ever transferred to non-federal ownership.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing.

- Visual inspections for evidence of damage to the soil cover due to erosion or intrusion by burrowing animals are being performed semi-annually as a minimum. 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.

The operation and maintenance (O&M) costs associated with the selected remedy for PRSB OU for the soil cover, institutional controls and Five-Year Remedy Reviews has a ROD estimated present worth of $596,000, discounted at 3.9% per year for 30 years of maintenance activities. The actual annual O&M costs since it became operable in FY07

until FY11 is $38,500 (Table TT-2). The actual O&M costs are less than the estimate because erosion control and drainage ditch repair have not yet been needed.

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. There were no recommendations or follow-up actions from the last 5-year remedy 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;
- Reviewed groundwater sampling data to confirm that contaminant migration from the PRSB OU is mitigated by the implemented remedy;
- Inspected and photographed the PRSB OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment TT-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 (PCR) (WSRC 2006) documents that contaminated soils in the SCA/IRMA 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 semiannual 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.

No specific groundwater investigations were conducted within the larger P-Area Groundwater OU prior to 1998 though sampling of PRSB monitoring wells dates back to 1979. Characterization activities that were conducted between 1998 and 2003 indicated that the PRSB OU was one potential source of the tritium plume originating from within P Area and extending to the reaches of Steel Creek.

Table TT-3 provides a summary of groundwater data for those contaminants that were identified in the TER (WSRC 2003a) as having the most potential to result in human exposure or to reach concentrations above groundwater maximum contaminant levels if no remedy was implemented. The constituents presented in the table are those identified in the Basis for Taking Action section of this chapter and the contaminant identified in the *Source Term Determination for P-Area Reactor Groundwater Operable Unit* (WSRC 2004b) whose source was the PRSB. Data from wells immediately upgradient and downgradient in the uppermost aquifer zone were reviewed. The data are presented for the period prior to implementation of the remedy and the post-construction period. Two sampling events have occurred in the PSB wells since 2006 and were evaluated in this review. In addition, time trends of tritium activity in the wells adjacent to the PRSB OU indicate decreasing activity from the mid-1980s to present. Comparison of the time trends to the tritium half-life decay curve indicates that the source of the tritium may be depleted or being controlled as the decrease in activity is greater than if it were by decay alone. Decreasing contaminant concentrations and activity indicate that the S/S soil and cap are maintaining an acceptable level of protectiveness in terms of transport of contaminants from the basins soils to the groundwater due to infiltration of rainfall.

Due to the P-Area groundwater field start being scheduled for December 2013, limited groundwater data is available. One of the objectives of the upcoming groundwater characterization is to develop data trends following remedial activities for surface units contributing to groundwater contamination.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The PRSB OU was inspected by SRNS and USDOE personnel on August 8, 2012 and October 15, 2012. No issues were identified for the PRSB OU during this inspection and interviews.

On January 16, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding the PRSB OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, data, 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.

Land use controls, including institutional controls, as implemented and monitored via the semiannual 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 2004a). All LUC objectives are being met.

The above remedial activities are meeting the RGs established for the PRSB OU, as discussed in Section II, by eliminating or controlling all routes of exposure to human health and ecological receptors.

An opportunity for system optimization was identified during this review. Based on the lack of findings during the semiannual site inspections and the effectiveness of institutional controls in preventing human activity at this OU, it is recommended that the inspection frequency be reduced from semi-annual to annual.

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. COCs and RGs were not explicitly identified in the ESD (WSRC 2003a). 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.

More stringent 2012 PRGs/RSLs do not impact the protectiveness of the remedy because the in-situ solidification/stabilization of the contaminated media followed by installation of low permeability soil cover and implementation of ICs prevent exposure of human and ecological receptors to remaining soil contaminants left in place.

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 and used as a basis to back calculate soils.

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

Recommendations and follow-up actions concerning PRSB OU are listed in Table TT-4.

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

The next five-year review is scheduled for January 2019.

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. *Land Use Control Implementation Plan (LUCIP) for the P Area Operable Unit (PAOU) (U)*, SRNS-RP-2010-00619, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1999a. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, 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, 2004a. *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, 2004b. *Source Term Determination for P-Area Reactor Groundwater Operable Unit*, WSRC-TR-2003-00142, Rev. 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 2007 through 2011 (semiannually)

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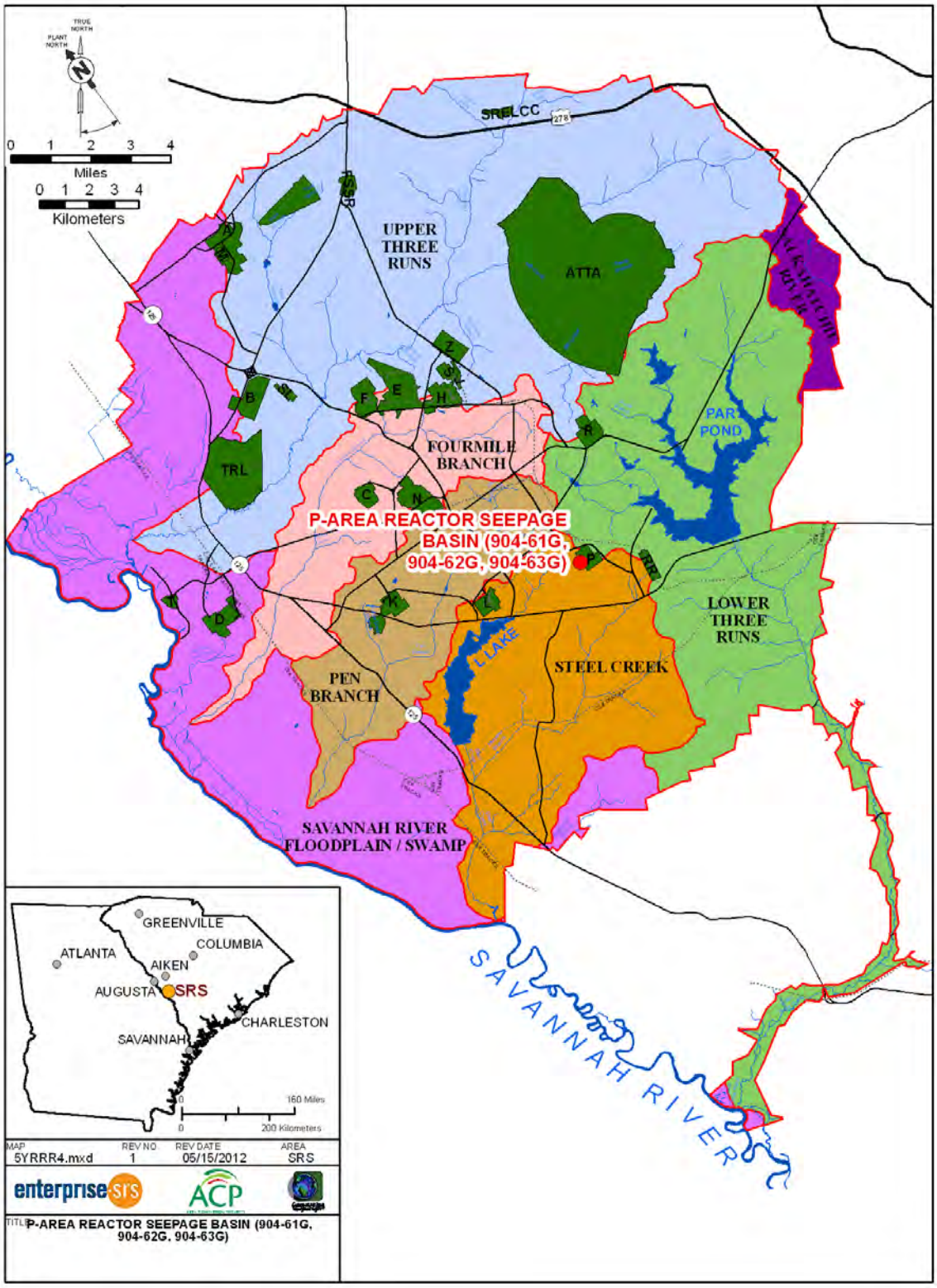


Figure TT-1. Location of P-Area Reactor Seepage Basins at SRS

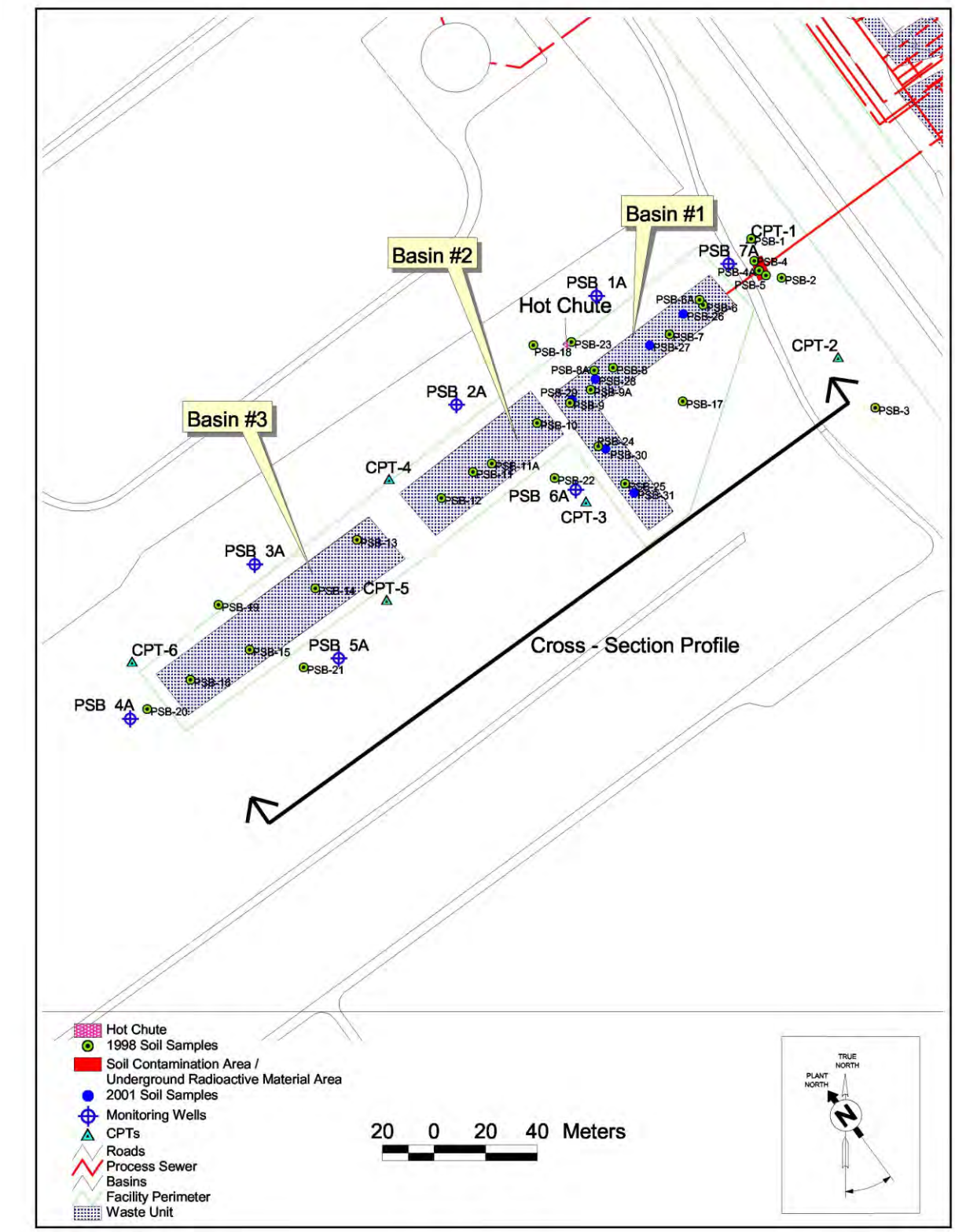


Figure TT-2. Plan View of P-Area Reactor Seepage Basins



Figure TT-3. Photographs from DOE Archives depicting the remediation of the P-Reactor Seepage Basins (February 2004 through May 2005)



Figure TT-4. 2010 Aerial of the P-Area Reactor Seepage Basins post-construction.



Figure TT-5. 2012 Photograph of the PRSB OU cover system. (P-Reactor in the background)

Table TT-1. Chronology of OU Events

Event	Date
Plug-in Record of Decision (ROD) Issuance	January 19, 2000
Explanation of Significant Difference (ESD) Issuance	October 3, 2003
Remedial Action Start/Complete	June 30, 2004 / November 15, 2005
Previous Five-Year Review	February 4, 2009

Table TT-2. O&M Costs – Actual versus Estimated

	FY07	FY08	FY09	FY10	FY11	5-Yr Total
Actual O&M Cost	9,100	10,500	6,100	7,100	5,700	38,500
ROD Estimated O&M Cost	23,450	23,450	23,450	23,450	23,450	117,250

Table TT-3. Review of groundwater data from "PSB" Monitoring Wells Upgradient and Immediately Downgradient to the PRSBs

Contaminants	MCL (µg/L or pCi/L)	Maximum Results (µg/L or pCi/L) Pre-Construction of Remedy (before November 2005) [# of sampling events]	Maximum Results (µg/L or pCi/L) Post-Construction of Remedy (2006-2011) [# of sampling events]
Arsenic[a]	10	2 †[18]	ND [2]
Strontium-90[a]	8*	19 [11]	2.25 [1]
Tritium	20,000*	365,646,000 [48]	18,400,000 [2]
Cesium-137[b]	200*	64.6 [7]	ND [2]
Cobalt-60[b]	100*	ND [37]	ND [5]

* The MCLs for these contaminants are based on the average concentration that is equivalent to 4 mrem/yr MCL for beta particles and photon emitters, assuming each contaminant is the only beta emitter present; thus, a conservative number.

† The one detection of arsenic occurred in 1987.

[a] Arsenic and strontium-90 were identified as having the potential to leach from soils to the groundwater if no action were taken (WSRC 2003a).

[b] Cesium-137 and cobalt-60 were identified as contributing to PTSM (WSRC 2003a).

Table TT-4. Recommendations and Follow-up Actions

Issues	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Optimization of inspection	Request change to the inspection frequency from semi-annual to annual via USDOE letter to the USEPA and SCDHEC within 45 days of final regulatory approval of the Fourth Five Year Remedy Review Report.	USDOE	USEPA/ SCDHEC	9/30/2014	N	N

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Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU

I. SITE INFORMATION			
Site Name:	**P-Area Reactor Seepage Basins OU**	**Date of Inspection:**	**08/08/2012**
Location and Region	**SRS, USEPA Region 4**	**CERCLIS OU #:**	**#66**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**92°F and clear**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other In Situ Stabilization, consolidation, grouting

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for P-Area Reactor Seepage Basin,* ER-IDS-019-035._____

_____

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Field Walkdown

Frequency: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/15/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks: Vegetation is mowed routinely.

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A
Remarks:

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident
Areal extent Depth
Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent
☐ Ponding ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent
Remarks:

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay
Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay
Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay
Remarks:

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☒ N/A
Remarks:_____

2. Outlet Rock Inspected: ☒ Functioning ☐ N/A
Remarks: Where visible the outlet rock was inspected and appears to be functioning._____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment TT-1. Five-Year Review Site Inspection Checklist – P-Area Reactor Seepage Basins OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedy for this OU consists of institutional controls, consolidation, in situ stabilization treatment, grouting and a geosynthetic cover system. In situ stabilization with a low permeability closure system is the final action for the source term for the PRSB operable unit. The remedy is functioning as designed because in situ stabilization is treating the PTSM and a soil cover with institutional controls is providing access controls.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of semi-annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining PRSB OU and the condition of its warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Optimization opportunities are provided in Table TT-4 of the OU specific report.

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R-AREA BINGHAM PUMP OUTAGE PITS (643-8G, -9G, -10G) AND R-AREA UNKNOWN PITS #1, #2, #3 (RUNK-1, -2, -3) OPERABLE UNIT

I. Introduction

This report is the second five-year review for the R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants and waste have been left in place at the RBPOP and RUNK OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the RBPOP and RUNK OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table UU-1 lists the chronology of site events for the RBPOP and RUNK OU.

III. Background

RBPOP and RUNK OU is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the RBPOP and RUNK OU is buried debris and associated contaminated soil. The U.S. Department of Energy (USDOE), U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) agreed in the Record of Decision (ROD) for the RBPOP and RUNK that groundwater at the OU will be evaluated separately in association with the R-Area Groundwater OU.

Physical Characteristics

The RBPOP and RUNK OU is located on the northeast side of R Area (Figure UU-1). The OU consists of six pits including three known pits referred to as the RBPOPs (643-8G, 643-9G, and 643-10G) and three pits with unknown or incomplete histories identified as the RUNKs (RUNK-1, RUNK-2, and RUNK-3) (Figure UU-2). The pits

were formed by excavating trenches to an average depth of 3.9 m (13 ft), disposing of 2.7 m (9 ft) of debris, and then returning the unit to grade by covering the debris with 1.2 m (4 ft) of backfill. Pits 643-8G and 643-9G are approximately 75 m (250 ft) long, 4.8 m (16 ft) and 6 m (20 ft) wide, respectively, and up to 3.9 m (13 ft) deep. Pit 643-10G is approximately 156.6 m (522 ft) long, 5.7 m (19 ft) wide, and 4.2 m (14 ft) deep. RUNK-1 and RUNK-3 are approximately 31.5 m (105 ft) and 40.5 m (135 ft) long, respectively, 7.5 m (25 ft) wide, and up to 2.4 m (8 ft) deep. RUNK-2 is approximately 133.5 m (445 ft) long, 9 m (30 ft) wide, and up to 3.6 m (12 ft) deep. The sum of the areas for each pit is 0.37 hectares (0.9 acres); the area of a polygon around all the pits, including the areas between the pits, is 0.71 hectares (1.75 acres). The combined volume of the six pits is 10,710 m^3 (14,000 yd^3) (WSRC 2002).

Historical aerial photographs indicate RUNK-2 predates the RBPOPs. RUNK-2 was in existence as early as 1953 and closed in 1956. The RBPOPs were constructed during 1957 and 1958 when major modifications were made to primary and secondary SRS reactor cooling water systems. The outages of the cooling water systems that occurred as a result of these modifications became known as Bingham Pump Outages (WSRC 2002).

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) indicates the RBPOP and RUNK OU is within the area identified for the R-Area OU (RAOU), which is currently under land use controls (LUCs) that prohibit residential land use (SRNS 2011). According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for the RBPOP and RUNK OU is reasonably anticipated to remain industrial with the USDOE maintaining control of the land.

History of Contamination

The RBPOPs were burial pits that received waste debris generated by major modifications to primary and secondary reactor cooling systems in 1957 and 1958. The waste consisted of miscellaneous construction materials such as pipes, cables, ladders,

concrete, and miscellaneous hardware. Wastes were segregated based on levels of radioactivity. Lower activity waste was buried in the RBPOPs and higher activity waste was sent to the SRS Burial Ground Complex in E Area.

RUNK-2 received construction debris based upon a magnetic survey, ground penetrating radar (GPR) surveys, and soil sampling in the pit. No debris has been identified in RUNK-1 and RUNK-3. It is possible that no debris was ever placed in these two RUNKs. A historical photograph indicates that liquid wastes were also introduced into RUNK-2, but no containerized liquids were discovered during characterization.

Initial Response

After the pit was filled to capacity in 1958, the debris was covered by 1.2-m (4-ft) of backfill as shown in Figure UU-3 (WSRC 2003). The cover material was placed at a time preceding the preparation of the formal CERCLA documentation and investigation.

Investigations began at this OU in 1987 with a radiological survey of vegetation, followed in 1991 (radiological screening of surface soils), 1992 (soil gas survey), 1993 (GPR survey to delineate vertical boundaries of the pits) and 1995 (magnetic survey to identify magnetic debris) (WSRC 2001). Characterization of RBPOPs and RUNKs was performed starting in 1996 through a series of sampling events.

Basis for Taking Action

The unit investigation confirmed that miscellaneous debris remains buried in the unit. Soil contaminants, identified as refined constituents of concern (RCOCs) for the residential receptor, include polycyclic aromatic hydrocarbon (PAHs) (benzo[b]-fluoranthene, indeno[1,2,3-c,d]pyrene, dibenzo[a,h]anthracene, benzo[a]pyrene, and benzo[a]anthracene) and radionuclides (cobalt-60 and cesium-137). These contaminants are primarily in the RBPOPs and RUNK-2. Benzo[a]pyrene, dibenzo[a,h]anthracene, cobalt-60, and cesium-137 were RCOCs for the future industrial worker.

Table UU-2 presents the soil RCOCs and remedial goals (RGs) for the future industrial worker based on a risk of $1x10^{-6}$.

The RCOCs pose a carcinogenic risk of $5.24x10^{-6}$ for the future industrial worker. The amount of unit-related contamination in the perimeter soils, if any, was minimal and not readily discernible from ambient background levels. There is no RCRA listed or characteristic wastes at the unit. The combined volume of the six pits, from land surface to the base of the pits, is 10,710 m^3 (14,000 yd^3)(WSRC 2002). There is no principal threat source material (PTSM) (highly mobile or highly toxic source materials that require treatment) at the RBPOP and RUNK OU; the waste is categorized as a low-level threat.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 2002), the remedial action objectives (RAOs) for the RBPOP and RUNK OU is as follows:

- Prevent exposure of future industrial workers to benzo[a]pyrene, dibenzo[a,h]anthracene, cesium-137, and cobalt-60 at concentrations that exceed RGs.

As stated in the ROD, the selected remedial actions for the RBPOPs and RUNKs OU are as follows:

- Institutional controls (i.e., LUCs) consisting of site maintenance and access controls.

Remedy Implementation

The implementation of the selected remedy included the following:

- Establishing a maintenance program to protect the 0.71-hectare (1.75-acre) native soil cover over the pits; and

- Establishing LUCs for 1.24 hectares (3.05 acres) including: 1) posting warning signs at appropriate locations in sufficient numbers to be seen from any approach; 2) requiring a SRS Site Use and Site Clearance Permit for any proposed use of land

within the OU area, which is applicable to all activities and personnel on site; 3) maintaining the site access controls (24-hour surveillance system, artificial and natural barriers, control entry systems, and warning signs) in place at the SRS boundary to comply with the security requirements for a RCRA-permitted facility; and 4) in the long-term, if the property ever is transferred to non-federal ownership, the US Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site (WSRC 2003).

Systems Operations/Operation and Maintenance

There are no system operation requirements.

The following maintenance activities are ongoing as long as the waste remains a threat to human health or environment:

- Visual inspections are being performed annually for evidence of damage to the native soil cover due to erosion or intrusion by burrowing animals. The inspection also addresses upkeep of the vegetative cover and the warning signs.

- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.

- Institutional controls (i.e., LUCs) are being enforced to preclude unauthorized access or intrusive activities through the SRS Site/Use Site Clearance program and SRS site security (WSRC 2003).

Costs associated with the selected remedy for RBPOP and RUNK OU includes operation and maintenance (O&M) costs of the site maintenance and institutional controls. The ROD estimated O&M cost associated with the selected remedy is $147,500. This is a present worth cost based on a 3.9% interest rate, including 65 years of maintenance activities. The total actual O&M cost from project support and other post-construction

expense to fiscal year 2011 is $147,226. The actual O&M costs over the last five years (Table UU-3) are as expected. The unusually high O&M costs prior to FY07 were due to initial clearing and grubbing around the perimeter of the OU and not due to a failure in the native soil cover. These costs are not expected to recur.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedial actions at RBPOP and RUNK OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The final remedial actions were not evaluated in the previous five-year review because the ROD had just been issued. The final remedial actions of institutional controls have now been implemented and have been functioning properly.

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed documents listed in Section XII, Documents Reviewed;
- Confirmed the remedial action remains in place;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist provided in Attachment UU-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The RBPOP OU was inspected by SRNS and USDOE personnel on June 27,

2012 and October 15, 2012. No issues were identified for the RBPOP OU during this inspection and interviews.

On January 23, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. During the inspection several sinkholes were identified. They have been backfilled, graded, seeded, and covered with straw (SRNS 2013). No other findings were identified.

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 native soil cover maintenance (i.e., repair of erosion damage, mowing, and warning signs) and LUCs is effective in preventing exposure of the future industrial workers to soil contaminants. LUCs for the RBPOP and RUNK OU include the following: warning signs; the requirement for a SRS Site Use and Site Clearance Permit for any proposed use of land within the OU area, which is applicable to all activities and personnel on site; site access controls (24-hour surveillance system, artificial and natural barriers, control entry systems, and warning signs) in place at the SRS boundary to comply with the security requirements for a RCRA-permitted facility; and deed notifications disclosing former waste management and disposal activities as well as remedial actions taken on the site if the property ever is transferred to non-federal ownership. The annual site inspection and maintenance data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk indicating the integrity of the native soil cover is intact. The main findings from a review of the annual site inspections for the period 2007 through 2011 were vegetation on various portions of the OU or access roads needing trimming/cutting.

- There have been no changes in the physical conditions of the RBPOP OU that would affect the protectiveness of the remedy.

The Land Use Control Implementation Plan for the RBPOP and RUNK OU is included as Appendix B of the Final Remediation Report and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2003). All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

Has any Other Information come to Light that could call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy at the RBPOP and RUNK OU from being protective.

IX. Recommendations and Follow-up Actions

There are no recommendations or follow-up actions for this RBPOP and RUNK OU.

X. Protectiveness Statement(s)

The remedy at RBPOP and RUNK OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by LUCs to prevent exposure to or ingestion of contaminated soil. All threats to remaining contaminated soil 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 RBPOP and RUNK 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

The next five-year review is scheduled for no later than January 2019.

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

SRNS, 2011. *Land Use Control Implementation Plan (LUCIP) for the R Area Operable Unit (RAOU) (U)*, SRNS-RP-2010-01208, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Savannah River Site's Responses to the U.S. Environmental Protection Agency's Comments during the Five-Year Remedy Review Report (SRNS-RP-2012-00011) Regulatory Inspections (January 15-16, 2013, January 22-23, 2013, and January 29-30, 2013)*, ERD-EN-2013-0016, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2000. *Remedial Investigation Report with Baseline Risk Assessment for the R-Area Bingham Pump Outage Pits and the R-Area Unknowns (U),* WSRC-RP-98-4106, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001. *Proposed Plan for the R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) and R-Area Unknown Pits #1, #2, #3 (RUNK-1, -2, -3) (U)*, WSRC-RP-2001-4128, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Record of Decision Remedial Alternative Selection for the R-Area Bingham Pump Outage Pits (643-8G, -9G, -10G) and R-Area Unknown Pits #1, #2, #3 (RUNK-1, -2, -3) (U)*, WSRC-RP-2001-4129, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Final Remediation Report (FRR) for the R-Area Bingham Pump Outage Pits (643-8G, -9G, -10G) and R-Area Unknown Pits #1, #2, #3 (RUNK 1, -2, -3) (U),* WSRC-RP-2003-4061, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various - *Field Inspection Checklist: R-Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits 1, 2, & 3) (U)*, ER-IDS-019-026, Inspection Period 2007 through 2011 (annually)

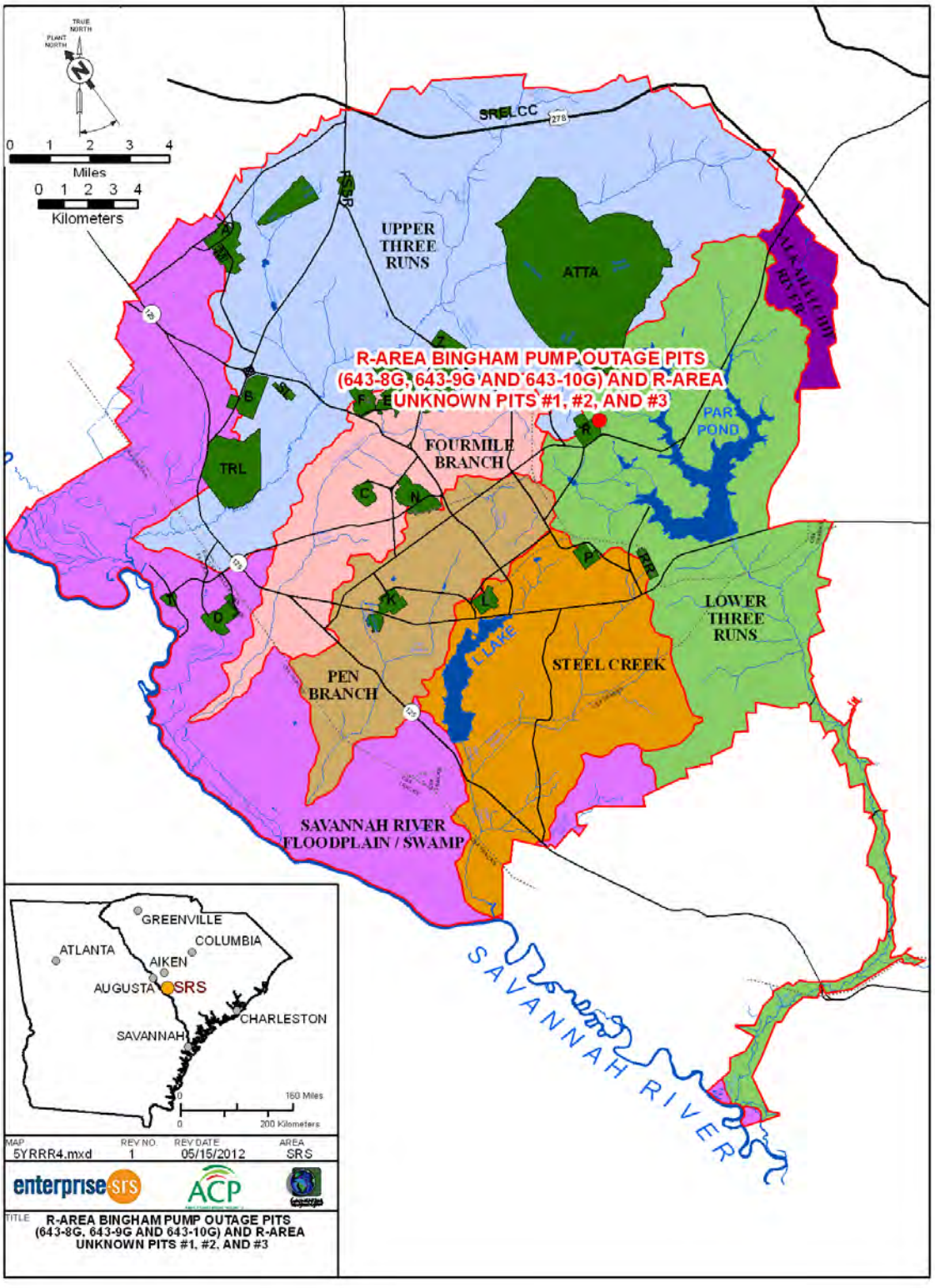


Figure UU-1. Location of the RBPOP and RUNK Operable Unit at SRS

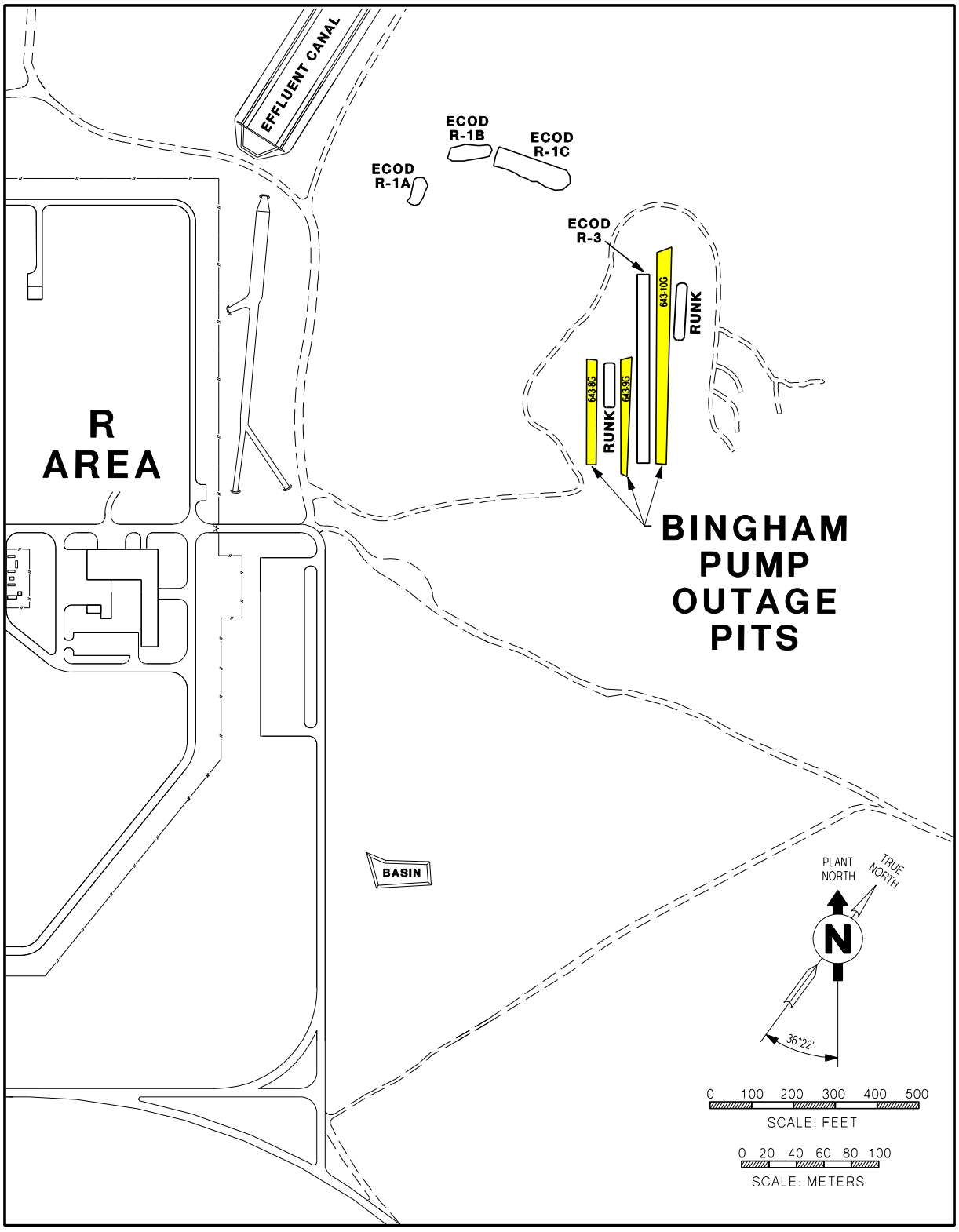


Figure UU-2. Site Layout for RBPOP and RUNK Operable Unit



All six pits of the OU are located in the center of the open grassy area behind the signs. The pits were backfilled to grade in the late 1950s and are not evident at the surface.

Figure UU-3. Ground Level Photograph of the RBPOP and RUNK OU





Figure UU-4. Current Photos of the RBPOP and RUNK OU

Table UU-1. Chronology of OU Events

Event	Date
RI Investigation Start / Complete	June 26, 1996 / February 28, 2001
Record of Decision (ROD) Issuance	April 23, 2003
Remedial Action Start / Complete	April 16, 2003 / August 25, 2003
Previous Five-Year Review	February 4, 2009

Table UU-2. RCOCs and RGs for Industrial Worker

RCOC	Medium	Maximum Concentrations	RGs
Benzo[a]pyrene	Soil	17000 µg/kg	256 µg/kg
Dibenzo[a,h]anthracene	Soil	4520 µg/kg	256 µg/kg
Cesium-137	Soil	537 ρCi/g	0.112 ρCi/g
Cobalt-60	Soil	3.61 ρCi/g	0.0224 ρCi/g

Table UU-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	6,500	7,300	3,700	3,600	3,000	24,100
Total ROD Estimated Direct O&M Costs	18,500	3,500	3,500	3,500	3,500	32,500

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Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU

I. Site Information			
Site Name:	**R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU**	**Date of Inspection:**	**06/27/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #38**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**73°F and clear**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. Interviews *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

II. Interviews *(Click all that apply)(Continued)*

3. **Local Regulatory Authorities and Response Agencies** (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. **Other Interviews** *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. Onsite Documents & Records Verified *(Click all that apply)*

1. O&M Documents:

☒ O&M Manual	☒ Readily Available	☒ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for RBPOP and RUNK OU*, ER-IDS-019-026.

_____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

III. Onsite Documents & Records Verified *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

IV. O&M Costs

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. Access and Institutional Controls ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

V. Access and Institutional Controls *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Field Walkdown

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/15/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

VI. General Site Conditions
A. Roads ☒ Applicable ☐ N/A
1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:
B. Other Site Conditions
Remarks: Survey monuments located and in good condition.
VII. Cover Systems ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent _____ Depth _____ Remarks:
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks:
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent _____ Depth _____ Remarks:
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent _____ Depth _____ Remarks:
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent _____ Depth _____ Remarks:

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

VII. Cover Systems *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☐ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☐ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay Remarks:_____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

VII. Cover Systems *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

VII. Cover Systems *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

VII. Cover Systems *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☐ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☐ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

VII. Cover Systems *(Continued)*
2. Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A
1. Siltation: ☐ Location shown on site map ☐ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☐ N/A Remarks:_____
VIII. Vertical barrier Walls ☐ Applicable ☒ N/A
1. Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

IX. Groundwater/Surface Water Remedies	☐ Applicable	☒ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. Other Remedies

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment UU-1. Five-Year Review Site Inspection Checklist – R-Area Bingham Pump Outage Pits (643-8G, 643-9G, 643-10G) (RBPOP) and R-Area Unknown Pits #1, #2, #3 (RUNK) OU *(continued)*

XI. Overall Observations
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedial action for this unit is institutional controls. The institutional controls are in place and being implemented to provide access control and prevent exposures as intended by the decision documents.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. As part of the institutional controls, warning signs were posted indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls are being used to maintain this site for industrial use only. In the long term, the elements of the institutional controls will comprise deed notifications, access controls, and further groundwater assessment as necessary.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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R-AREA BURNING/RUBBLE PITS (131-R/131-1R) AND RUBBLE PILE (632-25G) (RBRP/RRP) OPERABLE UNIT

I. Introduction

This is the second five-year review for the R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (631-25G) (RBRP/RRP) Operable Unit (OU). This review was conducted from August 2012 through September 2012. Contaminants have been left in place at the RBRP/RRP OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the RBRP/RRP OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table VV-1 lists the chronology of site events for the RBRP/RRP OU.

III. Background

The RBRP/RRP OU is a Resource Conservation Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS).

The OU includes five subunits: RBRP (Pit 131-R [Closed Pit] and Pit 131-1R [Open Pit]), the pit perimeter soils, RRP (631-25G), and soil beneath the pile, wetland, and groundwater in the vicinity.

Physical Characteristics

The RBRP/RRP OU is located at SRS, approximately 7.3 km (4.5 mi) from the nearest SRS boundary (Figure VV-1). Figure VV-2 depicts the site layout of the RBRP/RRP OU. Figures VV-3, VV-4, and VV-5 provide pictures of the three pits/piles before remedial actions. Figures VV-6 and VV-7 provide the most recent aerial photos of these basins (2010).

RBRP is located 335 m (1,100 ft) southeast of R-Reactor Area. RBRP is comprised of two parallel burial trenches, each approximately 69 m x 9 m (230 ft x 30 ft). The closed pit (131-R) was backfilled with soil to grade. When operational, this pit was 3.9 m (13 ft) deep. The open pit (131-1R) remained open until 2005. When operational, the open pit was 3 m (10 ft) deep, but waste disposal and subsequent erosion of the side slopes into the pit brought the current floor of the pit to 2.4 m (8 ft) below ground surface (bgs). The combined area of both pits was 1,282 m^2 (13,800 ft^2).

The RRP is an area of approximately 0.3 hectares (0.7 acres) where miscellaneous debris was placed on the ground, forming one contiguous pile generally 0.6 to 0.9 m (2 to 3 ft) deep. RRP is located 701 m (2,300 ft) southeast of R-Reactor Area.

A delineated wetland borders RRP on the east. The total area of the wetland is approximately 5.3 hectares (13 acres).

Groundwater flow is southeast towards Pond 4. The water table aquifer is believed to discharge to Pond 4, approximately 792 m (2,600 ft) southeast of the unit.

Land and Resource Use

The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the RBRP/RRP OU as being near an industrial area. According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for the RBRP/RRP OU is reasonably anticipated to be industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

Few historical records of specific activities at RBRP are known to exist; however, the general operational history of burning/rubble pits at SRS is known. Burning/rubble pits at SRS were used from 1951 to 1973 for periodic burning of combustible wastes such as wood, cardboard, paper, plastics, rubber, rags, oils, and organic liquids of unknown use or origin. Burning in open pits at SRS was discontinued in 1973; after that time, the pits that were still active continued to receive inert debris such as scrap metal and

construction materials. Disposal in burning/rubble pits at SRS ended by 1983. Because R Area ceased operation in May 1964, disposal activities at RBRP probably ceased before 1964 or shortly thereafter. A historical document search indicates that RBRP was active in 1959 and suggests that low-level radiological waste was inadvertently placed in the pit. Concrete monuments, typical of those used to mark radiological waste burial sites, are installed at both ends of the closed pit 131-R. However, no radiological contamination has been found at RBRP.

Disposal practices at the RRP likely consisted of dumping truckloads of debris on the land surface. An abandoned road constructed prior to SRS operations passes through the southwestern corner of RRP. The road was paved, and residual asphalt is visible. RRP was in the process of being cleaned up under the SRS general maintenance housekeeping program in January 1991 when workers discovered protective boot covers similar to those used in radioactive work among the debris. The work was halted, and a radiation survey was performed on February 3, 1991. No detectable contamination was found, indicating the boot covers were disposed of as clean waste. The pile consisted of a mixture of debris and soil. Debris identified in the pile included miscellaneous construction materials, friable asbestos material, stainless steel shavings, empty 55 gallon drums, approximately fifteen 25 gallon containers, railroad ties, building insulation, floor and ceiling tiles, lawn wastes, light bulbs, coiled metal, and small amounts of coal and ash. Friable asbestos was present in a large portion of the unit, which had been barricaded to prevent unprotected personnel from entering the area. The disposal dates are unknown, but because R Area was shut down in May 1964, disposal activities probably ceased before 1964 or shortly thereafter.

The wetland is addressed as a subunit of the RBPR/RRP OU based on its proximity to the rubble pile. The wetland was dry during pre-work plan characterization in 2000. However, it became saturated during the spring of 2003 and is now occasionally wet. No drainage pathways such as ditches have been identified that would transport contamination from RRP to the wetland.

Initial Response

There were no prior removals or remedial actions for this OU.

Basis for Taking Action

The *RCRA Facility Investigation/Remedial Investigation (RFI/RI) with Baseline Risk Assessment (BRA)* (WSRC 2003a) concluded that only the RBRP and RRP subunits have refined constituents of concern (RCOCs) and need remedial action. No RCOCs and thus no problems warranting action were identified for the perimeter pit soils, groundwater, or wetland.

Characterization of the burning/rubble pits indicated that contaminated soil was confined to the pits. Highest concentrations of contaminants were located at the bottom of the open pit (131-1R) and at the original base of the closed pit (3.9 m [13 ft] bgs). COCs were metals (cadmium, copper, lead, manganese, thallium, and zinc), tetrachloroethylene (PCE), and dioxins/furans.

Characterization of the rubble pile indicated that contamination was confined to the rubble pile and one foot of soil beneath the rubble pile. COCs were metals (cadmium, lead, copper, barium, and zinc) and asbestos.

The following problems warranting action at the RBRP subunit are identified as:

- Cadmium, copper, lead, manganese, thallium, and tetrachloroethene may leach to groundwater above the maximum contaminant level (MCL) or preliminary remediation goal (PRG) (manganese and copper) in less than 1,000 years and have been identified as contaminant migration refined constituents of concern (CM RCOCs) in the pits.
- Dioxins/furnace in the surface soil exceed a risk of 1E-06 for the future industrial worker (risk = 4.2E-05) and are identified as Human Health (HH) RCOCs.
- Lead, zinc, and dioxins/furans exceeded the hazard quotient (HQ) of 1 for the insectivorous birds and mammals, and are identified as ecological RCOCs in the Open Pit (131-1R).

The following problems warranting action at the RRP subunit are identified as:

- Cadmium, copper, and lead may leach to groundwater above the MCL (or PRG – copper) in less than 1,000 years and have been identified as CM RCOCs in the pile.
- Friable asbestos has been observed in the pile and has been identified as a HH RCOC.
- Ecological RCOCs in the pile (barium, cadmium, copper, lead, and zinc) exceeded the HQ of 1 for the soil-dwelling organisms, herbivorous mammals, and insectivorous birds and mammals.

Table VV-2 presents a summary of the COCs and RGs for the RBRP and RRP (WSRC 2004).

IV. Remedial Actions

Remedy Selection

Per the Record of Decision (ROD) (WSRC 2004), the following remedial action objectives (RAOs) have been established for the RBRP and are as follows:

- Prevent contaminants from leaching to groundwater above maximum contaminant levels/preliminary remediation goals (MCLs/PRGs);
- Prevent future industrial worker and residential exposure to soil contaminants;
- Prevent ecological receptors from exposure to soil contaminants; and
- Prevent residential exposure to soil contaminants.

Per the ROD, the RAOs for RRP are as follows:

- Prevent constituents from leaching to groundwater above MCLs/PRGs;
- Prevent ecological receptors from exposure to pile and soil contaminants; and
- Prevent future industrial worker exposure to lead and friable asbestos; and to prevent residential exposure to soil contaminants.

Per the ROD, the selected remedy for the RBRP/RRP is:

- Consolidation of RCRA non-hazardous rubble pile material into/over the open rubble pit subunit;
- Low permeability cover over the combination (pits and non-hazardous pile material);
- Offsite disposal of any RCRA hazardous pile materials; and
- Institutional controls for 131-R/131-1R.

Remedy Implementation

Implementation of the selected remedy included the following:

- Removing soils and debris to achieve residential remedial goals (RGs) at the RRP. Removing 191 m^3 (250 yd^3) of contaminated RRP soil by excavating all soils that exceeded the industrial RG levels from the rubble pile material (including 0.3 m [1 ft] beneath the rubble pile). Performing confirmatory sampling to verify the absence of contamination at RRP;
- Segregating excavated material from the RRP based on regulatory requirements. The non-hazardous soil was placed with chipped vegetation into the open R-Area Burning Rubble Pits subunit. Approximately 66 m^3 (220 yd^3) of hazardous soil was shipped offsite to Chemical Waste Management, Inc. in Emelle, AL. Approximately 23 m^3 (30 ft^3) of CERCLA non-hazardous waste (non-friable flooring tile) was shipped to Three Rivers Landfill. Seven lighting ballasts were shipped to the Clean Harbors Environmental distribution facility in Reidsville, North Carolina;
- Backfilling, grading, and seeding excavated areas with rubble pile material.
- Installing a low permeability cover system, consisting of a grading/structural fill layer, a geosynthetic clay layer, a geocomposite drainage layer and a vegetative layer, over RBRP covering 0.13 hectares (0.32 acres);
- Posted warning signs; and
- Established land use controls for 0.18 hectares (0.44 acres) to ensure no construction on, excavation of, or breaching of the low-permeability cover. These controls consist of (1) requiring that a Site Use and Site Clearance Permit for any proposed use of

land within the OU area, which is applicable to all activities and personnel on site; (2) maintaining the site access controls (24-hour surveillance system, artificial and natural barriers, control entry systems, and warnings signs) in place at the SRS boundary to comply with the security requirements for a RCRA-permitted facility; and (3) in the long-term, if the property is ever transferred to non-federal ownership, the US Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site.

System Operations/Operation and Maintenance

There are no systems operating at the RBRP/RRP OU.

The following operations and maintenance (O&M) activities are ongoing:

- Institutional controls (i.e., land use controls[LUCs]) consist of long-term site maintenance (repair of erosion damage and maintenance of warning signs) and site controls and use restrictions to prevent construction on, excavation of, or breaching of the low-permeability cover, and to prevent unrestricted land use.
- Continued groundwater monitoring. No remedial action is warranted for groundwater for the RBRP/RRP OU. However, groundwater monitoring data is collected to evaluate RBRP cap performance (WSRC 2007) in immobilizing the buried RCRA non-hazardous waste.

The estimated O&M costs associated with the selected remedy for RBRP/RRP OU include O&M costs of the soil cover and institutional controls has a present worth of $101,084, discounted at 3.9% per year for 30 years of maintenance activities. The actual O&M cost since the remedial action was completed in FY06 until FY11 is $45,000. The actual O&M costs (Table VV-3) are higher than expected because groundwater monitoring and well maintenance was not included in the ROD estimate.

V. Progress Since Last Review

The previous protectiveness statement from the last five-year review concluded that because the remedial actions at RBRP/RRP 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. This remedy is also protective because of the permanent removal of RCRA hazardous waste from RRP. Exposure pathways that could result in unacceptable risks are controlled by the low permeability cover system and 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;
- Reviewed existing groundwater data and annual inspection reports of the OU as part of the evaluation of the effectiveness of the RBRP cover system;
- Inspected the OU, photographed the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment VV-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls;
- Reviewed changes in standards and to-be-considered guidance.

Data Review

A review of the groundwater data was conducted. Table VV-4 provides a summary of groundwater data for the contaminant migration COCs for the period prior to implementation of the remedy and the post-construction period of the remedy. The post-construction period mirrors the period of this five-year review. None of the COCs exceeded MCLs. In addition, the data indicate decreasing groundwater concentrations. This indicates that the cover system is protective, decreasing the potential for

contaminant transport to groundwater. Review of depth to groundwater data indicates there continues to be at least a 3 m (10 ft) distance between the bottom of the RBRP (location of waste) and the water table. Thus, the cap is maintaining an acceptable level of protectiveness in terms of the groundwater.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The RBRP/RRP OU was inspected by SRNS and USDOE personnel on May 24, 2012 and October 15, 2012. No issues were identified for the RBRP/RRP OU during this inspection and interviews.

On January 23, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding the RBRP/RRP OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended 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 in providing protection to ecological receptors, industrial workers, and future residents. The recurring finding was active ant mounds that were treated immediately.

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.

An opportunity for optimization exists in regards to the frequency of sampling the wells associated with this OU. Concentrations of metals are low and consistent with natural background. Additionally, PCE has never been detected in wells RRP 3 or RRP 4. Transport time for contaminants is very long due to the presence of the low-permeability cover. Therefore, the frequency of groundwater sampling can be relaxed without diminishing the overall protectiveness of the monitoring program.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

With regard to the RRP, more stringent 2012 PRGs/RSLs do not impact the protectiveness of the remedy because excavation of contaminated soil and debris 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 RBRB subunit prevents exposure of human and ecological receptors to contaminants left in place. In addition, more stringent PRGs/RSLs would not impact the LUCs that are in place to prevent exposure to contaminated media at the RBRP/RRP OU.

Fact sheets provided on the US EPA webpage regarding emerging contaminants were reviewed for applicability to this site. None of the listed emerging contaminants were identified as applicable to this OU.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues for this OU.

IX. Recommendations and Follow-up Actions

A meeting was held on September 18, 2012 between USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) to discuss opportunities for groundwater optimization, including at RBRP/RRP. The frequency of groundwater sampling was discussed. The three parties agreed in principal to a reduced frequency of sampling (from annual to every five years) and that the change would be documented through a letter from USDOE. This reduced monitoring frequency would also coincide well with the reporting frequency of the five-year remedy reviews.

Recommendations and follow-up actions concerning RBRP/RRP OU are listed in Table VV-5.

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 RRBP, 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

The next five-year review is scheduled for January 2019.

XII. Documents Reviewed

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, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2001. *RCRA Facility Investigation/Remedial Investigation Work Plan for the R-Area Burning/Rubble Pits (131-R and 131-1R) and Rubble Pile (631-25G) (U)*, WSRC-RP-2000-4046, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003a. *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, 2003b. *Statement of Basis/Proposed Plan for the R-Area Burning/Rubble Pits (131-R and 131-1R) and Rubble Pile (631-25G) Operable Unit (U)*, WSRC-RP-2003-4117, Revision 1.1, 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 2007 through 2011 (annually)

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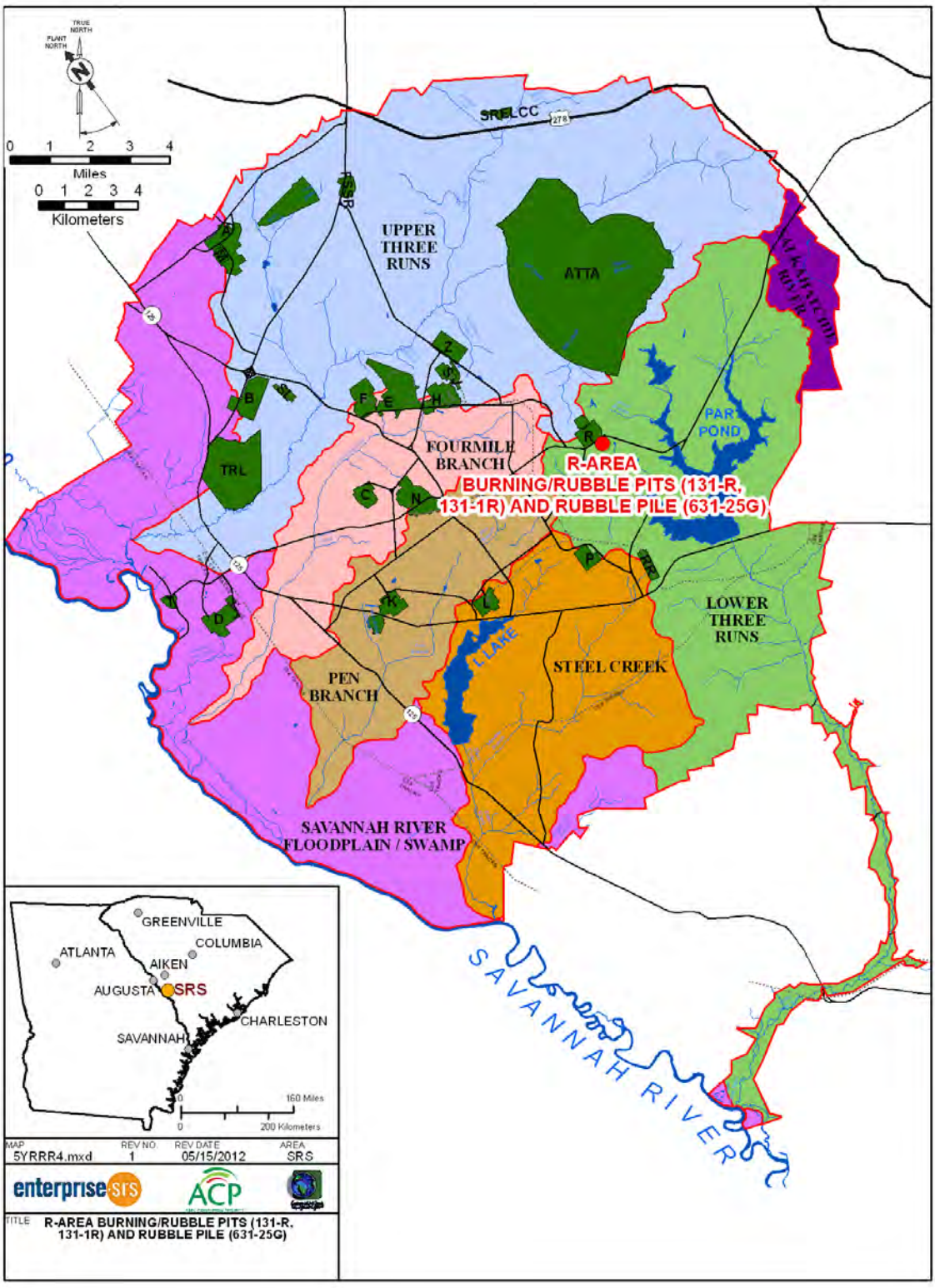


Figure VV-1. Location of the RBRP/RRP OU at SRS

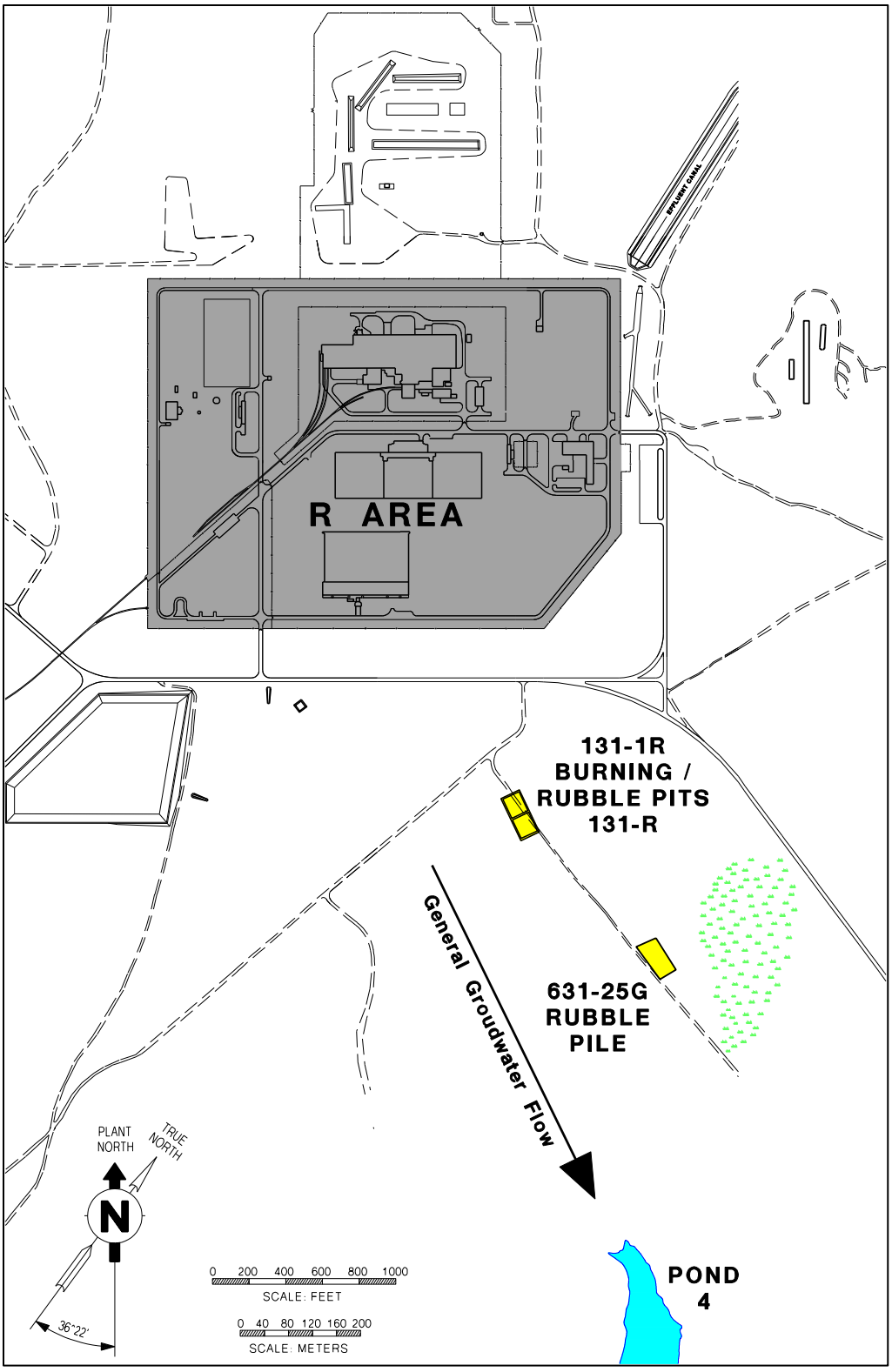


Figure VV-2. Layout of the RBRP/RRP OU at SRS



Figure VV-3. Photograph of RBRP, Closed Pit, 131-R prior to remedy construction.



Figure VV-4. Photograph of RBRP, Open Pit, 131-1R prior to remedy construction.



Figure VV-5. Photograph of RRP, 631-25G prior to remedy construction.



Figure VV-6. 2010 Aerial photo of RBRP, 131-1R and 131-R, with cover in place. Inset is a surface level photo of 131-1R and 131-R as of 2012.



Figure VV-7. 2010 Aerial photo of RRP, 631-25G, post closure.

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Table VV-1. Chronology of OU Events

Event	Date
RFI/RI Field Start/Complete	1999/July 2, 2003
Record of Decision (ROD) Issuance	September 13, 2004
Remedial Action (RA) Start/Complete	September 22, 2005 / January 25, 2006
Previous 5-Year Review	February 4, 2009

Table VV-2. Summary of Remedial Goals for RBRP/RRP OU Soils

Sub-unit	RCOC	CM RGO (mg/kg)	HH Industrial RGO (mg/kg)	ECO RGO (mg/kg)	2X Avg. Background (mg/kg)	RG (mg/kg)
RBRP	Cadmium	6.70E-01			1.59E+00	1.59E+00
	Copper	1.82E+02			9.10E+00	1.82E+02
	Lead	2.17E+01		2.65E+01	1.10E+01	2.17E+01
	Manganese	2.35E+02			2.88E+01	2.35E+02
	Thallium	5.35E-01				5.35E-01
	Zinc			5.49E+01	1.24E+01	5.49E+01
	Tetrachloroethylene	1.50E-02				1.50E-02
	1,2,3,4,6,7,8-Heptachlorodibenzo – p- dioxin			3.22E-04		3.22E-04
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin			3.22E-05		3.22E-05
	2,3,7,8-Tetrachlorodibenzo-p-furan			1.31E-06		1.31E-06
	Heptachlorodibenzo-p-dioxin isomers		1.67E-03	3.22E-04		3.22E-04
	Hexachlorodibenzo-p-dioxin isomers			3.22E-05		3.22E-05
	Octachlorodibenzo-p-dioxin		1.67E-02	3.22E-03		3.22E-03
	Pentachlorodibenzo-p-dioxin isomers		3.35E-05			3.35E-05
	Pentachlorodibenzo-p-furan isomers		3.35E-05	3.67E-05		3.35E-05
	Tetrachlorodibenzo-p-dioxin isomers		1.67E-05	3.22E-06		3.35E-05
	Tetrachlorodibenzo-p-furan isomers		1.67E-04	1.31E-06		1.31E-06
RRP	Barium			2.35E+02	2.78E+01	2.35E+02
	Cadmium	6.70E-01		1.38E+00	1.59E+00	1.59E+00
	Copper	1.82E+02		5.00E+01	9.10E+00	5.00E+01
	Lead	2.17E+01		2.65E+01	1.10E+01	2.17E+01
	Zinc			5.49E+01	1.24E+01	5.49E+01

Table VV-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	14,000	9,400	5,900	6,000	5,700	41,000
Total ROD Estimated Direct O&M Costs	18,000	3,000	3,000	3,000	3,000	30,000

Table VV-4. Review of Groundwater Data from Monitoring Wells RRP3 and RRP4

COC	MCL (µg/L)*	Maximum Results (µg/L) Pre-remedy (prior to 2006) [# samples]	Maximum Results (µg/L) Post-remedy (2006-2011) [# samples]
Cadmium	5	ND [17]	ND [5]
Copper	1300	67.9 [14]	9.08 [5]
Lead	15	26 [28]	4.15 [5]
Manganese	50#	682 [20]	11.1 [5]
Tetrachloroethylene (PCE)	5	ND [18]	ND [5]
Thallium	2	ND [6]	0.12 [5]

* MCL values are based on US EPA values available February 2012.
# Manganese has no MCL. The value used is the secondary standard published by US EPA in November 2011.

Table VV-5. RBRP/RRP OU Groundwater Recommendations and Follow-up Actions

Issue	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Optimization of sampling to correlate with rate of change of contaminant concentrations	Reduce sampling for full suite in selected wells from semiannual to every 5 years.	USDOE	SCDHEC	1/2019	N	N

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Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU

I. SITE INFORMATION			
Site Name:	**R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU**	**Date of Inspection:**	**05/24/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #43**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**80°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Excavation/Consolidation

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for R-Area Burning Rubble Pits and Rubble Pile OU, ER-IDS-019-036*

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Field Walkdown

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/15/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☒ 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.

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay Remarks:_____
4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay Remarks:_____

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☒ Applicable ☐ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

VII. COVER SYSTEMS *(Continued)*
2. Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A
1. Siltation: ☐ Location shown on site map ☐ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☐ N/A Remarks:_____
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
1. Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☐ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

Remarks:

E. Monitored Natural Attenuation ☐ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment VV-1. Five-Year Review Site Inspection Checklist – R-Area Burning/Rubble Pits (131-R/131-1R) and Rubble Pile (632-25G) (RBRP/RRP) OU *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The selected remedy consists of excavation and offsite disposal of RCRA hazardous waste material and consolidation of RCRA non-hazardous waste under a low-permeability cover system. The remedy is effective and functioning as designed, as indicated by post construction well sampling data.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining R-Area Burning/Rubble Pits and Rubble Pile Operable Unit (OU) and the condition of its warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Optimization opportunities are documented in Table VV-4 of this OU specific report.

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R-AREA OPERABLE UNIT

I. Introduction

This report is the first five-year review for the R-Area Operable Unit (RAOU). The review was conducted from August 2012 through October 2012. Contaminants have been left in place at RAOU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at RAOU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table WW-1 lists the chronology of site events for the RAOU.

III. Background

The RAOU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media of concern is surface soil, rail bed materials, metal components, concrete, sediment, and groundwater.

An area-based remedial strategy has been implemented in R Area, excluding prior remedial decisions for the following Operable Units (OUs) as presented in their respective Record of Decisions (RODs) documents:

- R-Area Reactor Seepage Basins,(904-57G, -58G, -59G, -60G, -103G, and -104G) and 108-4R Overflow Basin, (108-4R);
- R-Area Acid/Caustic Basin(904-77G);
- R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G), R-Area Unknown Pit #1 (RUNK-1), Pit #2 (RUNK-2), and Pit #3 (RUNK-3), (No Building Number [NBN]); and

- R-Area Burning/Rubble Pits (131-R and -1R) and R-Area Rubble Pile (631-25G).

RAOU remedial actions are addressed by the Early Action Record of Decision (ROD) for the C-, K-, L-, and R-Reactor Complexes (SRNS 2009b) and the ROD for the RAOU (SRNS 2010a). Removal actions were completed for the following units within R-Area and the actions described in Decommissioning Project Final Reports (DPFRs) and Engineering Evaluation/Cost Analysis (EE/CA) Reports:

- R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (SRNS 2009c);
- Grouting of the R-Reactor Disassembly Basin at the Savannah River Site (USDOE 2002);
- R-Reactor Building (105-R) Complex (SRNS 2009d);
- P-Area Ash Basin (Including Outfall P-007) (188-P) and the R-Area Ash Basin (188-R) (SRNS 2010e);
- R-Area Operable Unit (RAOU) R-Area Process Sewer Line (RPSL) Combined Subunit (SRNS 2010f); and
- 151-1R, Primary Substation (High Volt 115/13.8KV) (SRNS 2010g).

Physical Characteristics

The RAOU is located in east-central SRS approximately 5.0 km (3.1 mi) east of the geographical center of SRS and about 7.0 km (4.3 mi) west of the nearest site boundary (Figure WW-1). RAOU is approximately 70.8 hectare (175 acre) and is located primarily in the Lower Three Runs watershed. The northwestern portion of the RAOU lies within the Upper Three Runs Watershed. Figures WW-2 and WW-3 show before (1999) remediation and after (2011) remedial activities photos of R Area. The RAOU has a flat to gently rolling topography, and is approximately 88.4 m (290 ft) above mean sea level (msl).

The RAOU is comprised of the following subunits and PSAs (Figure WW-4):

- R-Reactor Building (105-R) Complex (RBC):

- R-Reactor Building (105-R) including the Engine Houses (108-1R and 108-2R);
  - R-Reactor Vessel;
  - R-Reactor Disassembly Basin; and
  - R-Reactor Emergency Basin;
- Area on the North Side of Building 105-R, Laydown Area North of 105-R, Release from the Decontamination of R-Area Reactor Disassembly Basin (NBN); Combined Spills North of Building 105-R (NBN); and
- Potential Release from the R-Area Disassembly Basin (105-R);

- R-Area Process Sewer Line (PSL) Combined Subunit:
  - R-Area PSLs as Abandoned (NBN);
  - Process Water Storage Tank (106-R) PSA;
  - Cooling Water Effluent Sump (107-R);and
  - Purge Water Storage Basin (109-R);
- R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN);
- R-Area Ash Basin (188-R);
- R-Area Groundwater (NBN);
- R-Area Isolated Contamination Area (NBN);
- Process Storage Building (122-R);
- Potential Release of $NaOH/H_2SO_4$ from 183-2R;
- Power House (184-R) PSA;
- Cooling Tower (185-R) PSA;
- Former Coal Pile (NBN) PSA;
- Administrative and Maintenance Building (704-R) PSA;

- Maintenance Material Storage Building (711-R) PSA; and
- Eastern Volatile Organic Compound (VOC)/Tritium Groundwater plume PSA.

Within the RAOU area are the following Deactivation and Decommissioning (D&D) No Further Action (NFA) Facilities and Site Evaluation NFA Area:

- Primary Substation (151-lR);
- Primary Substation (151-2R);
- Cooling Water Clarification Plant (183-1R);
- Filter and Softener Plant (183-2R);
- Cooling Water Reservoir (186-R);
- Cooling Water Pump House (190-R); and
- Potential Release from R-Area Concrete Lakes (183-1R/186-R)

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates much of RAOU as being within the site industrial support area. The land use control boundaries for RAOU that encompass the groundwater plume are predominantly outside of the industrial area for R Area. However, shallow groundwater and surface water at SRS are not used for drinking water, hygiene, recreation, and process water. The future land use for RAOU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

In December 1953, R-Reactor began operations, and was placed in shutdown status in 1964 due to decreased demand for nuclear materials. The primary sources of radioactive contamination in R Area are activation products, fission products, and tritium, the majority of which were the consequence of R-Reactor operations. Spills, leaks,

accidental releases, or simply the operation itself resulted in releases of hazardous and/or radioactive substances. Tritium and volatile organic compounds (VOC) released from reactor operations have created four contaminated groundwater plumes in R Area (Figure WW-4). A Northern Tritium Plume originates at the R-Reactor Seepage Basins, travels to the northwest, and discharges to surface water at Mill Creek. An Eastern Tritium Plume originates outside of the Purification Area of R-Reactor (105-R), travels to the northeast, and discharges to surface water at Joyce Branch. A Western Tritium Plume originates at the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN) at the western end of R-Reactor (105-R), migrates to the south, but decays to below detection concentrations prior to discharging to a surface water body. An Eastern VOC Plume originates outside the Assembly Area of R-Reactor (105-R), travels to the northeast, and discharges to surface water at Joyce Branch.

Initial Response

R-Reactor Building (105-R) and all other facilities within R Area have been decommissioned and/or are remnants that require no further action. The Early Action ROD for the C-, K-, L-, and R-Reactor Complexes (SRNS 2009b) documents the selected remedy for the R-Reactor Building (105-R) Complex as in situ decommissioning (ISD) with land use controls (LUCs). Regulatory decisions were made previous to the RAOU ROD at selected RAOU subunits. Non-Time Critical (NTC) removal actions are documented in five Engineering Evaluations/Cost Analyses (EE/CAs) and include the following subunits and actions:

- R-Reactor Building (105-R) Complex (including the R-Reactor Building [105-R], the Engine Houses [108-lR and 108-2R], the R-Reactor Vessel, the R-Reactor Disassembly Basin, the R-Reactor Emergency Basin, the Area on the North Side of Building 105-R, Laydown Area North of 105-R, Release from the Decontamination of R-Area Reactor Disassembly Basin [NBN], Combined Spills North of Building 105-R (NBN), and the Potential Release from the R-Area Disassembly Basin [105-R]) – in situ decommissioning (SRNS 2010d);
- R-Reactor Disassembly Basin – evaporation and grouting (USDOE 2002);

- R-Area PSL Combined Subunit (including the R-Area PSLs as Abandoned [NBN], Process Water Storage Tank [106-R], Purge Water Storage Basin [109-R], Cooling Water Effluent Sump [107-R] Subunit, Septic Tank [607-lR], outfalls, manholes, miscellaneous weirs and boxes; sumps, etc.) – grouting access points and open structures (SRNS 2010f);

- R-Area Reactor Area Cask Car Railroad Tracks as Abandoned Subunit – excavation and disposal (SRNS 2010c); and

- R-Area Ash Basin (188-R) Subunit – soil cover (SRNS 2010e).

Basis for Taking Action

The nature and extent of contamination in soil, sediment, surface water, and groundwater at the RAOU were characterized. Results from the past characterization activities (SRNS 2009a) and recent monitoring have demonstrated that residual contaminants exceed the RBC ISD remedial goals (RGs) at specific subunits. In addition, there are three tritium plumes and one VOC plume, which comprise the RAGW Subunit, that exceed the maximum contaminant levels (MCLs) (Table WW-2). The shallow groundwater aquifers impacted by tritium and VOCs in R Area have never been used as drinking water, however until tritium and VOCs are reduced below MCLs, the potential for human exposure requires action. ISD of the R-Reactor Building (105-R) Building left radionuclides, lead, and polychlorinated biphenyls (PCBs) in place at levels that present a potential for future contaminant migration to groundwater (SRNS 2009a). Therefore, monitoring of the RBC ISD is required to ensure groundwater is not impacted by the remedy. Table WW-3 summarizes the RCOCs and RGs determined for the RAOU subunits. RAOU subunits with contaminant levels that exceed 1.0E-06 risk for an industrial worker scenario required the following removal actions, LUCs, and monitoring to be protective of human health and the environment:

- The removal action for the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned Subunit (soil removal to 10 ρCi/g cesium-137) has been completed (SRNS 2010c). Additionally, this subunit will be managed with the land use controls (LUCs) selected for the entire RAOU to prevent unrestricted use.

- The removal action for the R-Reactor Disassembly Basin has been completed and radioactive contaminants have been grouted in place (SRNS 2011c). Additionally, this subunit will be managed with the LUCs selected for the entire RAOU to prevent unrestricted use.

- The removal action for the R-Reactor Building (105-R) Building Complex has been completed and radioactive contaminants have been grouted in place (SRNS 2011d). Additionally, this subunit will be managed with the LUCs selected for the entire RAOU to prevent unrestricted use.

- The removal action for the R-Area PSLs has been completed and radioactive contaminants have been left in place (SRNS 2011b). The subunit requires LUCs selected for the entire RAOU to prevent unrestricted use.

- A contaminant migration analysis was performed to identify refined contaminant migration COCs (SRNS 2009h).

- A principle threat source material (PTSM) evaluation for the RAOU subunits determined refined COCs for the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned, R-Area PSLs, and R-Reactor Building (105-R) Complex subunits. The radioactive inventory located in the R-Reactor Building (105-R) has been estimated to be $6.39x10^{4}$ Ci (SRNS 2009h), and the cumulative risk for the RBC was estimated at $5.61x10^{1}$ (SRNS 2009a).

IV. Remedial Actions

Remedy Selection

As stated in the ROD, the Remedial Action Objectives (RAOs) for the RAOU are as follows:

- Eliminate or control all routes of exposure to residual radioactive or chemical contamination posing risks exceeding $1x10^{-6}$ to the industrial worker or the resident in media or structures associated with the R-Reactor Building (105-R) Complex, the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned , the R-Area PSL

Combined Subunit, the R Area ICA PSA, the R-Area Ash Basin (188-P), and the RAGW;

- Prevent the migration of contaminants from residual water in the Process Water Storage Tank (106-R) to groundwater at concentrations exceeding regulatory standards (MCLs);
- Prevent human exposure to tritium and VOCs in groundwater that exceed regulatory standards (MCLs), and restore contaminated groundwater to below regulatory limits (MCLs) for the RAGW Subunit; and
- Prevent exposure of potential contamination in media or structures to a residential receptor associated with the following subunits:
  - Process Storage Building (122-R) Subunit
  - Potential Release of $NaOH/H_2SO_4$ from 183-2R Subunit
  - Power House (184-R) PSA
  - Cooling Tower (185-R) PSA
  - Former Coal Pile (NBN) PSA
  - Administrative and Maintenance Building (704-R) PSA
  - Maintenance Material Storage Building (71 l-R) PSA
  - Eastern VOC/Tritium Groundwater Plume PSA

As stated in the ROD, the remedial actions selected to meet the RAOs for the RAOU is as follows:

- Land Use Controls include: (1) institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefing of health and safety requirements; (2) engineering controls consisting of signage located at the RAOU LUC boundaries to discourage unauthorized entry and uses; and (3) SRS access controls to prevent exposure to

trespasses including a 24-hour surveillance system, control entry systems, and warning signs in place at the SRS boundary; and

- Monitored Natural Attenuation (MNA).

Remedy Implementation

The selected remedial action was based on successful completion of the NTC removal actions as listed below:

- Removed 53.6 m^3 (70 yd^3) of contaminated media at the R-Reactor Cask Car Railroad Tracks by excavating and transporting to the E-Area Slit Trenches for disposal. The excavated area was backfilled with structural fill material and approximately 10-cm (4-in) of crusher run was placed, graded, and compacted on the backfilled area.

- Placed a 6.1-hectare (15-acre), 0.6-m (2-ft) thick soil cover over the R-Area Ash Basin (188-R). The multi-layer cover system consisted of a 45-cm (18-in) thick compacted common fill, 10-cm (4-in) thick topsoil, and sod.

- Isolated/plugged the R-Area PSLs; grouted associated underground structures, manholes, weirs and boxes; select removal of process equipment external to the PSLs; sealed/plugged of outfalls; transported 60,000 gallons of radiologically contaminated water from the 106-R Process Water Storage Tank to P-Area Disassembly Basin for evaporation.

- ISD of the R-Reactor Building (105-R) Complex included:

  - Leaving the R-Reactor Building (105-R) (Process, Purification, and Assembly Areas) and the Actuator Tower in place;

  - Installing an evaporation system to treat the R-Reactor Disassembly Basin water; Grouting the below grade portions of the R-Reactor Building (105-R) including Disassembly Basin and the Purification Area (94,055 m^3 [122,948 yd^3] total) to stabilize contaminants;

- Grouting the Reactor Vessel in place (109.4 m^3 [143 yd^3]) and placing a 1.2-m (4-ft) thick constructed concrete cover over the Reactor Vessel; cover is sloped to allow water runoff in the event of future rainwater ingress;
- Demolishing the above-grade structure of the Disassembly Area to grade-level and transported 10,254 m^3 (13,404 yd^3) of debris to the E-Area Low-Level Waste Facility;
- Placed a 0.57 hectare (1.4 acre), 17.5-cm (7-in) thick sloped 4000 psi reinforced concrete cover over the grouted Disassembly Basin, including the contaminated soil and slabs in the area north of the R-Reactor Building (105-R),
- Removing the stack above the plus 16.8-m (55-ft) elevations;
- Constructing a new partial roof over the shield door slots to prevent rainwater ingress;
- Leaving the Process Room, an above-grade structure, in its current state;
- Monitoring the groundwater adjacent to the R-Reactor Building (105-R) in order to verify the effectiveness of the ISD remedy; and
- Sealing all R-Reactor Building (105-R) exterior openings.

The selected final remedy components met the RAOs at RAOU by implementing the following activities:

- MNA for the RAGW Subunit (SRNS 2010d);
- Performance evaluation groundwater monitoring for ISD of the R-Reactor Building (105-R) Complex; and
- LUCs for 183 hectares (450 acres) comprising the RAOU.

System Operations/ Operation and Maintenance

Currently, there are no systems in operation at the RAOU. Operations are complete for the evaporators which removed 4.5 to 5 million gallons of Disassembly Basin water. The

remaining 380,000 gallons of shield water was absorbed/evaporated (through heat of hydration) by the grout.

The following maintenance activities are ongoing:

- Groundwater monitoring to ensure the ISD remedy is performing as expected and that no contaminant migration COCs have impacted groundwater. Groundwater and surface water monitoring will be part of the MNA remedy for tritium and VOC plumes. The estimated time frames for MNA to restore contaminated groundwater to below MCLS are:
  - Northern Tritium Plume - 124 years;
  - Eastern Tritium Plume - 77 years;
  - Western Tritium Plume 37 years; and
  - Eastern VOC Plume - 26 years.

Annual site inspections and maintenance activities include:

- The roof structure of the R-Reactor Building (105-R) Complex to ensure that it is functioning properly. Herbicides will be applied as necessary to prevent the growth of woody vegetation on the roof structure;
- The doors into the R-Reactor Building (105-R) Complex to ensure that they remain sealed;
- The Disassembly Basin cover to ensure that excessive deterioration has not occurred and that no woody vegetation is growing on the cover;
- The R-Ash Basin (188-R) cover to verify that significant erosion has not occurred (60.9 cm [2 ft] thickness maintained), to ensure that no woody vegetation is growing on the cover, and to ensure that no burrowing or mounding animals are present;
- The RAOU to ensure no unauthorized excavations, digging, or construction activities within the LUC boundaries have occurred.
- Inspection and maintenance of access control warning signs.

The operation and maintenance (O&M) costs associated with the selected remedy for RAOU include maintenance costs, as described above, groundwater monitoring, and institutional controls (LUCs). These activities have a ROD estimated total present worth of $5,466,429 discounted at 2.7% per year for 200 years of maintenance activities. The actual O&M cost since FY2011 is $83,300, which is not significantly different from the estimated costs included in the ROD. Table WW-4 shows the annual comparison of O&M actual and ROD estimated costs.

V. Progress Since Last Review

This is the first five-year review. Therefore, there is no previous protectiveness statement.

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 remedial actions;
- Reviewed groundwater monitoring data to determine if MCLs were exceeded;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist, provided in Attachment WW-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

Recent data (2002 – 2012) have been reviewed for the RAOU Groundwater subunit and ISD monitoring of the RBC. The Eastern VOC, Eastern Tritium, Western Tritium, and Northern Tritium plumes all indicate decreasing concentrations over this time period.

None of the RBC ISD constituents (chlorine-36, potassium-40, lead, nickel-59, niobium-94, molybdenum-93, iodine-129, PCBs, carbon-14, and silver-108[m]) were found to

impact groundwater. All ISD monitoring results were below method detection limits, with the exception of one lead result that was attributed to high turbidity (49.6 NTU).

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 at the RAOU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The RAOU was inspected by SRNS and USDOE personnel on June 27, 2012 and October 15, 2012. No issues were identified for the RAOU during this inspection and interviews.

On January 23, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection. A minor item noted during the inspection of the RAOU, documented with response (SRNS 2013), had no impact on the protectiveness of the remedy.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedies selected for the RAOU are functioning as intended, as demonstrated below:

The closure of the RAOU by ISD and maintaining a protective cover system over the R-Reactor Building (105-R) is meeting the remedial objectives of preventing physical exposure of contaminants as indicated by the following:

- Site inspection and maintenance data do not indicate problems or potential remedy failure, which could place protectiveness at risk (Attachment WW-1).
- Per the Environmental Monitoring Plan (EMP) (SRNS 2010d), groundwater monitoring will take place at ten wells located around the R-Reactor Building (105-R) (Figure WW-5). Because the time frame for groundwater impacts (if any) is over 1,000 years, groundwater sampling will occur every five years to support the remedy review analysis.

- Based on the results of the ISD sampling event from March 2012, tritium (9 of 10 samples) and lead (6 of 10 samples) were detected, while no PCBs or other radionuclide results were above detection limits (Table WW-2). The concentration of lead (25.4 μg/L) is above the MCL (15 μg/L) (SRNS 2010d). However, the lead result is consistent with previous results (maximum 24.1 μg/L) from well RDB 1D, and not a new release from the R-Reactor Building (105-R) Complex. Nine of the ten tritium samples had concentrations exceeding the MCL (20 ρCi/ml) with the maximum concentration being 1650 ρCi/ml. These results are consistent with prior results (maximum 1710 ρCi/mL) from Well RPS004C, and indicate the tritium is from the existing groundwater plume rather than a new release from the R-Reactor Building (105-R) Complex.

- The annual site inspection confirmed that the roof structure and Disassembly Basin cover are functioning properly, the doors are sealed, and the R-Ash Basin cover is in good condition (Attachment WW-1).

- LUCs are preventing human health exposure and include the following: institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program; other administrative controls to ensure worker safety include work controls, worker training, and worker briefing of health and safety requirements; engineering controls consisting of signage located at the RAOU LUC boundaries to discourage unauthorized entry and uses; and SRS access controls to prevent exposure to trespasses including a 24-hour surveillance system, control entry systems, and warning signs in place at the SRS boundary. The Land Use Control Implementation Plan for RAOU governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (SRNS 2010b). All LUC objectives are being met."

The early remedial actions, removal actions, and final remedial action are meeting the RGOs established for the RAOU, 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 R-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 standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

Due to the presence of chlorinated solvents at the site, there is a potential that 1,4-dioxane may also exist because it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. The presence of 1,4-dioxane is not likely to change the protectiveness of the remedial action that includes LUCs (at a minimum) which consequently renders the exposure pathway to human receptors incomplete. An evaluation of the effectiveness of the remedy is premature until such time that a formal MCL is established. SRS has performed a historical review of 1,4-dioxane groundwater data for the RAOU. Twelve surface water samples from the R-Reactor Discharge Canal, Joyce Branch and Pond A were analyzed for 1,4-dioxane in 2010, and all results were below the detection limit. However, no groundwater samples were analyzed as part of the 2010 sampling effort. Before the next Five-Year Remedy Review, groundwater samples at RAOU will include the analysis of 1,4-dioxane. The 1,4-dioxane results will be reported in the subsequent annual groundwater monitoring report, as well as summarized in the next Five-Year Remedy Review.

With regard to the CCRT subunit, more stringent 2012 PRGs/RSLs do 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 R-Area Ash Basin subunit. Exposure to contamination left in place at the R-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 MCL for tritium that is part of the MNA remedy. Finally, more

stringent PRGs/RSLs would not impact the LUCs that are in place to prevent exposure to contaminated media at the RAOU.

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

Issues related to the RAOU are presented in table WW-5.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions for the RAOU are presented in Table WW-6.

X. Protectiveness Statement(s)

The remedy is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to contaminated soil at the RAOU have been addressed through implementation of soil covers, ISD, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the RAOU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

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. *RCRA Facility Investigation/Remedial Investigation with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for R-Area Operable Unit (U)*, WSRC-RP-2008-4035, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009b. *Record of Decision Remedial Alternative Selection for the C-, K-, L-, and R-Reactor Complexes (U)*, SRNS-RP-2009-00707, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009c. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (U)*, WSRC-RP-2008-4090, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009d. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for the R-Reactor Building (105-R) Complex (U)*, SRNS-RP-2009-00801, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010a. *Record of Decision Remedial Alternative Selection for the R-Area Operable Unit (U)*, SRNS-RP-2010-01062, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010b. *Land Use Control Implementation Plan for the R-Area Operable Unit (U)*, SRNS-RP-2010-01208, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010c. *Early Action Post-Construction Report for the High Contamination Area Associated with the R-Area Cask Car Railroad Tracks (U)*, SRNS-RP-2010-00795, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010d. *Effectiveness Monitoring Plan for the R-Area Operable Unit (U)*, SRNS-RP-2010-01259, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010e. *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 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010f. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis for the R-Area Operable Unit (RAOU) R-Area Process Sewer Line (RPSL) Combined Subunit (U)*, SRNS-RP-2009-01341, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010g. *Decommissioning Project Final Report 151-1R, Primary Substation (High Volt 115/13.8KV)*, V-PCOR-R-00016, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Post Construction Report for the R-Area Operable Unit (U)*, SRNS-RP-2011-01574, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Savannah River Site's Responses to the U.S. Environmental Protection Agency's Comments during the Five-Year Remedy Review Report (SRNS-RP-2012-00011) Regulatory Site Inspections (January 15-16, 2013, January 22-23, 2013, and January 29-30, 2013)*, ERD-EN-2013-0016, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 2002. Engineering Evaluation/Cost Analysis for the Grouting of the R-Reactor Disassembly Basin at the Savannah River Site, DOE/EE/CA-0001, U.S. Department of Energy, Savannah River Operations Office

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various – Inspection Data Sheets – *Field Inspection Checklists for the R-Area Operable Unit*, ER-IDS-019-064, Inspections began in 2012 (annually)

Various – Inspection Data Sheets – *Field Inspection Checklists for the R-Area Ash Basin (188-R)*, ER-IDS-019-064, Inspections began in 2011 (annually)

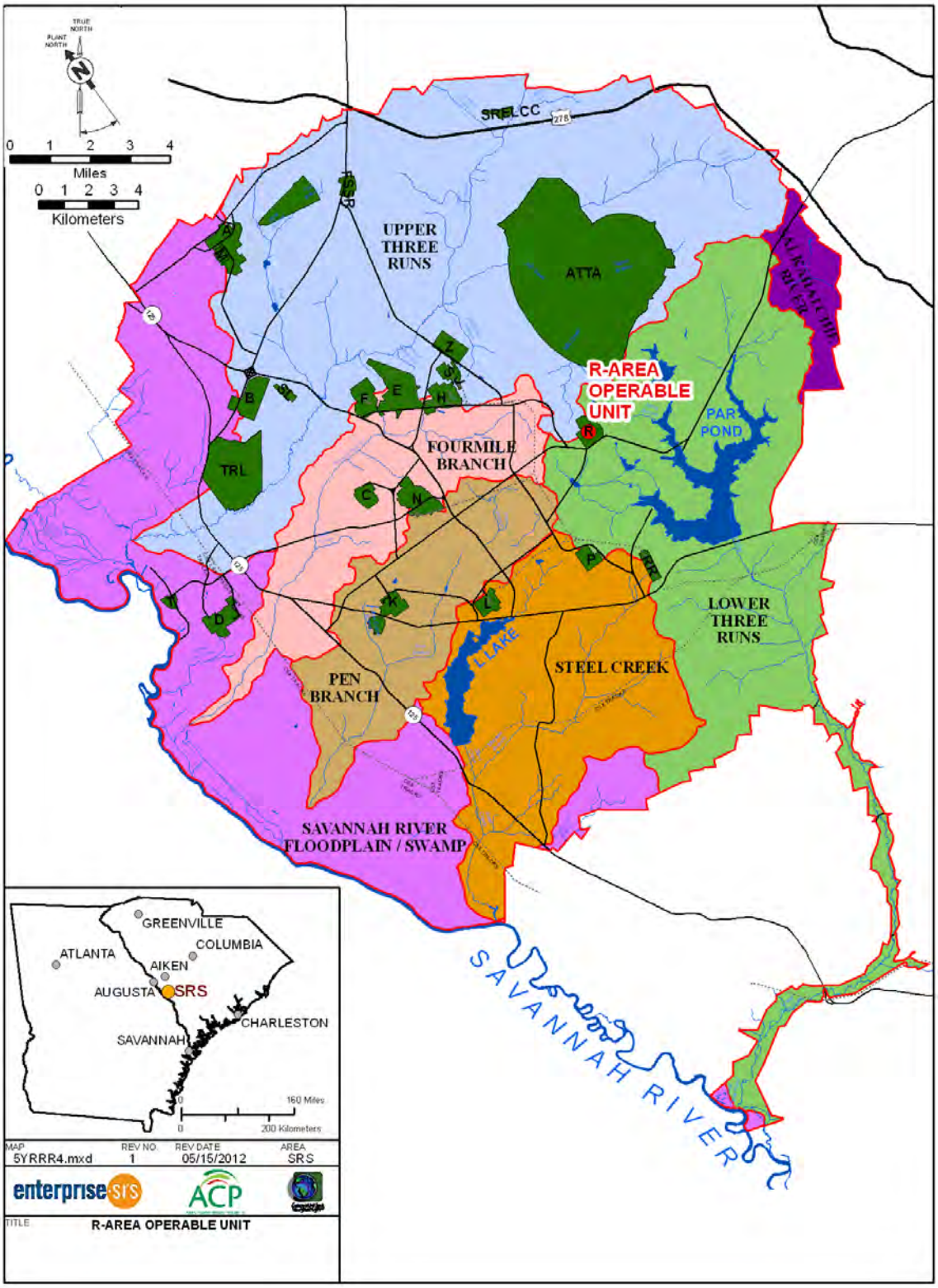


Figure WW-1. Location of RAOU at Savannah River Site

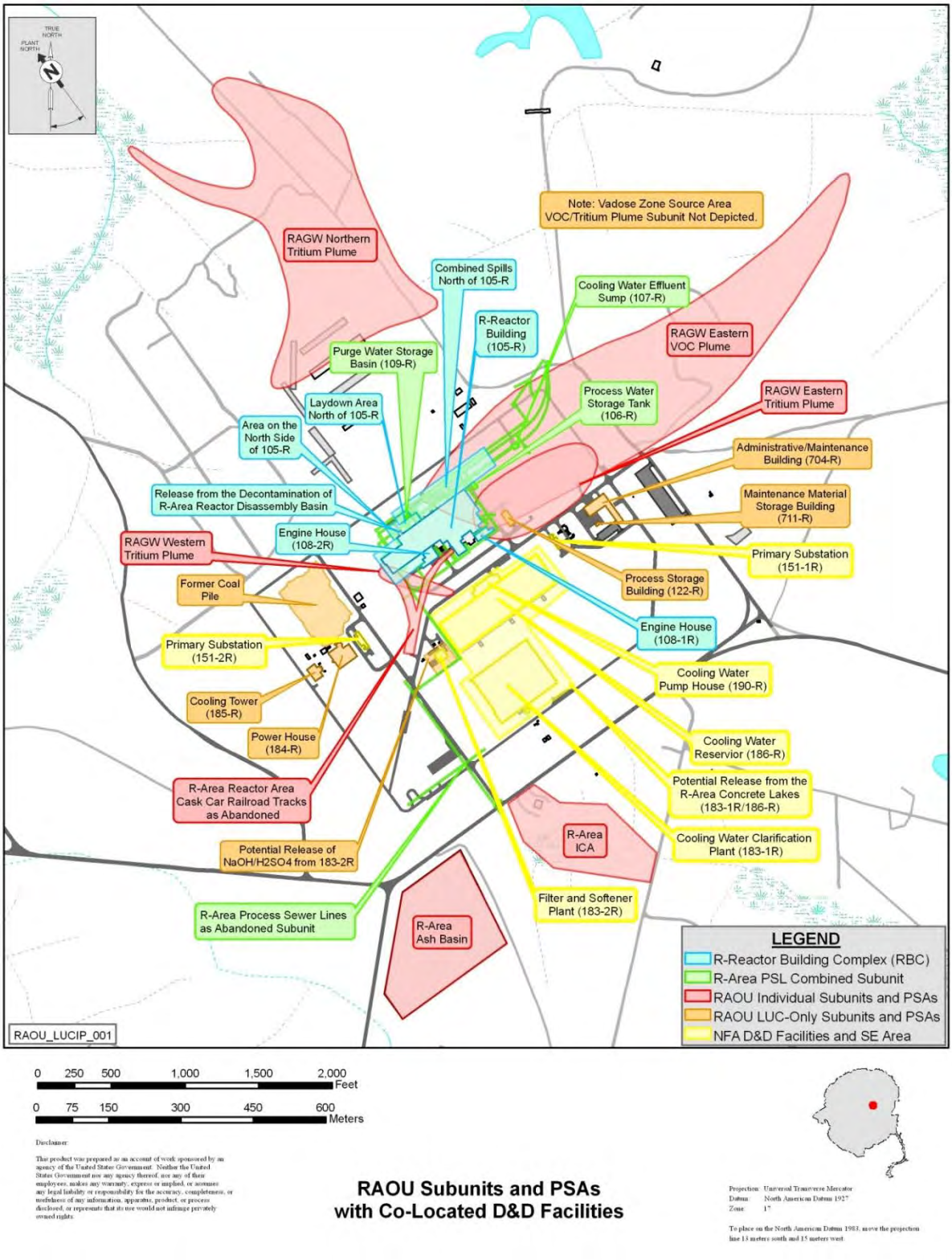


Figure WW-2. Location of RAOU Subunits



Figure WW-3. Photo of RAOU before Remediation Activities





Figure WW-4. Current Photos of RAOU (2011)

Table WW-1. Chronology of OU Events

Event	Date
Early Action R-Reactor Disassembly Basin Grouting Start / Finish	October 1, 2002 / April 29, 2003
Early Action R-Reactor Disassembly Basin (Forced Evaporation and Grouting) Start / Finish	April 29, 2003 / November 30, 2010
Issue Early Action ROD for the C-, K-, L-, and R-Rx Complexes	December 8, 2009
Issue Record of Decision Remedial Alternative Selection for RAOU	April 20, 2011
Remedial Action Start / Finish	May 25, 2011 / September 22, 2011
Final Regulatory Walk down – LUCIP and EMP Implementation	September 22, 2011
Previous Five-Year Reviews	None

Table WW-2. RAGW and R-Reactor Building (105-R) Complex ISD Groundwater Monitoring RGs

RAGW Refined COCs	2012 Max Concentration	RG (MCL)	Units
Tritium	1,650	20	ρCi/mL
TCE	15.9	5	µg/L
Cis-1,2-Dichloroethylene	18.4	70	µg/L
Vinyl Chloride	5.05	2	µg/L
Carbon Tetrachloride	All Results < Detection Limit	5	µg/L
Chloroform	All Results < Detection Limit	70	µg/L
R-Reactor Building Complex ISD Refined Contaminant Migration COCs	**2012 Max Concentration**	**RG (MCL or PRG)**	**Units**
Carbon-14	All Results < Detection Limit	2,000	ρCi/L
Chlorine-36	All Results < Detection Limit	700	ρCi/L
Iodine-129	All Results < Detection Limit	1	ρCi/L
Lead	25.40 [A]	15.0	µg/L
Molybdenum-93	All Results < Detection Limit	15.8[B]	ρCi/L
Nickel-59	All Results < Detection Limit	300	ρCi/L
Niobium-94	All Results < Detection Limit	6.81[B]	ρCi/L
Potassium-40	All Results < Detection Limit	2.14[B]	ρCi/L
PCBs	All Results < Detection Limit	0.5	µg/L
Silver-108m	All Results < Detection Limit	6.5[B]	ρCi/L
Tritium	1,650 [C]	20	ρCi/mL

NOTES:
A = Consistent with historical data for ISD well RDB 1D: lead value of 24.1 µg/L on 9/21/03.
B = EPA Preliminary Remediation Goal (PRG) for Radionuclides Residential Tap Water (August 2010).
C = Consistent with historical data for ISD well RPS004C: tritium value of 1,740 ρCi/mL on 3/19/08.
COC = Constituent of Concern

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Table WW-3. RAOU RCOCs and RGs

RAOU Subunit or PSA		RCOC	Human Health	Ecological	PTSM	CM	RG	Units	RG Source
R-Reactor Building (105-R) Complex	R Reactor Building (105-R) and Engine Houses (108-1R and 108-2R)	Arsenic	X				1.59	mg/kg	PRG
		Aroclor 1254	X			X	0.5	µg/L	MCL
		Americium-241 (+D)	X				7.76	ρCi/g	PRG
		Americium-243 (+D)	X				0.344	ρCi/g	PRG
		Cesium-137 (+D)	X		X		0.113	ρCi/g	PRG
		Cobalt-60	X		X		0.0602	ρCi/g	PRG
		Lead				X	15	µg/L	MCL
		Strontium-90 (+D)	X				14.3	ρCi/g	PRG
	R-Area Disassembly Basin[1]	Cesium-137 (+D)	X		X		0.113	ρCi/g	PRG
		Cobalt-60	X		X		0.0602	ρCi/g	PRG
		Europium-154	X		X		0.085	ρCi/g	PRG
		Tritium	X		X		4.23	ρCi/g	PRG
	R-Reactor Emergency Basin	Iodine-129				X	1	ρCi/L	MCL
	R-Reactor Vessel[1]	Barium-133	X		X		0.306	ρCi/g	PRG
		Cesium-137	X		X		0.113	ρCi/g	PRG
		Chlorine-36				X	700	ρCi/L	MCL
		Cobalt-60	X		X		0.0602	ρCi/g	PRG
		Europium-152	X		X		0.0737	ρCi/g	PRG
		Lead				X	15	µg/L	MCL
		Molybdenum-93				X	14.2	ρCi/L	PRG
		Nickel-59				X	300	ρCi/L	MCL
		Nickel-63	X		X		55,500	ρCi/g	PRG
		Niobium-94	X		X	X	6.13	ρCi/L	PRG
		Potssium-40				X	1.93	ρCi/L	PRG
		Silver-108m	X		X		0.0326	ρCi/g	PRG
Area on North Side of Building 105-R, Laydown Area North of 105-R, and Combined Spills North of Building 105-R (NBN), and Release from the Decontamination of R- Area Reactor Disassembly Basin (NBN), and Potential Release from the R-Area Disassembly Basin Subunits		Cesium-137 (+D)	X				10	ρCi/g	Other[2]
R-Area Process Sewer Lines as Abandoned (NBN) Subunit		Radionuclides[3]	X		X		NA	ρCi/g	PRG

Table WW-3. RAOU RCOCs and RGs (continued)

RAOU Subunit or PSA	RCOC	Human Health	Ecological	PTSM	CM	RG	Units	RG Source
R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN) Subunit	Cesium-137 (+D),	X		X		10	ρCi/g	Other[2]
	Uranium-235 (+D)	X				0.394	ρCi/g	PRG
R-Area Ash Basin (188-R) Subunit	Arsenic	X				1.59	mg/kg	PRG
	Potassium-40	X				0.271	ρCi/g	PRG
	Radium-226 (+D)	X				0.0255	ρCi/g	PRG
	Uranium-235 (+D)	X				0.394	ρCi/g	PRG
	Uranium-238 (+D)	X				1.79	ρCi/g	PRG
R-Area Reactor Groundwater Subunit[4]	Trichloroethylene	X				5	µg/L	MCL
	cis-1,2-Dichloroethylene	X				70	µg/L	MCL
	Vinyl chloride	X				2	µg/L	MCL
	Carbon tetrachloride	X				5	µg/L	MCL
	Chloroform	X				70	µg/L	MCL
	Tritium	X				20	ρCi/mL	MCL
R-Area Isolated Contamination Area PSA	Arsenic	X				1.59	mg/kg	PRG
	Cesium-137 (+D)	X				0.112	ρCi/g	PRG
	Cobalt-60	X				0.0596	ρCi/g	PRG
	Potassium-40	X				0.271	ρCi/g	PRG
	Radium-226 (+D)	X				0.0255	ρCi/g	PRG

1. The HHRA and PTSM discussions identify several radiological and hazardous constituents as HH RCOCs or PTSM, but only the major risk drivers for the individual subunits are presented in this table.
2. A concentration of 10 ρCi/g and LUCs established as RGO based on Core Team agreement.
3. Radiological constituents are qualitatively identified as HH and PTSM RCOCs based on process history and the potential for fixed residual contamination on the inside surfaces of the R-Area Process Sewer Lines as Abandoned (NBN).
4. These are based on MCLs rather than a HHRA evaluation. Only the constituents forming plumes are listed in Table 3.

MCL = Maximum Contaminant Level.
PRG = Preliminary Remediation Goal.
NA = Not Applicable.
RG = Remedial Goal.
CM = Contaminant Migration.
PTSM = Principle Threat Source Material.

Table WW-4. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	n/a	n/a	n/a	n/a	$83,300	$83,300
Total ROD Estimated Direct O&M Costs	n/a	n/a	n/a	$47,300	$47,300	$94,600

Table WW-1. Issues Identified for RAOU

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1,4-Dioxane has been identified as being a potential contaminant at RAOU based on its possible association with other solvents that are present at RAOU. However, there is a lack of groundwater data to dismiss 1,4-dioxane as being present at levels which would be harmful to human health or the environment.	N	N

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Table CC-2. Recommendations and Follow-up Actions for RAOU

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date*	Affects Protectiveness? (Y/N)	
					Current	Future
1,4-Dioxane has not been monitored recently in the RAOU wells.	1,4-Dioxane will be monitored in all of the RAOU wells sampled for VOCs during the 4Q2013 sampling event. The data results will be presented in the subsequent annual groundwater report that will be submitted in June 2014, as well as in the next Five-Year Remedy Review. Based on the results, the USEPA, SCDHEC and USDOE will decide whether or not 1,4-dioxane should be permanently added to the list of monitored constituents.	USDOE	SCDHEC/ USEPA	June 2014	N	N

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Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit

I. SITE INFORMATION			
Site Name:	**R-Area Operable Unit**	**Date of Inspection:**	**06/27/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS # 95**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**80°F and clear**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other ISD by grouting, grouting PSLs, forced evaporation

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance*, ER-SOP-019, *Field Inspection Checklist for RAOU Ash Basin 188-R*, ER-IDS-019-051 and *Field Inspection Checklist for R-Area Operable Unit*, ER-IDS-019-064.

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-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 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-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

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area 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: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/15/12 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks:

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area 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:_____

VII. COVER SYSTEMS ☒ Applicable ☐ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ Applicable ☐ N/A

Remarks: Concrete Cover system

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent _____
☐ Ponding	☐ Location shown on site map	Areal extent _____
☐ Seeps	☐ Location shown on site map	Areal extent _____
☐ Soft subgrade	☐ Location shown on site map	Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment WW-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Remedy for this site is removal action, land use controls and MNA to eliminate or control all routes of exposure to residual radioactive or chemical contamination. All systems appear to be functioning as expected
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures are adequately maintaining the MNA system. The O&M procedures consisting of annual site inspections and site maintenance (vegetation removal, structures integrity and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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R-AREA REACTOR SEEPAGE BASINS (904-57G, -58G, -59G, -60G, -103G, -104G) AND 108-4R OVERFLOW BASIN OPERABLE UNIT

I. Introduction

This report is the second five-year review for the R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin (RRSB) Operable Unit (OU). The review was conducted from June 2012 through September 2012. Contaminants have been left in place at the RRSB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the RRSB OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table XX-1 lists the chronology of site events for the RRSB OU.

III. Background

RRSB OU is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the RRSB OU are soil and groundwater.

The RRSB OU consists of the following: six seepage basins, process sewer lines, sanitary sewer system (sewer lines and sanitary discharge lagoon), an area of contaminated vegetation north of R-Reactor Building (105-R), surface water and sediment, RRSB groundwater, and the 108-4R Overflow Basin.

Physical Characteristics

R Area is located in the east-central portion of SRS, west of PAR Pond (Figure XX-1). The RRSB OU is located north of the R-Reactor Building (105-R) (Figure XX-2) and straddles the boundary between the Upper Three Runs and Lower Three Runs watersheds. Prior to initiation of remedial actions the entire area, 11 hectares (27 acres), was fenced and approximately 45%, 5 hectares (12 acres), was paved.

Six unlined earthen basins were constructed to receive radioactively contaminated purge water from R-Reactor's spent fuel storage process. All six basins were constructed between June 1957 and March 1958. The basins varied in depth from 2 to 4.9 m (6.6 ft to 16.4 ft) below ground surface (bgs). Basin 1 was L-shaped, with each leg approximately 60 m (200 ft) long by 12 m (40 ft) wide. Basin 2 was 60 m (200 ft) long by 15 m (50 ft) wide. Basin 3 was 90 m (300 ft) long by 9 m (30 ft) wide. Basin 4 was 97.5 m (325 ft) long by 9 m (30 ft) wide. Basin 5 was 112.5 m (375 ft) long by 12 m (40 ft) wide. Basin 6 was 165 m (550 ft) long by 15 m (50 ft) wide (WSRC 1997).

Process sewer lines conveyed process water from the R-Reactor disassembly basin to the six seepage basins. The pipelines to Basins 1 through 5 were 7.5-cm (3-in) polyvinyl chloride (PVC) (554 m [1,848 ft] in total length) and the pipeline to Basin 6 was 10-cm (4-in) steel (340.5 m [1,135 ft] in total length) (WSRC 1997).

A 15-cm (6-in) and 30-cm (12-in) terra cotta sanitary sewer line that supported a housing camp during construction of the R-Reactor extended through the RRSB OU to convey wastewater to a sanitary discharge lagoon (WSRC 1997).

Three small surface areas, called the eastern, western, and northern contamination areas, were contaminated near the basins ranging in size respectively [6 x 12 m (20 x 40 ft), 4.5 x 9 m (15 x 30 ft), and 3.6 x 4.5 m (12 x 15 ft)] (SRNS 2008).

The 108-4R Overflow Basin is located 75 m (250 ft) southwest of the R-Reactor and approximately 150 m (500 ft) southwest of R-Reactor Seepage Basins. The basin was constructed to collect overflow from two adjacent underground storage tanks (USTs) within a vault (108-3R) that stored diesel fuel for standby generators in the R Reactor. The unlined basin was approximately 60 feet x 60 feet x 8 feet deep. A soil berm up to 0.6 m (2 ft) above grade was placed around the basin's perimeter. The USTs were removed in March 1990 and the associated piping was abandoned in place after being flushed and purged as directed by South Carolina Department of Health and Environmental Control (SCDHEC).

The RRSBs lie north of and adjacent to R-Reactor on an elevated divide between Mill Creek and the primary discharge canal northeast of the R-Area perimeter fence

(Figure XX-2). The OU is situated between drainage to PAR Pond located 2.7 km (1.7 mi) to the southeast (beyond the boundaries of the figure) and the headwaters of Mill Creek located 0.4 km (0.25 mi) to the northwest. The western edge of the basin area slopes towards the west. Surface water drainage from the RRSB OU flows north and west into Mill Creek or east into the R-Area Discharge Canal and Pond A.

Groundwater in the shallow water table aquifer, a horizon of the Upper Aquifer Zone of the Upper Three Runs Aquifer, has been contaminated. Historically, large fluctuations in the water table elevation occur as a result of changes in precipitation, resulting in occurrences of groundwater coming close to or in contact with contamination in the bottom of the basins. Groundwater flow is primarily vertical from the A to AA horizon to the Transmissive Zone, where flow becomes more lateral moves radially away from the basins. A review of water table elevations from the currently monitored wells over the last five years indicate increasing levels through early 2010, with falling levels consistent with decreased rainfall since then.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates RRSB OU as being within the site industrial support area. The future land use for RRSB OU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The six basins received an estimated 5-million gallons of purge water, containing approximately 3,276 curies (Ci) total activity, from the R-Reactor disassembly basin. Primary radionuclides present were strontium-90 and cesium-137. A non-routine discharge, due to a calorimeter test failure in 1957, released approximately 2,700 Ci of radionuclides primarily to Basin 1 with Basins 2 through 5 receiving a lesser amount. A sanitary sewer system was breached during the construction of Basins 1 and 5 and received the contaminated water discharged to the basins (WSRC 1997).

Basins 1 through 5 were retired and backfilled during the period 1958 through 1959. The backfill operation involved placement of clean soil followed by a cover of a thin asphalt emulsion to restrict the infiltration of surface water and to inhibit the growth of vegetation. Between 1960 and 1963, clay dikes were placed around Basin 1 and the northwest end of Basin 3. The dikes extended down to a clay layer at an approximate depth of 4.5 m (15 ft) and 2.4 m (8 ft) at Basins 1 and 3, respectively. Clay caps were then placed over the diked areas to control exposure to radioactively contaminated surface soils and infiltration of surface water (WSRC 1997). Basin 6 was retired in 1964, when operations at R-Reactor ceased. In 1977, this basin was backfilled with soil and covered with a thin asphalt emulsion (WSRC 1997).

In 1996, the asphalt emulsion over all the basins was determined to be contaminated with radioactive soil, vegetation, and fire ant mounds. The surface contamination was being spread by surface water runoff and wind (WSRC 1997). Figure XX-3 shows a photograph of one of the basins prior to any remedial action.

The 108-4R Overflow Basin was in operation from 1953 to 1964. The USTs were removed in March 1990, and associated piping was abandoned in place after being flushed and purged to less than 20 percent of the lower explosive limit as directed by SCDHEC. Soil and groundwater samples taken during excavation of the USTs indicated no detectable levels of contamination. The groundwater samples were collected from groundwater that seeped into the excavation (WSRC 1990).

Initial Response

The Removal Site Evaluation Report for the R-Reactor Seepage Basin, Erosion Control Activities and Asphalt Cover Refurbishment (WSRC 1996), determined that the spread of contamination due to the deteriorated condition of the asphalt emulsion cover warranted action. A removal action was performed during the summer of 1996, which included a 4.34-hectare (10.7-acre) cover system over the existing asphalt emulsion. The cover system consisted of a 10-cm (4-inch) thick layer of asphalt over 0.45 m (1.5 ft) minimum thick layer of clean soil. Prior to the cover system installation, the surfaces of the basins

were treated with herbicides and insecticides, and the surface was recontoured to promote drainage.

Basis for Taking Action

Because of the large quantity of radioactivity in the historical releases, it was concluded that the subsurface soil associated with the basin bottoms, the process sewer lines, and the contaminated sections of the sanitary sewer line should be considered principal threat source material (PTSM). Final contaminants of concern (COCs) and associated remedial goals (RGs) were developed for the RRSB (WSRC 2002, 2003) (Table XX-2).

The 108-4R Overflow Basin, Surface Water, and Sediment subunits were characterized under a separate soil investigation from February to April 1996. No final COCs were identified for soil or groundwater. Therefore, there is no problem warranting action at the 108-4R Overflow Basin, surface water, and sediment. With approval of SCDHEC and US Environmental Protection Agency (USEPA), this subunit was backfilled and covered by a vegetative layer.

The basis for taking action was due to potential exposure of residents or industrial workers to unacceptable levels of carcinogenic contaminants in soils and groundwater, and due to the potential continuing impact to groundwater due to leaching from contaminated soils. Risks were highest for exposures to soils attributable to the presence of multiple radionuclides, including cesium-137 and strontium-90. Potential risks associated with exposure to groundwater are attributed to the presence of strontium-90. No ecological risks were associated with this OU.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 2003), the RAOs for the four RRSB OU subunits that require remedial actions:

Seepage Basins

- Minimize transport of soil contaminants to groundwater above maximum contaminant levels (MCLs);

- Prevent industrial worker exposure to contamination (including contaminated vegetation) in the long-term;
- Consider treatment or removal to address PTSM to the extent practicable; and
- Prevent residential development within the RRSB OU and any exposure to basin contents.

Abandoned Process Sewer Lines

- Prevent industrial worker exposure to the pipelines;
- Consider treatment alternatives to address PTSM (pipelines) to the extent practicable; and
- Prevent residential development within the OU and any exposure to the pipelines.

Sanitary Sewer System

- Prevent industrial worker exposure to the sanitary sewer lines and associated subsurface soil contaminants;
- Prevent industrial worker exposure to contaminated vegetation;
- Prevent future transfer of subsurface soil contaminants towards the surface through biotic uptake or bioturbation;
- Consider treatment alternatives to address PTSM (sanitary sewer line) to the extent practicable; and
- Prevent residential development within the OU and any exposure to the sewer lines.

Groundwater

- Prevent industrial worker exposure to groundwater contaminated above MCLs.
- Reduce strontium-90 concentrations in groundwater to below MCLs.
- Minimize the spread of groundwater contamination and prevent discharge of contaminated groundwater to surface water; and

- Prevent residential development within the OU and any exposure to contaminated groundwater.

As stated in the ROD (WSRC 2003), the selected remedial action for the RRSB OU included the following:

- Placement of a reinforced-concrete intruder barrier system with granite monuments over all PTSM and contaminated pipelines inside the RRSB boundary fence;
- Excavation of all contaminated process and sewer lines and associated soils above PTSM levels outside of the boundary fence, dispose on-unit, and cover with the intruder barrier;
- Disposal of (bury) contaminated vegetation on-unit;
- Placement of a biobarrier (asphalt bioturbation barrier) over areas where contaminated vegetation was discovered to prevent the growth of any new contaminated vegetation;
- Placement of granitic monuments, a fence, and warning signs around the perimeter of the intruder barrier to warn potential intruders of the presence of hazardous material;
- Implementation of monitored natural attenuation (MNA) by radioactive decay for contaminated groundwater, with mixing zone established for contaminated area;
- Implementation of institutional controls via access controls, deed notification, deed restriction upon transfer and field walkdown/maintenance to maintain the site for industrial activities and prevent unauthorized access to the unit and
- Excavation and disposal of three small contamination areas (CAs) on-unit.

Remedy Implementation

Implementation of these remedial actions included the following activities (SRNS 2008):

- Consolidated PTSM in a PTSM Waste Trench, which included excavation of all contaminated process and sanitary sewer lines, and associated soil located outside of

the OU boundary, and contaminated soils in the CAs. The PTSM consisted of approximately 230 m^3 (300 yd^3) of process pipes and associated soil, 54 m^3 (70 yd^3) of soil from the three CAs, seven 55-gallon drums of solidified residual water collected from the process sewer lines and five thrust blocks (2 x 2 x 2 ft). The CAs were backfilled using adjacent soils (in two CAs) or common fill (in one CA). Where practical, the pipes were grouted prior to removal to contain contaminants. The excavated areas were backfilled with clean fill material.

- Consolidated contaminated trees from the RRSB OU and the Warner's Pond OU, secondary waste and track hoe in areas where contaminated vegetation had grown. The contaminated trees were cut down, chipped, stockpiled, composted, and blended with the first foot of soil where contaminated vegetation had previously grown. The secondary waste consisted of pre-existing concrete markers, galvanized corrugated metal pipe and miscellaneous job control waste and personal protective equipment (PPE).

- Installed a concrete intruder barrier covering 2.2 hectares (5.5 acres) over all PTSM located in all six basins, the PTSM Waste Trench, and the process sewer lines inside the boundary fence (Figures XX-2 and XX-4). The barrier consisted of a 15-cm (6-in) minimum reinforced concrete placed directly on the existing asphalt cover or over a 15-cm (6-in) minimum thick layer of clean, compacted structural fill on soils and newly placed asphalt. The barrier extended 3 m (10 ft) beyond the edge of the PTSM.

- Installed an asphalt bioturbation barrier covering 5.1 hectares (12.6 acres) where contaminated vegetation had previously grown (Figures XX-2 and XX-4). The barrier consists of a 10-cm (4-in) minimum thick asphalt layer over a 15-cm (6-in) minimum thick layer of clean, compacted structural fill. The barrier extended 6 m (20 ft) beyond the edge of the area.

- Installed five granite monuments on the concrete intruder barrier to warn future inadvertent intruders.

- Established a mixing zone monitoring well network by installing 15 monitoring wells and abandoning 30 existing monitoring wells.
- Installed 26 Access Control Warning signs and fencing along the perimeter of the RRSB OU.
- Established land use controls (LUCs) for 15.3 hectares (37.8 acres) including: 1) requiring a Site Use and Site Clearance Permit for any proposed use of land within the OU area, which is applicable to all activities and personnel on site; 2) maintaining the site access controls (24-hour surveillance system, artificial and natural barriers, control entry systems, and warning signs) in place at the SRS boundary to comply with the security requirements for a RCRA-permitted facility; and 3) in the long-term, if the property ever is transferred to non-federal ownership, the US Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site (WSRC 2003).

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Groundwater mixing zone monitoring program has been implemented. Groundwater Mixing Zone Reports are being issued biennially, with the first report issued in August 2010 (SRNS 2010, SRNS 2012a). Groundwater is being monitored for strontium-90, americium-241, and water elevation.
- Annual site inspections and site maintenance (i.e., intruder and bioturbation barriers maintenance, repair of erosion damage, fencing and warning signs) (WSRC 2008). Minor repairs (e.g., seal small cracks, remove vegetation growth) to the RRSB bioturbation asphalt barrier are completed soon after discovery. Major repairs (e.g., complete asphalt resurfacing) are anticipated approximately every fifth year.

The RRSB OU asphalt barrier is currently scheduled for major repairs during fiscal year 2014.

- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented.

Costs associated with the selected remedy for RRSB include operation and maintenance (O&M) costs of the cover, groundwater mixing zone monitoring, and institutional controls. The ROD estimated (O&M) cost, including Five-Year Remedy review costs, associated with the selected remedy is $13,789,000, which was discounted at 3.9% per year. This is a present worth cost, including 30 years of maintenance activities. The actual (O&M) cost since the remedial action was completed in FY06 until FY11 is $1,287,000. The actual O&M costs (Table XX-3) are as expected.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedial actions at RRSB OU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The final remedial actions were not evaluated in the previous five-year review because the ROD had just been issued. The final remedial actions of excavation, consolidation, and backfilling of excavated areas, constructing intruder and bioturbation barriers followed with groundwater mixing zone and LUCs have now been installed and have been functioning properly.

There were no recommendations or follow-up actions from the last Five-Year Review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Evaluated the mixing zone to ensure that the contamination has not migrated beyond its established boundaries and the progress of radioactive decay in bringing contamination below MCLs. This process is calculated to take approximately 300 to 400 years (WSRC 2003);

- Confirmed the implementation of the remedial action;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist, provided in Attachment XX-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

Per the approved RRSB Mixing Zone Application, groundwater is monitored for strontium-90 and americium-241. Strontium-90 and americium-241 data through June 2012 indicated only strontium-90 is detected. Figure XX-5 presents time trends of strontium-90 for the plume/intermediate wells. Except for one result at well RSE 10, the concentrations of strontium-90 in all wells are below the mixing zone concentration limits. However, it is believed that the elevated strontium-90 is due to increased turbidity in the well, as it frequently goes dry.

The boundary well data was reviewed (123 records from 12 wells) and except for one record, all strontium-90 data was below detection limits. This is consistent with the groundwater modeling predictions and uncertainty analysis that were the basis for the groundwater mixing zone application that predicted the strontium-90 plume to diminish in all horizons within 100 years, be relatively stationary, and not ostensibly move in any direction (WSRC 2004). The selected remedy of MNA by radioactive decay is effective in reducing strontium-90 concentrations in the groundwater. The mixing zone groundwater data verifies that groundwater does not exceed MCLs at the compliance points (boundary monitoring wells). Per the ROD, the mixing zone is monitored to ensure that the contamination does not migrate beyond its established boundaries and to follow the progress of radioactive decay in bringing contamination to MCLs. This process is calculated to take approximately 300 to 400 years (WSRC 2003).

In addition to americium-241 and strontium-90, carbon-14 and plutonium-239/240 are identified as soil contaminant migration COCs (CMCOCs). The groundwater data for these two contaminants were reviewed. Sampling occurred sporadically during the

period 1992 through 2004, resulting in 46 records for carbon-14 and 55 records for plutonium-239/240. In March 2012 two samples were collected for carbon-14, both were non-detects. Twelve of the carbon-14 records and five of the plutonium-239/240 samples were identified as detected or estimated. While the paucity of data makes it infeasible to draw any definitive conclusions, the dominance of non-detects would indicate the early actions did not result in mobilization of these contaminants.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 25, 2012 at the RRSB OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The RRSB OU was inspected by SRNS and USDOE personnel on June 27, 2012 and October 15, 2012. No issues were identified for the RRSB OU during this inspection and interviews.

On January 23, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection. However, cracks in the asphalt bioturbation barrier were noted. These cracks will be sealed during maintenance/repair activities scheduled for fiscal year 2014.

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 consolidation of PTSM and contaminated trees and materials from RRSB OU and Warner's Pond OU, followed by placement of a concrete intruder barrier over PTSM contaminated materials and process sewer lines within the boundary fence is effective in preventing industrial worker exposure to contamination. This remedy with MNA by radioactive decay is minimizing rainwater infiltration, thus preventing the mobilization of CMCOCs to groundwater above MCLs. The remedial action has achieved the remedial action objectives (RAOs) for this OU. The effective implementation of institutional controls has prevented exposure to

contaminated materials (i.e., soil, pipelines, vegetation) that remain beneath the cover system.

The annual site inspections, site maintenance (i.e., intruder and bioturbation barriers maintenance, repair of erosion damage, fencing and warning signs), and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) currently implemented continue to maintain the effectiveness of response actions. The main finding in the inspection reports has been growth of vegetation on fencing and around survey markers that was remedied by cutting and application of herbicides. Inspection and maintenance data do not indicate a history of problems with the cover systems, which could place protectiveness at risk. No issues were identified that require corrective action.

Several groundwater monitoring optimization ideas were recently agreed to at the OU (SRNS 2012a). They include: a) deleting americium-241 from the list of monitored analytes; b) removing one monitoring well that is producing redundant data with another well in close proximity and screened within the same aquifer zone; c) suspending sampling of boundary wells in the lowest monitored aquifer zones until such time as shallower wells within the flow path have detections of strontium-90; d) reducing sampling frequency from annual to biennial and reporting frequency from every two years to every fourth year (a letter report will be submitted two years after the full report); and e) adding five existing wells to the boundary MCL compliance network. Additional details and the rationale supporting these changes are provided in the groundwater mixing zone report for 2011 (SRNS 2012a) and the groundwater monitoring optimization report (SRNS 2012b).

The land use controls that are in place controls include (1) physical access controls to prevent unauthorized entry to SRS and the OU (fences, guards, security patrols, etc.); (2) administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions); and (3) fencing, warning signs and land use controls (SRS Site Use/Site Clearance Program). The Land Use Control Implementation Plan for RRSB OU governs LUC implementation, maintenance,

monitoring, reporting, and enforcement of LUCs (WSRC 2008). No activities were observed that would have violated the institutional controls.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site conditions or activities that currently prevent the remedy at the RRSB OU from being protective.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions concerning RRSB OU are listed in Table XX-4.

X. Protectiveness Statements

The remedy is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to contaminated soil at the RRSB OU have been addressed through excavation, consolidation, and backfilling of excavated areas, and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the RRSB OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site

Clearance Program. Protectiveness of the remedial action will be verified by continued groundwater monitoring.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2008. *Post-Construction Report for the R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) Operable Unit (U)*, WSRC-RP-2005-4070, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *2009 Biennial Groundwater Mixing Zone Report for the R-Area Reactor Seepage Basins and 108-4R Overflow Basin Operable (U)*, SRNS-RP-2010-00999, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012a. *2011 Biennial Groundwater Mixing Zone Report for the R-Area Reactor Seepage Basins and 108-4R Overflow Basin Operable (U)*, SRNS-RP-2012-00349, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012b. *EC&ACP Groundwater Monitoring Optimization Report: A Comprehensive, Technical Approach for the Evaluation and Optimization of Groundwater Monitoring and Reporting (U)*, SRNS-RP-2012-0196, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1990. *Site Assessment of the 108-R Underground Storage Tank System at the Savannah River Site*, under cover from J.V. Odum to J.R. Hess (SCDHEC), ESH-FSG-900260, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.

WSRC, 1996. *Removal Site Evaluation Report for the R Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) Erosion Control Activities and Asphalt*

Cover Refurbishment (U), WSRC-RP-96-141, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997. *Preliminary Characterization Report Phase 1 RFI/RI for the R-Reactor Seepage Basins/108-4R Overflow Basin (U)*, WSRC-RP-97-196, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2002. *RCRA Facility Investigation/Remedial Investigation Report with Baseline Risk Assessment for the R-Area Reactor Seepage Basins/ 108-4R Overflow Basin Operable Unit (U)*, WSRC-RP-98-314, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Record of Decision for the R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit (U)*, WSRC-RP-2003-4093, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *R-Area Reactor Seepage Basins and 108-4R Overflow Basin Operable Unit Mixing Zone (U)*, WSRC-RP-2002-4053, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Land Use Control Implementation Plan for the R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) Operable Unit (U)*, WSRC-RP-2004-4032, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist, R-Reactor Seepage Basins 904-57G, 58G, 59G, 50G, 103G, 104G (U)*, ER-IDS-019-048, Inspection period 2007 through 2011 (annually)

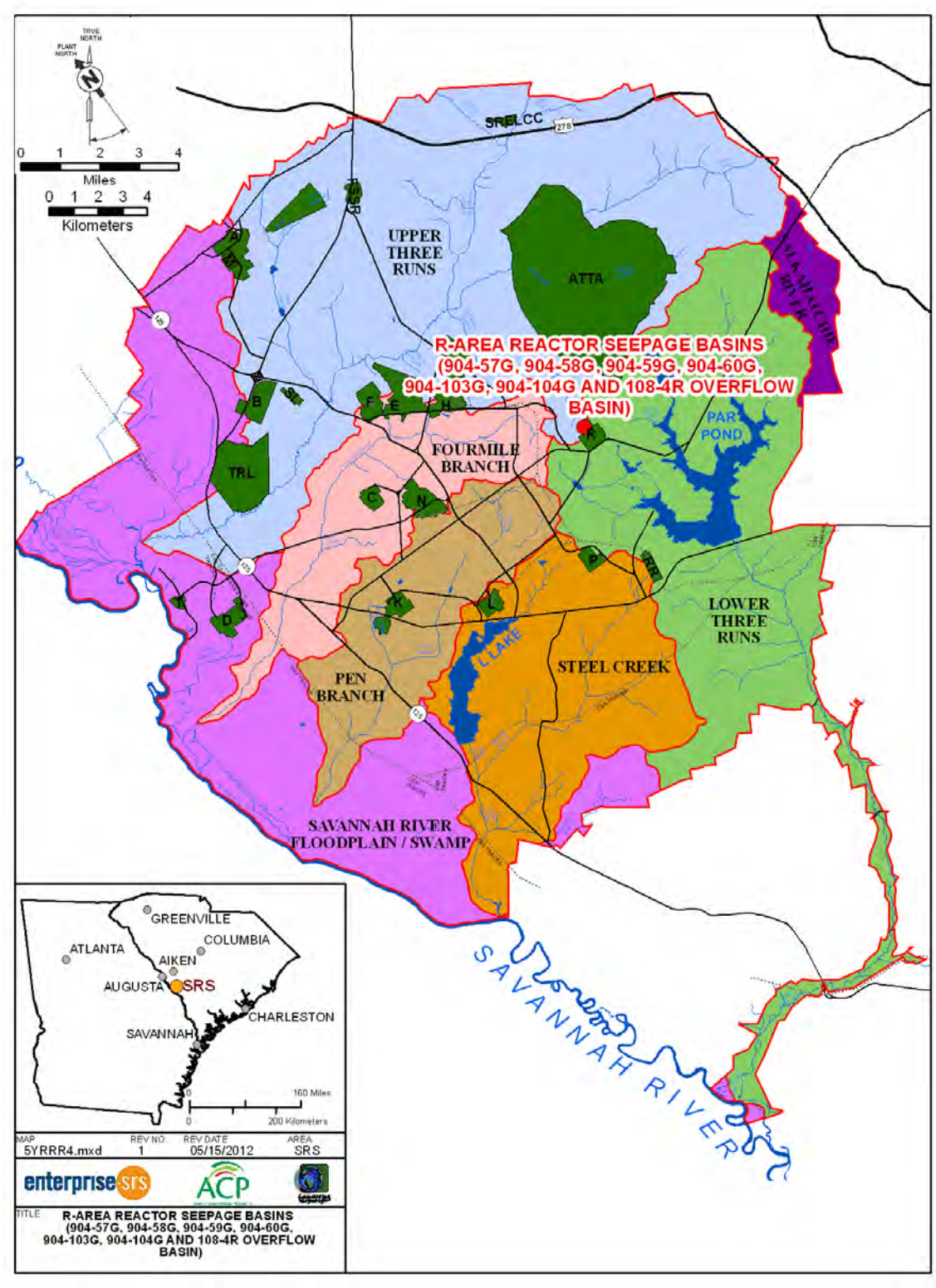


Figure XX-1. R-Area Reactor Seepage Basins Operable Unit

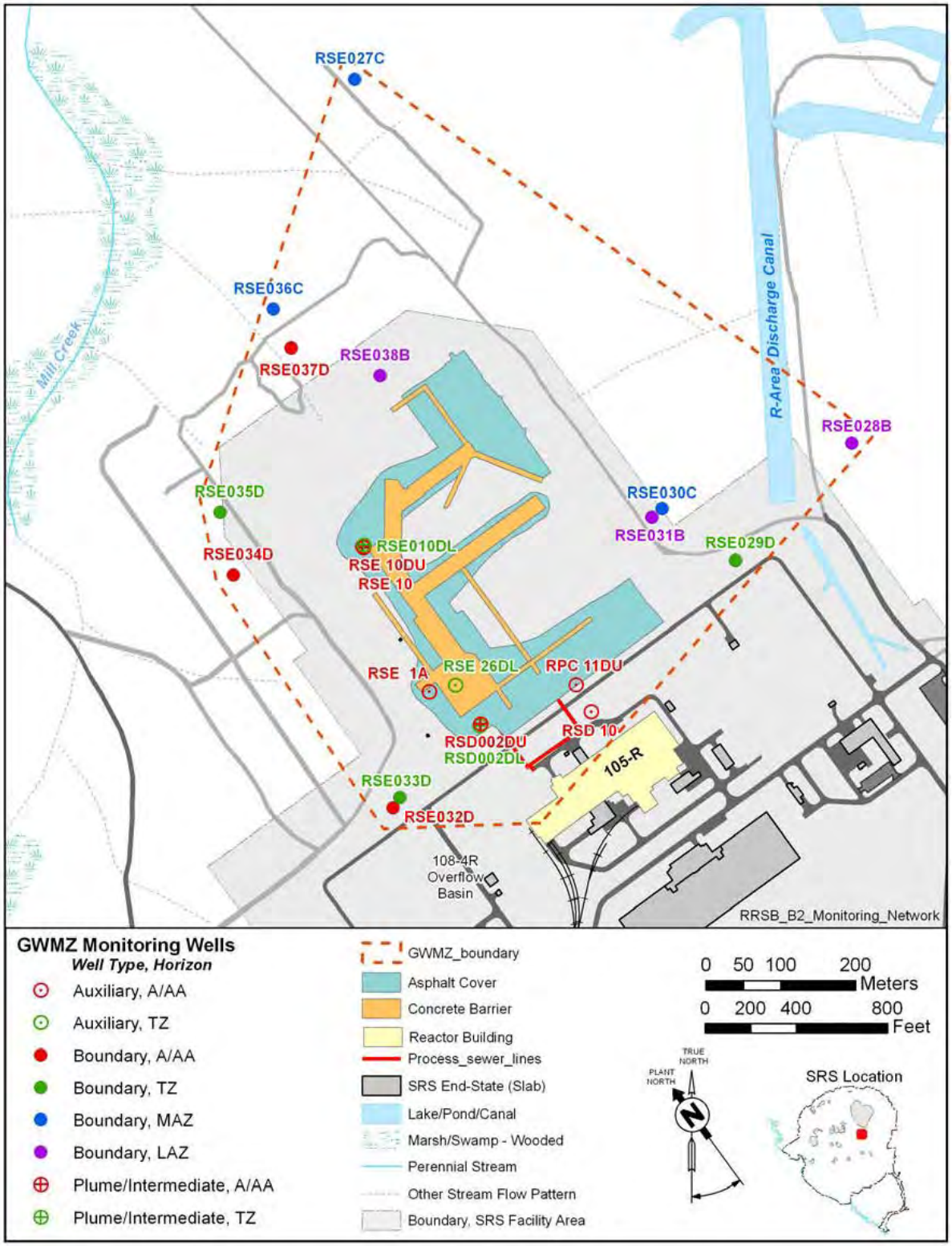


Figure XX-2. Current Layout of the RRSB OU with Monitoring Well Network



Figure XX-3. Photograph of the R-Reactor Seepage Basins prior to Record of Decision approved remedial action (exact date unknown)



Figure XX-4. Current Aerial Photo of the R-Reactor Seepage Basins OU (2010)

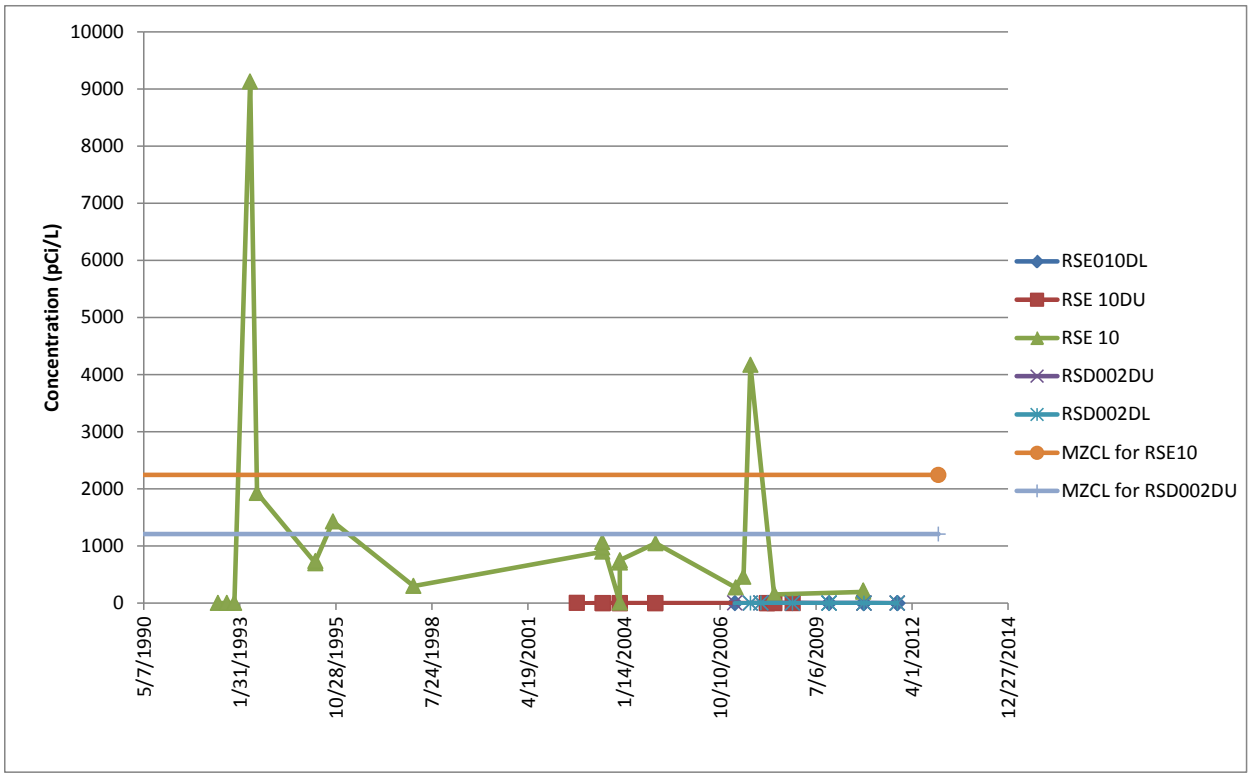


Figure XX-5. Strontium-90 Time Trend Data for RRSB Plume/Intermediate Wells

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Table XX-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	1995 / 2000
Removal Action and Asphalt Cover Completed	1996
CMS/FS Rev 1 Submittal	January 30, 2003
Record of Decision (ROD) Issuance	March 10, 2004
Remedial Action Start / Complete	March 4, 2005/ January 30, 2008
Previous Five-Year Review	February 4, 2009

Table XX-2. Final COCs and RGs for 1E-06 Risk to Industrial Worker at RRSB OU

Medium	Final COC	CM RG	HH RG	ECO RG (Earthworm)
Surface Soil	Cesium-137		0.105 ρCi/g	
Subsurface Soil	Americium-241		7.75 ρCi/g	332 ρCi/g
	Cesium -137		0.105 ρCi/g	2220 ρCi/g
	Cobalt-60		0.0225 ρCi/g	
	Plutonium-238		10.4 ρCi/g	
	Plutonium -239/240		9.69 ρCi/g	
	Strontium-90		56.5 ρCi/g	2420 ρCi/g
Total Soil Profile	Americium-241	0.0532 ρCi/g		
	Carbon-14	4.08 ρCi/g		
	Plutonium -239/240	0.0138 ρCi/g		
	Strontium-90	0.0532 ρCi/g		
Groundwater	Americium-241		0.488 ρCi/L	
	Strontium-90		2.86 ρCi/L	

Notes: CM – Contaminant Migration
HH – Human Health
ECO - Ecological

Table XX-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	4,200	352,000	172,000	338,000	419,000	1,287,000
Total ROD Estimated Direct O&M Costs	13,300	320,000	320,000	320,000	320,000	1,293,000

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Table XX-4. RRSB OU Recommendations and Follow-up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date*	Affects Protectiveness? (Y/N)	
					Current	Future
	•					
Optimization – Sampling Frequency	Reduce sampling frequency from annual to biennial	USDOE	USEPA/ SCDHEC	4/9/13	N	N
Optimization – Analyte list	Delete americium-241 from the monitoring program	USDOE	USEPA/ SCDHEC	4/9/13	N	N
Optimization – Well Sampling	For well pairs providing redundant data, remove 1 each from the sampling program	USDOE	USEPA/ SCDHEC	4/9/13	N	N
Optimization – Well Sampling	Add 5 wells to monitoring network to alleviate data gap in boundary well sampling	USDOE	USEPA/ SCDHEC	4/9/13	N	N
Optimization – Well Sampling	Suspend sampling of 6 wells in deeper aquifers until 1 well in overlying zone detects CMCOCs	USDOE	USEPA/ SCDHEC	4/9/13	N	N
Optimization – Reporting	Reduce reporting frequency from a 2-year to a 4-year cycle. A letter report will be submitted two years after the full report.	USDOE	USEPA/ SCDHEC	4/9/13	N	N

* The optimization items, incorporated into the Mixing Zone Report (2012a) submitted to USEPA and SCDHEC August 2012, were approved by US EPA on 3/18/2013 and SCDHEC on 4/9/13.

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Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit

I. SITE INFORMATION			
Site Name:	**R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit**	**Date of Inspection:**	**06/27/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #25**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**75°F and clear**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Mixing Zone (groundwater); Excavation/Consolidation of process and sanitary sewer lines

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)
   Interviewed: ☒ At Site ☐ At Office ☐ By Phone Phone No.: 803-952-4416
   Problems/Suggestions: ☐ Report Attached

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: Annual site inspections are performed per SRS procedure ER-SOP-019, *Waste Unit Inspection and Maintenance*, and ER-IDS-019-048, *Field Inspection Checklist for the RRSB*.

_____

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*			
2. Health and Safety Plans (HASPs):			
☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER			
3. O&M and OSHA Training Records:	☒ Readily Available	☒ Up to Date	☐ N/A
Remarks: Training Records are complete and up to date per ACP training matrix.			
4. Permits and Service Agreements:			
☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
5. Gas Generation Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
6. Settlement Monument Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
7. Groundwater Monitoring Records:	☒ Readily Available	☒ Up to Date	☐ N/A
Remarks:			
8. Leachate Extraction Records:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
9. Discharge Compliance Records:			
☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			
10. Daily Access/Security Logs:	☐ Readily Available	☐ Up to Date	☒ N/A
Remarks:			

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin 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.) Field Walk Down

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/15/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin 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: Vegetation mowed routinely

VII. COVER SYSTEMS ☒ 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: NA.

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks: The cover system includes a concrete intruder barrier, an asphalt bioturbation barrier, and the original asphalt cover installed in 1996.

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent_____ Depth_____

Remarks:

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent_____
☐ Ponding	☐ Location shown on site map	Areal extent_____
☐ Seeps	☐ Location shown on site map	Areal extent_____
☐ Soft subgrade	☐ Location shown on site map	Areal extent_____

Remarks:

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent_____

Remarks:

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☒ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*: ☐ Good condition ☐ Needs maintenance ☐ N/A Remarks:_____
F. Cover Drainage Layer ☐ Applicable ☒ N/A
1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A Remarks:_____
2. Outlet Rock Inspected: ☐ Functioning ☐ N/A Remarks:_____
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. Siltation: Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks:_____
2. Erosion: Areal extent_____ Depth_____ ☐ N/A ☐ Erosion not evident Remarks:_____
3. Outlet Works: ☐ Functioning ☐ N/A Remarks:_____
4. Dam: ☐ Functioning ☐ N/A Remarks:_____
H. Retaining Walls ☐ Applicable ☒ N/A
1. Deformations: ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks:_____

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Remarks:_____

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident

Areal extent_____ Depth_____

Remarks:_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A

☒ Vegetation does not impede flow

Areal extent_____ Type_____

Remarks:_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent_____ Depth_____

Remarks:_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A

Remarks:_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident

Areal extent_____ Depth_____

Remarks:_____

2. Performance Monitoring:

Type of Monitoring_____ ☐ Performance not monitored

Frequency_____ ☐ Evidence of breaching Head Differential_____

Remarks:_____

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*
C. Treatment System ☐ Applicable ☒ N/A
1. Treatment Train (Check components that apply)**:** ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters_____ ☐ Additive (e.g., chelation agent, flocculent)_____ ☐ Others_____ ☐ Good Condition ☐ Needs maintenance ☐ Sampling ports properly marked and function ☐ Sampling/maintenance log displayed and up-to-date ☐ Equipment properly identified ☐ Sampling ports properly marked and function ☐ Quantity of groundwater treatment annually_____ ☐ Quantity of surface water treatment annually_____ Remarks:_____
2. Electrical Enclosures and Panels *(properly rated and function)***:** ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
3. Tanks, Vaults, Storage Vessels: ☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance Remarks:_____
4. Discharge Structure Appurtenances: ☐ N/A ☐ Good Condition ☐ Needs maintenance Remarks:_____
5. Treatment Building(s): ☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks:_____

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒ Applicable ☐ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment XX-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The selected remedy for the R-Area Reactor Seepage Basin is the installation of a reinforced concrete intruder barrier system over PTSM with granitic monuments, installation of an asphalt bioturbation barrier over contaminated vegetation areas, excavation and consolidation on-unit of PTSM outside boundary fence, monitored natural attenuation (MNA) by radioactive decay with mixing zone for groundwater, and institutional controls. Selected remedies for the RRSB OU are functioning as intended. There are no issues requiring corrective actions.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the cover system, the condition of the fencing and warning signs is good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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SILVERTON ROAD WASTE UNIT (731-3A) OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the Silverton Road Waste Unit (731-3A) (SRWU) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the SRWU OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the SRWU OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table YY-1 lists the chronology of site events for the SRWU OU.

III. Background

SRWU OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media associated with the SRWU OU is soil.

Physical Characteristics

The SRWU OU is located in the northwestern part of the SRS in Aiken County, approximately 2.4 km (1.5 mi) southwest of A/M Area (Figures YY-1 and YY-2). The SRWU OU is not located in or near an environmentally sensitive area and is unpopulated. The SRWU area is an irregular quadrilateral, which contains an unlined earthen depression dug into surficial soils. The area of waste disposal is within the orange ball markers and covers an area of approximately 180 by 120 m (600 by 400 ft) with waste being buried to a maximum depth of approximately 4.8 m (16 ft) below ground surface (bgs). Therefore, the SRWU planar area is assumed to be 225 by 180 m (750 by 600 ft). Using an average estimated depth of 1.8 m (6 ft) for the excavated area. The approximate waste volume of the SRWU is 76,500 m^3 (100,000 yd^3).

The SRWU is located on the southwestern flank of an inter-stream divide between Upper Three Runs Creek and the flood plain of the Savannah River. The ground surface elevation at the unit averages 105 m (350 ft) above mean sea level (msl). The water table at the SRWU ranges from about 12 m (40 ft) bgs to the southwest to about 39 m (130 ft) bgs to the northeast.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. Although the *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the SRWU OU as being outside of an industrial area, the future land use for the SRWU OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The SRWU was first used before the construction of SRS. Although there is no written record of when disposal began at the SRWU, or what materials were accepted, it is believed that the SRWU was originally a borrow pit used as an "open dump" by the local municipalities, including Old Ellenton before the land was acquired by the federal government. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. The waste material at the dump was probably burned periodically, as was the practice at that time, for volume reduction. This practice would have eliminated many of the combustible organic materials while creating combustion byproducts.

After procurement by the federal government, the SRWU land continued to be used as an open dump (a legal practice at the time) by SRS. Historical and aerial photographs, presented in Figure YY-3, show large piles of metal shavings (possibly aluminum), 55-gallon drums, cardboard drums, tires, lumber, wooden pallets, cardboard, construction debris, tanks, possibly asbestos, and other unidentified metal and wood objects. No records of waste disposal activities were kept. In 1974, the disposal of waste at the

SRWU ceased. The estimated volume of waste is 76,500 m^3 (100,000 yd^3) (WSRC 1997).

Initial Response

After operations ceased, the area was bulldozed, graded, covered with native soil, and planted with grasses. The cover material was placed prior to the CERCLA investigation and preparation of the formal CERCLA documentation.

SRWU OU was designated as excavated area (filled). Soil borings were conducted in 1993 to identify the extent of waste buried beyond the excavated area. Since characterization data indicated contamination of the surface soils, the entire area within the orange balls is included in the SRWU OU.

Basis for Taking Action

Nonradiological contaminants and cesium-137 were present in soil that exceeded a $1x10^{-6}$ risk for future human receptors. Low levels of contaminants were detected in the M-Area groundwater aquifer, which minimally and infrequently exceeded maximum contaminant levels (MCLs). SRWU OU was probably not the source of contamination in the M-Area groundwater aquifer. The basis for taking a remedial action at the SRWU OU was due to potential exposure of future occupational workers and residents to contaminants in groundwater exceeding MCLs, and contaminants in soils above $1x10^{-6}$ risk levels (WSRC 1996a, WSRC 1996b). The presence of contamination in surface soil prohibits this waste unit for residential use (i.e., unrestricted land use) (WSRC 1997).

The constituents of concern (COCs) and respective remedial goals options (RGOs) for the future occupational worker receptor as identified in the SRWU OU ROD (WSRC 1997) are shown in Table YY-2. Although RGOs for groundwater were presented in the ROD, the groundwater in the lower aquifers is addressed separately as part of the 1995 RCRA Permit for the A/M Area Western Sector Corrective Action Program.

IV. Remedial Actions

Remedy Selection

As stated in the ROD (WSRC 1997), the remedial action objectives (RAOs) developed for the SRWU OU are as follows:

- For the future on-unit resident (adult/child and child): Prevent ingestion of soil and produce, and dermal contact with soil from arsenic, benzo[a]pyrene, dibenzo[a,h]anthracene, and benzo[b]fluoranthene; and
- For the future on-unit resident (adult/child and child) and occupational worker: Prevent ingestion, dermal contact, and inhalation of groundwater from constituents with concentrations that minimally and infrequently exceed MCLs.

The preferred alternative for the SRWU OU consisted of Institutional Controls with groundwater monitoring (WSRC 1997). The confirmatory groundwater monitoring program was established in 1998 to ensure that chosen remedy was appropriate for this OU. Sampling was conducted semi-annually. The groundwater monitoring program was discontinued in 2003 after no COCs were detected above MCLs between 2000 and 2003. Per the ESD (WSRC 2005), the groundwater monitoring program was discontinued in 2003.

Remedy Implementation

Implementation of the SRWU OU remedial action included:

- Establishment of a maintenance program for the 2.2-hectares (5.5-acres) existing native soil cover;
- Installation of two new and one replacement groundwater monitoring wells;
- Posting of four warning signs; and
    - Establishment of land use controls for 2.2 hectares (5.5 acres) to include: (1) use of existing SRS access controls to maintain the use of this site for industrial use only; (2) in the long-term if the property ever is transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner,

which would include information needed for compliance with Section 120(h) of CERCLA, and would prepare, certify, and record a survey plat of the area.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activity has been discontinued:

- Confirmatory groundwater monitoring program

The following maintenance activities are ongoing:

- Semiannual site inspections and site maintenance (repair of erosion damage, maintenance of native soil cover, mowing, and warning signs); and
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit).

The operation and maintenance (O&M) costs associated with the selected remedy for the SRWU OU includes the semiannual inspections and institutional controls. The O&M cost has a ROD estimated present worth of $18,060 discounted at 7% per year for 30 years. The total actual O&M cost from the start of O&M in FY98 until FY11 is $297,411. The actual O&M costs (Table YY-3) over the last five years are higher than expected because the O&M cost estimate was based on a small area being maintained in comparison to the 15 acres that are currently under O&M activities. The additional area allows for a grass-covered access road along the perimeter of the waste unit.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedial actions at SRWU OU are protective and therefore the site is protective of the human health and the environment. The original remedy has been modified through an ESD (WSRC 2005) to discontinue the confirmatory groundwater monitoring program. An evaluation of the groundwater monitoring program has indicated that the monitoring is no longer required as the RGs for groundwater have been reached. Per the ESD, the groundwater portion of

the OU will not be included in the five-year review (WSRC 2005). The institutional controls, included in the original remedy, will still be required for the SRWU OU soils.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implemented remedial action is being maintained;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment YY-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 24, 2012 and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The SRWU OU was inspected by SRNS and USDOE personnel on August 16, 2012 and September 12, 2012. No issues were identified for the SRWU OU during this inspection and interviews.

On January 30, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding the site were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as demonstrated below:

- The selected remedies of maintenance of the native soil cover and institutional controls are effective in preventing ingestion, inhalation, and dermal contact with contaminants. The maintenance procedures and institutional controls (i.e. land use controls), including access controls and field walk-downs currently implemented,

continue to maintain the effectiveness of the institutional controls response action. The main findings identified during review of the semiannual field inspections were vegetation needing mowing, the drainage ditch needing clearing, and active ant mounds. All findings were addressed in a timely manner. Historical data do not indicate a history of remedy problems or potential remedy failure, which could place protectiveness at risk. An opportunity for system optimization was identified during this review. Based on the lack of findings that would suggest remedy problems and the modeling results indicating the remaining contaminants are not migration hazards, it is recommended that the inspection frequency be reduced from semi-annual to annual. No other actions are indicated that are necessary to ensure that immediate threats have been addressed. A 2012 photograph of the SRWU is provided in Figure YY-4.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD that call into question the protectiveness of the remedy.

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

Recommendations and follow-up actions concerning SRWU OU are listed in Table YY-4.

X. Protectiveness Statement(s)

The remedy at SRWU OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are controlled by the institutional controls (i.e., land use controls). All threats to contaminated soil 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 SRWU 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

The next five-year review is scheduled for no later than January 2019.

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, 1996a. *Final Baseline Risk Assessment for the Silverton Road Waste Unit (U*), WSRC-RP-95-215, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1996b. *Final RFI/RI Report for the Silverton Road Waste Unit (U)*, WSRC-RP-95-214, Revision 1.2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997. *Record of Decision Remedial Alternative Selection for the Silverton Road Waste Unit (731-3A) (U),* WSRC-RP-96-171, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1998. *Final Remediation Report for the Silverton Road Waste Unit (73 1 -3A) (U),* WSRC-RP-97-153, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 2003. *Technical Evaluation for Groundwater Monitoring at the Silverton Road Waste Unit (731-3A) (U)*, WSRC-RP-2003-4037, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005. *Explanation of Significant Difference (ESD) to the Revision 1 Record of Decision Remedial Alternative Selection for the Silverton Road Waste Unit (731-3A) (U)*, WSRC-RP-2004-4092, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various – Inspection Data Sheets - *Field Inspection Checklists for the Silverton Road Waste Unit (731-3A)*, ER-IDS-019-001, Inspection Period 2007 through 2011 (semiannually)

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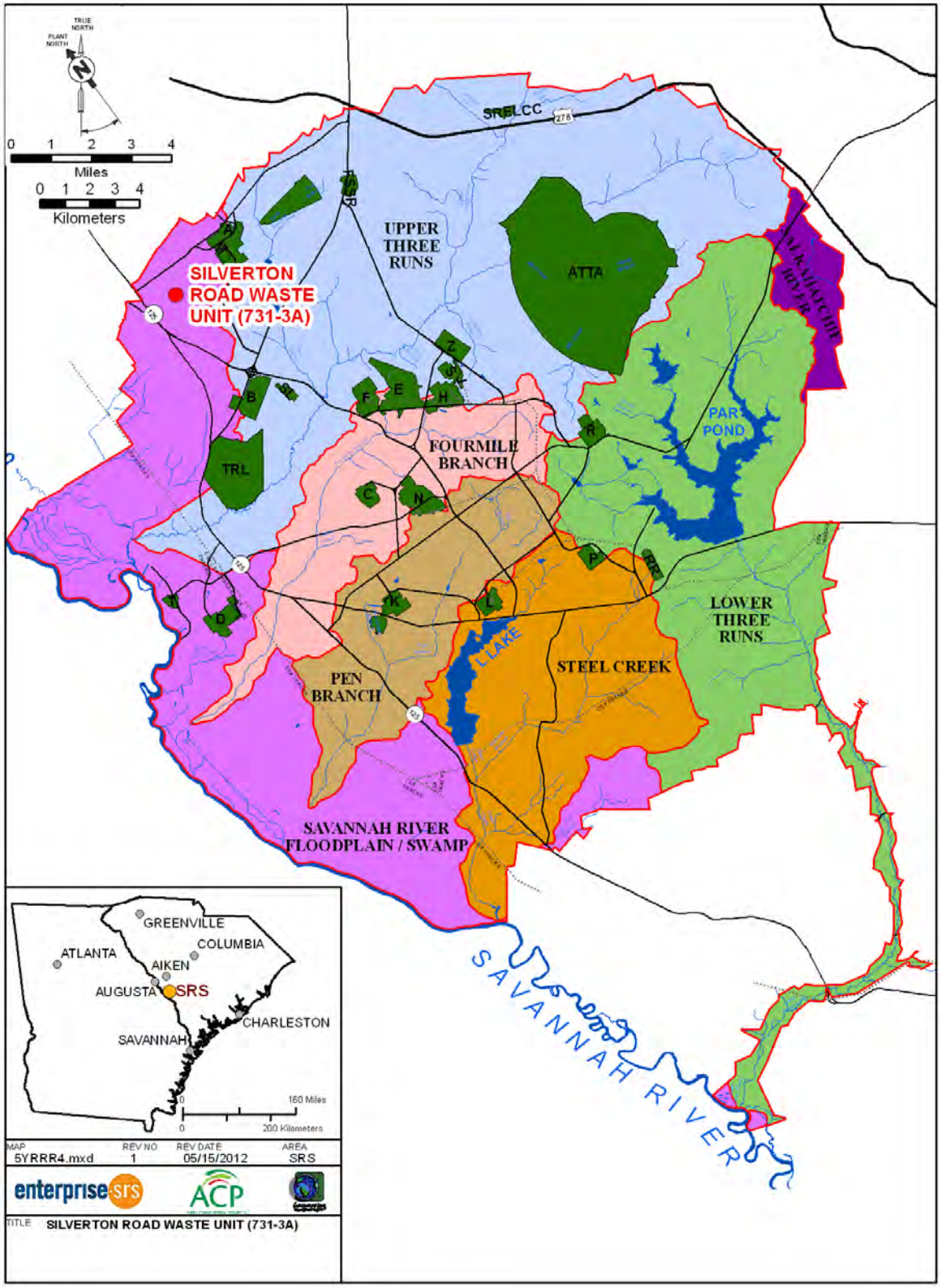


Figure YY-1. Location of the Silverton Road Waste Unit

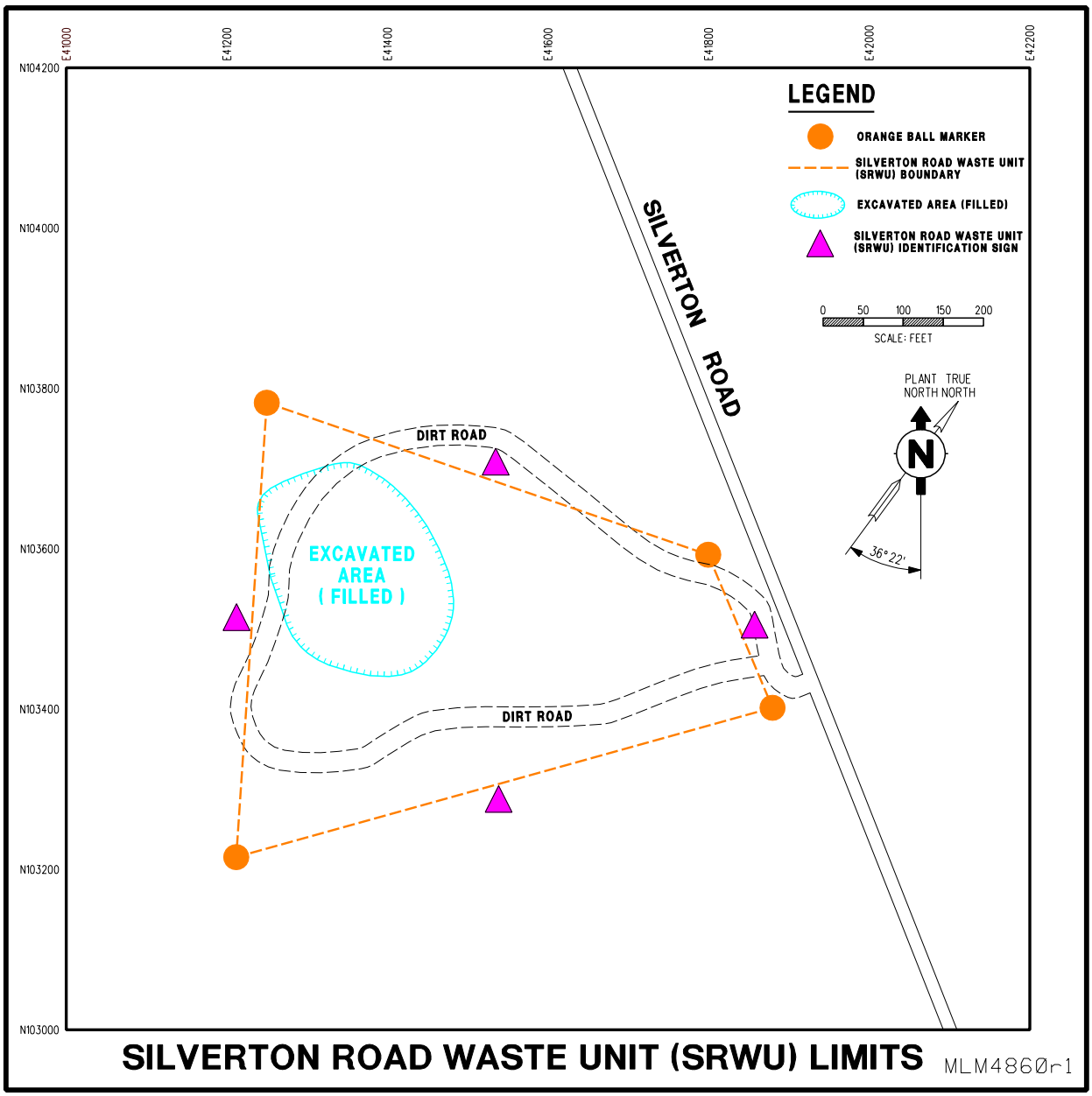


Figure YY-2. Layout of the Silverton Road Waste Unit (SRWU)



Figure YY-3. Aerial Photos before Remediation (left photo is western sector and right photo is eastern sector)



Figure YY-4. Current Photo of the Silverton Road Waste Unit OU

Table YY-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	1993 / August 21, 1996
Record of Decision (ROD) Issuance	April 22, 1997
Remedial Action Start/Complete	July 7, 1998/ September 9, 1998
Approval to Shutdown Groundwater Monitoring received	June 17, 2003
Explanation of Significant Difference (ESD) to the ROD Issuance	June 16, 2005
Previous Five-year Reviews	June 30, 1997 / February 12, 2004 / February 4, 2009

Table YY-2. COCs and RGOs for 1E-06 Risk to Future Occupational Worker at SRWU OU

Medium	COC	RGO	Units
Soil	Arsenic	3.8	mg/kg
	Benzo[a]pyrene	0.78	mg/kg
	Dibenzo[a,h]anthracene	0.78	mg/kg
	Cesium-137	0.0833	ρCi/g
Groundwater	Arsenic	1.6E-04	mg/L
	Aldrin	1.7E-05	mg/L
	Bis(2-ethylhexyl)phthalate	4.8E-03	mg/L
	Carbon tetrachloride	2.9E-03	mg/L
	Dieldrin	1.8E-05	mg/L
	Thallium	2.3E-03*	mg/L
	Radium-226	1.3	ρCi/L
	Radium total	1.6	ρCi/L
	Thorium-228	16.0	ρCi/L

* Hazard index of 0.1.

Table YY-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$8,000	$9,100	$5,300	$6,000	$5,200	$33,600
Total ROD Estimated Direct O&M Costs	$3,500	$500	$500	$500	$500	$5,500

*Source of estimate: The ROD (WSRC 1997) provides a total present worth of $18,060 for SRWU. The total present worth estimate was divided into a $2,000 capital cost for surveys, signs and deed records, $8000 for 6 FYRs and $2,060 for 30 years of inspections and maintenance were based on similar estimates during that time. Using a standard present worth formula, the annual cost of site inspections and maintenance was calculated to be equal to $500 based on 30 years of site maintenance and a 5% discount rate. Similarly, a present worth analysis was used to convert the FYR estimated total present worth cost into six unit costs of $3,000 for each of the five-year ROD reviews.

Table YY-4. Recommendations and Follow-up Actions

Issues	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Optimization of inspection	Request change to the inspection frequency from semiannual to annual via USDOE letter to the USEPA and SCDHEC to be sent within 45 days of final regulatory approval of the Fourth Five Year Remedy Review Report	USDOE	USEPA/ SCDHEC	9/30/2014	N	N

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit

I. SITE INFORMATION			
Site Name:	**Silverton Road Waste Unit (731-3A) Operable Unit**	**Date of Inspection:**	**08/16/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #13**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**93°F and sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/24/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached _____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☒ O&M Manual	☒ Readily Available	☒ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for Silverton Road (731-3A)*, ER-IDS-019-001._____

_____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks: Groundwater monitoring ceased in 2003.

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) 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.) Walk-through

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey wooden stakes were located. Several had been damaged due to control burn in the area.

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 YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) 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: Vegetation is mowed routinely.

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks:

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent _____
☐ Ponding	☐ Location shown on site map	Areal extent _____
☐ Seeps	☐ Location shown on site map	Areal extent _____
☐ Soft subgrade	☐ Location shown on site map	Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
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)
1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement Areal extent_____ Depth_____ Remarks:_____
2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation Material Type_____ Areal extent_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion Areal extent_____ Depth_____ Remarks:_____
4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks:_____
5. Obstructions: Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks:_____
6. Excessive Vegetative Growth: Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks:_____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☐ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☐ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☒ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment YY-1. Five-Year Review Site Inspection Checklist – Silverton Road Waste Unit (731-3A) Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.).

The remedy for this OU is institutional controls with a period of groundwater monitoring (ceased in 2003). A summary report, including data and interpretation was submitted to SCDHEC, DOE, and USEPA following each monitoring event. During five consecutive monitoring and reporting cycles over the last five years, none of the constituents of concern exceeded its MCL; therefore, in 2003, SCDHEC, DOE, and USEPA concurred with terminating the groundwater monitoring. There are no issues requiring corrective actions.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M procedures consisting of semi-annual site inspections and site maintenance (verify no invasive activities have occurred and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the waste unit and the condition of its warning signs is good. There are no issues requiring corrective actions.

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Recommendations for optimization are provided in Table YY-4.

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SRL Seepage Basins Operable Unit

I. Introduction

This report is the third five-year review for the Savannah River Laboratory Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) (SRLSB) Operable Unit (OU). The review was conducted from August 2012 through September 2012. Contaminants have been left in place at the SRLSB OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the SRLSB OU is protective of human health and the environment. This report documents the results of the review

II. OU Chronology

Table ZZ-1 lists the chronology of site events for the SRLSB OU.

III. Background

SRLSB OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the SRLSB OU is soil.

Physical Characteristics

The SRLSB OU is located within the northwestern section of SRS, approximately 1,200 m (4,000 ft) from the nearest SRS boundary and 1,350m (4,500 ft) from the nearest residence (Figure ZZ-1). The SRLSB OU consists of four seepage basins, designated as Seepage Basins 1 through 4, and a process sewer pipeline (Figure ZZ-2). The four basins lie within the northern portions of the A/M Area, northeast of Savannah River Ecology Laboratory and southeast of the Savannah River National Laboratory (SRNL). The settings to the north, east, and south of the basins are wooded. Tims Branch is located north of the basins and an unnamed intermittent stream is immediately east of them. The

area to the west is cleared and vegetated with low grasses. The four basins (Figure ZZ-2) had an approximate depth of 3.6 m (12 ft), and covered a total area of approximately 0.87 hectares (2.15 acres). The total capacity of the basins is 2,605 m^3 (688,200 gal). A berm of undisturbed soil separated each of the four basins. The four basins were connected by a series of sequential overflow channels designed to receive wastewater by overflow from Basin 1 (904-52G) to Basin 2 (904-53G) to Basin 3 (904-54G) and then to Basin 4 (904-55G).

Wastewater was conveyed from Building 776-A (SRNL) to the west end of Basin 1 through a vitrified clay process sewer pipe. The line was constructed in conjunction with Basins 1 and 2 for start of operation in 1954. There is no surface water within the boundaries of the SRLSB.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a) designates SRLSB OU as being within the site industrial support area. The future land use for SRLSB OU is reasonably anticipated to remain industrial with the U.S Department of Energy (USDOE) maintaining control of the land.

History of Contamination

Basins 1 and 2 were placed into operation in 1954, and Basins 3 and 4 were added in 1958 and 1960, respectively (WSRC 1999b). The basins were used from 1954 to 1982 to dispose of low-level radioactive liquid waste generated in the SRNL laboratories (735-A and 773-A). The laboratory-derived, low-level liquid waste was stored in Building 776-A waste tanks until the activities was confirmed to be below 100 dpm/mL alpha and/or 50 dpm/mL beta-gamma. Waste meeting this transfer criterion was then sent via the process sewer line to Basin 1. Figures ZZ-3 and ZZ-4 present photographs of the SRLSB OU before remediation and as they currently look (2012).

During the 28 years of operation, the basins received 1.2 million m^3 (340 million gal) of wastewater, or about 42,960 m^3/yr (12.1 million gal/yr). There is no record of overflow out of the basins and no account of any local ground surface seeps. The wastewater seeped into the ground within the basins as designed.

Initial Response

Over the years, large trees had grown in and around the basins. A CERCLA removal action for removal of the vegetation at the SRLSBs was performed in 1997. The vegetation was stored and covered with geotextile material in Basins 2 and 4 until disposal at the SRS E-Area Low-Level Waste Disposal Facility (LLWDF) in October 1999. Disposal of this contaminated vegetation was not a part of the SRLSB OU remedial action, but was performed as a separate action under USDOE removal action authority.

Basis for Taking Action

Analytical data collected for the Remedial Facility Investigation/Remedial Investigation (RFI/RI) Baseline Risk Assessment (BRA) and Focused Corrective Measures Study/ Feasibility Study (CMS/FS) (WSRC 1998) indicate that significant impacts to the soil media associated with the SRLSB had occurred from both radiological and inorganic contaminants. Major radionuclide contaminants detected in the soil at SRLSB OU include actinium-228, cesium-137, cobalt-60, curium-243/244, radium-228, thorium-228, and uranium-238. The primary inorganic contaminants are mercury, silver, vanadium, and chromium. Process knowledge suggests that no significant quantities of chlorinated organics were discarded into the SRLSB OU.

As determined in the RFI/RI/BRA/CMS/FS, SRLSB operations and resulting soil contamination have not significantly impacted groundwater. The fate and transport analysis does not predict future impacts to the groundwater from the contaminants within the SRLSB OU. Therefore, groundwater is not a media of concern. Additionally, there are no contaminant migration (CM) constituents of concern (COCs) as indicated by contaminant migration modeling.

The final list of human health COCs for the future industrial worker scenario includes 18 radionuclides and two metals (Table ZZ-2). Only one ecological COC, chromium, was determined. Remedial goals (RGs) were established for the industrial worker scenario based on a risk of 1 x 10^{-6}, or a hazard quotient (HQ) of 1.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 1999b), the remedial action objectives (RAOs) for the SRLSB OU are as follows:

- Eliminate exposure of the future industrial worker to radiochemical constituents, mercury, and chromium in the soils of SRLSB OU;
- Remove all principal threat source material (PTSM) (soil above 1 x 10^{-3} industrial worker health risk level) from Basins 1, 2, and 3; and
- Reduce risk to soil invertebrates from the ingestion of chromium in the surface soils of Basin 1.

As stated in the ROD (WSRC 1999b), the selected remedy for the SRLSB OU was to excavate soil above 1 x 10^{-3} industrial risk (principal threat source material), dispose at an off-SRS site, such as Envirocare of Utah, Inc., place an earthen cover over all four basins, and use institutional controls to maintain future industrial land use only.

Remedy Implementation

Implementation of the selected remedy at SRLSB OU included the following activities:

- Removal of 4,740 m^3 (6,200 yd^3) of PTSM soil by (1) excavation of approximately 1.2 m (4 ft) from the bottom of Basins 1, 1.5 m (5 ft) from the bottom of Basin 2, and 0.6 m (2 ft) from the bottom of Basin 3, and 0.3 m (1 ft) from all of the berms in the three basins; (2) excavation of the process sewer pipeline and the soils 0.3 m (1 ft) below and 0.45 m (1.5 ft) on each side of the pipeline from Basin 1 to the first

manhole; and (3) packaging all job control waste and transporting to Envirocare of Utah, Inc., a low-level waste disposal facility.

- Performing confirmatory soil samples to verify all PTSM soil was removed.
- Backfilling the process sewer trench and all four basins (2.1 acres) with clean soil to a depth between 2.7 m (9 ft) and 5.7 m (19 ft) and sloped to provide proper stormwater drainage. The top 15 cm (6 in) of the vegetative layer contained topsoil, fertilizer, lime, seed and mulch.
- Established land use controls (LUCs) for 1 hectare (2.56 acres) including physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the SRLSB OU for industrial use only, and warning signs and site use restrictions via the SRS Site Use/Site Clearance Program, for the SRLSB OU.
- Conducting maintenance and maintaining institutional controls (i.e., LUCs) of the covered basins to prevent unauthorized access.

Systems Operations/Operation and Maintenance

There are no system operational requirements. The following maintenance activities are ongoing:

- Annual site inspections and site maintenance (i.e., soil cover maintenance, repair of erosion damage, and warning signs);
- Site controls and land use restrictions via the SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the SRLSB OU.

The ROD (WSRC 1999b) estimated operation and maintenance (O&M) cost associated with the selected remedy is $80,000. This is a present worth cost, including 30 years of maintenance activities. The total actual O&M cost from O&M start in fiscal year 2002 to fiscal year 2011 is $39,621. The actual O&M costs (Table ZZ-3) are as expected.

V. Progress Since Last Review

The previous protectiveness statement concluded that because the remedial actions at SRLSB OU are protective, the site is protective of human health and the environment. The implementation of institutional controls, including controlled access to SRLSB OU is protective of human health and the environment. Exposure pathways that could result in unacceptable risks have been controlled through soil excavation and disposal at an off-SRS CERCLA-approved facility, backfilling the area to grade with clean soil, re-vegetation of the area and institutional controls (i.e., LUCs).

There were no recommendations or follow-up actions from the last five-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Inspected the OU and documented the results on the Inspection Checklist provided in Attachment ZZ-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls;
- Ensured that all actions required under the RCRA Permit were implemented; and
- Reviewed changes in standards and to-be-considered guidance.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 31, 2012 at the SRLSB OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The SRLSB OU was inspected by SRNS and USDOE personnel on September 17, 2012. No issues were identified for the SRLSB OU during this inspection and interviews.

On January 22, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The removal of contaminated soil (PTSM) and the installation of soil covers are effective in preventing human health and ecological exposure to residual contaminated basin soils.

- The cover system maintenance program and LUCs have been effective in maintaining the integrity of the cover system and preventing human and ecological exposure. The annual inspection reports indicate no visible signs of erosion, signs are legible, and Administrative Controls are still in place.

  Land use controls include physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the SRLSB OU for industrial use only, and warning signs and site use restrictions via the SRS Site Use/Site Clearance Program for the SRLSB OU. The Land Use Control Implementation Plan for SRLSB OU is included as Appendix A of the *Corrective Measure Implementation Report/Post-Construction Report/ Final Remediation Report (CMIR/PCR/FRR)* and governs LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2001). All LUC objectives are being met.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or physical conditions of the SLRSB OU that would affect the protectiveness of the remedy.

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 SRLSB OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated soil media. Threats from contaminated soil at the SRLSB OU have been addressed through excavation of PTSM soil and installation of the soil cover, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the SRLSB OU for industrial use only, and warning signs and site use restrictions via the SRS Site Use/Site Clearance Program.

XI. Next Review

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1998. *RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment and Focused Corrective Measures Study/Feasibility Study for the SRL Seepage Basins Operable Unit (904-53G, -54G, and –55G) (U)*, WSRC-RP-97-846, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999a. *Land Use Control Assurance Plan for the Savannah River Site*, WSRC-RP-98-4125, Revision 1.1, March 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

WSRC, 1999b. *Record of Decision, Remedial Alternative Selection for the SRL Seepage Basins Operable Unit (904-53G1, -53G2, -54G and –55G) (U)*, WSRC-RP-97-848, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2001. *Corrective Measure Implementation Report/Post-Construction Report/ Final Remediation Report (CMIR/PCR/FRR) for Closure of SRL Seepage Basins Operable Unit (904-53G, -53G, -54G, and -55G) (U)*, WSRC-RP-2001-4123, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

Various – Inspection Data Sheets - *Field Inspection Checklist for SRL Seepage Basins*, ER-IDS-019-011, Inspection Period 2007 through 2011 (annually)

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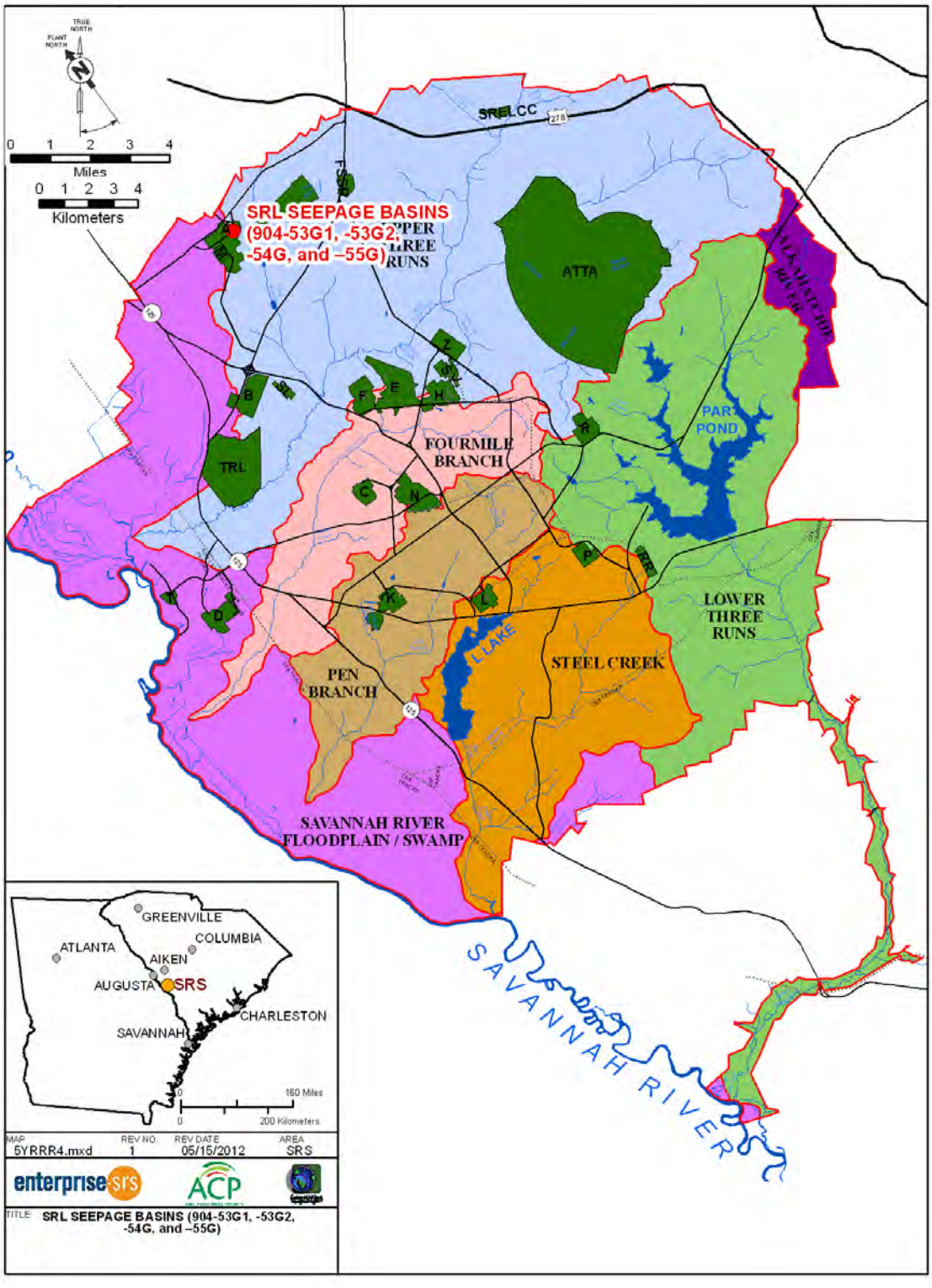


Figure ZZ-1. Location of the SRL Seepage Basins at SRS



Figure ZZ-2. Layout of the SRLSB OU (904-53G, -53G, -54G, and -55G) after Construction Completion August 2001



Figure ZZ-3. Photo of SRLSB OU Before Remediation Activities



Figure ZZ-4. Current Photo of the SRLSB OU (2012)

Table ZZ-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	September 25, 1996/ May 27, 1997
Removal Action Start / Complete (Trees Only)	July 28, 1997 / December 9, 1997
CERCLA Removal Action Start / Complete	August 22, 1997 / October 15, 1997
Record of Decision (ROD) issuance	March 15, 2000
Remedial Action Start / Complete	December 8, 1999 / August 20, 2003
Previous Five-Year Reviews	February 12, 2004 / February 4, 2009

Table ZZ-2. COC for SRL SB OU

SRL SB Subunit	Human Health COCs	Ecological COCs	Contaminant Migration COCs
Basin 1	Actinium-228, Americium-241, Cesium-137, Cobalt-60, Curium-243/244, Lead-2 12, Potassium-40, Radium-228, Plutonium-238, Plutonium-239/240, Strontium-90, Thorium-228, Thorium-230, Thorium-232, Uranium-233/234, Uranium-235, Uranium-238, Mercury, Chromium (Hexavalent).	Chromium	None
Basin 2	Actinium-228, Americium-241, Cesium-137, Cobalt-60, Curium-243/244, Neptunium-239, Potassium-40, Radium-228, Plutonium-238, Plutonium-239/240, Strontium-90, Thorium-228, Uranium-233/234, Uranium-235, Uranium-238, Mercury	None	None
Basin 3	Cesium- 137, Cobalt-60, Curium-243/244, Neptunium-239, Strontium-90, Uranium-235, Uranium-238	None	None
Basin 4	Cesium- 137, Cobalt-60, Curium-2431244, Radium-228, Strontium-90, Thorium-228, Uranium-235, Uranium-238	None	None

Table ZZ-3. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$6,800	$7,700	$4,100	$4,200	$3,600	$26,600
Total ROD Estimated Direct O&M Costs	$18,000	$3,000	$3,000	$3,000	$3,000	$30,000

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Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)

I. SITE INFORMATION			
Site Name:	**SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)**	**Date of Inspection:**	**05/31/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #47**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**83°F and partly cloudy**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Excavation, off-site disposal

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 05/31/2012 (Date)

Interviewed: ☐ At Site ☐ At Office ☒ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☐ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for SRL Seepage Basins*, ER-IDS-019-011._____

_____

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Continued)*

2. Health and Safety Plans (HASPs):

☐ Site-Specific Health and Safety Plans	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Contingency Plan/Emergency Response Plan	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: Routine O&M activities do not require a SSHASP under 29 CFR 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

IV. O&M COSTS

1. O&M Organization:

☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

2. O&M Cost Records:

☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place
☒ Other: Project cost data is summarized in Section IV of this OU-specific review.

Total annual cost by year for review period, if available

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: Fencing at this site is in good condition.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition.

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walk-through

Frequency: Once in 5 years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Karen Adams (Name) | Federal Project Director (Title) | 09/17/12 (Date) | 803-952-7871 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A

Violations have been reported: ☐ Yes ☐ No ☒ N/A

Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Survey monuments located and in good condition.

D. General

1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: Roads at this site are in good condition.

B. Other Site Conditions

Remarks:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress

Areal extent Depth

Remarks: Vegetation is mowed routinely.

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks: _____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent _____ Depth _____

Remarks: _____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

- ☐ Wet areas ☐ Location shown on site map Areal extent _____
- ☐ Ponding ☐ Location shown on site map Areal extent _____
- ☐ Seeps ☐ Location shown on site map Areal extent _____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent _____

Remarks: _____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☒ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)*:
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☒ Deformation not evident
Remarks:

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks:

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent Type
Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks:

4. Discharge Structure: ☐ Location shown on site map ☒ N/A
Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident
Areal extent Depth
Remarks:

2. Performance Monitoring:
Type of Monitoring ☐ Performance not monitored
Frequency ☐ Evidence of breaching Head Differential
Remarks:

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____
Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance
Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance
Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks:_____

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☒ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment ZZ-1. Five-Year Review Site Inspection Checklist – SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G) *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The removal of contaminated soil and the installation of soil covers have met the remedial action objectives of protecting human health and the environment by eliminating surficial soil exposure, and removing all principal threat source material. Residual contamination (at levels below 1x 10^{-3} risk) will remain in place. These actions combined with both short term and long term institutional controls will eliminate any risk to the industrial worker. Selected remedies for the SRLSB are functioning as intended. There are no issues requiring corrective actions.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover system, fencing, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the physical integrity of the soil cover, the condition of the warning signs are good. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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T-AREA OPERABLE UNIT

I. Introduction

This report is the second five-year review for the T-Area Operable Unit (TAOU). This review was conducted from August 2012 through September 2012. Contaminants have been left in place at the TAOU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the TAOU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table AAA-1 lists the chronology of site events for the TAOU.

III. Background

The TAOU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media of concern is soil and concrete.

An area-based remedial strategy has been implemented in T Area. The TAOU incorporates all of the applicable OUs, Site Evaluation Areas (SEAs), and the dismantled facilities of the T-Area footprint and the TNX Swamp except the remedial actions of the TNX Area Groundwater OU, which include the TNX Burying Ground (TBG) SVE and associated TNX-Area Groundwater air stripper.

Physical Characteristics

TAOU is located in the southwestern portion of SRS, approximately (0.4 km (0.25 mi) east of the Savannah River (Figure AAA-1). TAOU incorporates most of the T-Area footprint (Figure AAA-2) and the TNX Swamp. The TAOU is approximately 26.8 hectares (66 acres). T Area was used in the development and testing of processes, facilities, and equipment for various SRS programs. Constructed in 1950, T Area included three main buildings: Pilot Plant Building (677-T), Chemical Semi-Works

Building (678-T), and Engineering Text Facility (679-T). After 1978, the T Area was expanded to include over 30 buildings (Figure AAA-2), comprising office administrative buildings, process buildings for large-scale experimental demonstrations, laboratories for research and analytical purposes, pilot-scale facilities, bulk tank storage, industrial wastewater processing facilities, and warehouse storage for a wide range of chemicals and specialty equipment. All of the facilities in T Area have been dismantled and removed (Figure AAA-3) with the following exceptions: the Semiworks Waste Tank Mock-Up Facility (678-5T) and ancillary structures, the Telecommunications Building (702-T), the 906-T Air Stripper, and a soil vapor extraction (SVE) system. Operation of the air stripper and the SVE system was discontinued in December 2007 through present. After completion of the engineered cap, the conventional mobile SVE system was replaced with five MicroBlowers™, which began operating in January 2007 (Figure AAA-4). T-Area Tile Fields (TTF) 1, 2, and 3 were part of a sanitary sewer system previously closed under the TNX Septic System Closure Plan.

The TNX Swamp was not used in T-Area industrial processes; however, it was used routinely to manage surface runoff and stormwater. The TNX Swamp was divided into four subunits: the Outfall Delta (OD), the Inner Swamp (IS), the High Ground Swamp, and the Outer Swamp. The TNX Swamp, and the Lower Discharge Gully (LDG) and Swamp Operable Unit (OU) are included as part of the TAOU.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates the TAOU as being within the site industrial support area. The future land use for TAOU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The contamination requiring action at the TAOU is a result of T-Area industrial processes, waste management practices, and an industrial accident during facility

operations. Within the industrial area, the contamination is related to leaks from industrial processes and disposal facilities such as tile fields, burying grounds, and seepage basins. In the TNX Swamp, the contamination resulted from a release of process water and entrained sediment from the Old TNX Seepage Basin down the topographic slope and into the swamp.

The X001 Outfall received water from a sump located outside of building 677-T that contained radiologically contaminated equipment.

Initial Response

Multiple actions have occurred within T Area and are summarized in Table AAA-2. Those media addressed under the TAOU ROD are identified in Column E of the table. The TNX groundwater is being addressed under the TNX Area OU, Appendix BBB of this document.

Three removal actions were performed in 2005 for waste consolidation under the TAOU cover system per the Removal Action Reports:

- Outfall Delta and Inner Swamp Soil was excavated to a 0.3-m (1-ft) depth (406 m^3 [531 yd^3]) to remove soil containing thorium-238 in excess of 35 pCi/g and backfilled to grade (WSRC 2007);
- X001 Outfall Drainage Ditch was excavated to a 1.2-m (4-ft) depth over 0.4 hectare (0.1 acre) (191 m^3 [250 yd^3]) to remove soil containing uranium-238 and Aroclor 1260 in excess of 1.79 pCi/g and 10 mg/kg, respectively (WSRC 2005a); and
- Tile Field 2 was excavated to 3 to 3.6 m (10 to 12 ft) in depth (574 m^3 [750 yd^3]) to remove a vitrified clay sewer line and soil containing mercury above the remedial goal (RG) of 0.078 mg/kg (WSRC 2007).

All contaminated material was stockpiled in the industrial portion of T Area waiting for final placement under the TAOU cover system.

Basis for Taking Action

A release of hazardous and radiological substances to the environment occurred at the TAOU, resulting in soil and sediment contamination (Table AAA-3). Soil contaminants include mercury, tetrachloroethene, a polychlorinated biphenyl (Aroclor 1260), cesium-137, and uranium/thorium decay chain radioisotopes. Sediment contaminants include uranium/thorium decay chain radioisotopes (actinium-228, lead-212, radium-228, thorium-228, uranium-233/234, uranium-235, and uranium-238).

The following potential risks associated with unrestricted land use are the basis for taking action at the TAOU:

- Exposure and possible contaminant migration risks from soil and sediment with residual uranium/thorium decay series radioisotope contamination in the TNX Outfall Delta OU;
- Exposure and contaminant migration risks in the TBG from soils contaminated with mercury, PCE, and uranium/thorium decay series radioisotopes;
- Uncertainties associated with soils contaminated with uranium/thorium decay series radioisotopes that pose a potential contaminant migration threat from the TNX Area Process Sewer Lines;
- Soil contaminated with uranium/thorium decay series radioisotopes and stockpiles in the TAOU and present exposure or contaminant migration risks;
- Remaining building slabs that have metals or uranium/thorium decay series radioisotopes contamination on concrete slabs or in soils that may pose an exposure risk; and
- Uncertainty with potential under-slab soil contamination of metal or uranium/thorium decay series radioisotopes that may pose a future contaminant migration risk. This includes the residual soil contamination at Neutralization Sump 678-T.

IV. Remedial Actions

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 2005b), the remedial action objectives (RAOs) for the TAOU are as follows:

- Ensure that the future land use in the industrial portion of T Area is restricted to industrial lands use and the future land use of the TNX Swamp is restricted to industrial buffer zone land use;
- Prevent exposure to contaminants that exceed target risk levels for receptors in the industrial portion of T Area;
- Prevent exposure to residual contamination in the Outfall Delta and Inner Swamp;
- Prevent contaminants in the industrial portion of T Area, the Outfall Delta, and the Inner Swamp from leaching to groundwater and impacting groundwater above maximum contaminant levels (MCLs); and
- Prevent exposure to ecological receptors.

As stated in the ROD (WSRC 2005b), the following remedies were selected for TAOU to meet the RAOs:

- Placement of a low permeability cap with an effective soil hydraulic conductivity of less than 1x10-8 cm/sec over contaminated soils, contaminated debris and building slabs that had been left in place, and contaminated soils excavated from T-Area facilities under previous removal actions and staged for placement beneath the cover
- Treatment of contaminated soil in T-Area swamp with soil amendments to attenuate the leachability of radiological contaminants in the soils. Soil amendments will be reapplied if long-term monitoring indicates that they are losing their effectiveness.
- Implementing institutional controls (i.e., land use controls [LUCs]) to manage the TAOU. These controls include access control for on-site workers via the Site Use and Site Clearance Programs; access controls against trespassers at the SRS boundary

including entry control systems, and security procedures; signage posted and maintained at the TAOU; and deed restrictions.

Remedy Implementation

The selected remedy met the RAOs at TAOU by implementing the following activities:

- Consolidation of 1,171 m^3 (1,531 yd^3) of contaminated soils excavated from T-Area facilities under previous removal action and placing beneath the cover for disposal.
- Placement of a 3.8-hectare (9.4-acre) low permeability cover system over contaminated soils, debris, and building slabs that had been left in place, and soils excavated from T-Area facilities. The cover system consists of the following layers: grading fill, 0.3-m (1-ft) thick structural fill, geosynthetic clay liner with an effective soil hydraulic conductivity of less than $1x10^{-8}$ cm/sec, geocomposite drainage layer, 0.45-m (18-in) thick common fill, 0.15-m (6-in) thick topsoil, and vegetation.
- In situ treatment of 2.4 hectares (5.8 acres) of the Outfall Delta and Inner Swamp by applying apatite at a rate of 1.5 tons per acre to the area where uranium exceeded its RG.
- Posted warning signs.
- Established institutional controls (i.e., LUCs) for 19.3 hectares (47.58 acres), which included installing access control warning signs along the perimeter (WSRC 2005c, WSRC 2007).

System Operations/Operation and Maintenance

There are no system operation requirements.

The following maintenance activities are ongoing as long as waste remains a threat to human health or environment:

- Annual site inspections for evidence of damage to the cover system due to erosion or intrusion by burrowing animals. The inspections also address upkeep of the vegetative cover and access control barriers (e.g., the warning signs).

- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.
- Institutional controls are being enforced to preclude access through the SRS Site/Use Site Clearance program and SRS site security (WSRC 2006).

The estimated operation and maintenance (O&M) costs associated with the selected remedy for TAOU, including O&M costs of the soil cover and institutional controls, has a present worth cost of $3,122,000 discounted at 3.9% per year for 100 years (WSRC 2005b). The actual O&M cost since the remedial action was completed in FY08 until FY11 is $271,800. The actual O&M costs (Table AAA-4) are as expected.

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedial actions at TAOU are expected to be protective, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The final remedial actions were not evaluated in the previous five-year review because the remedial action had just been completed. The final remedial actions of excavation, removal, and the backfilling of excavated areas along with institutional controls and contaminated soil consolidation under a low permeability geosynthetic cover system have now been installed and have been functioning properly.

There were no recommendations or follow-up actions from the last 5-year review.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section X11, Documents Reviewed;
- Confirmed implementation of the remedial action;
- Reviewed groundwater monitoring data to evaluate whether contaminants are leaching into groundwater above MCLs;

- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment AAA-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 effectiveness of both the low-permeability geosynthetic cover in the industrial portion of this OU and the soil amendments that were implemented in the Outfall Delta and Inner Swamp to prevent contaminants from leaching to groundwater above MCLs is evaluated through the groundwater monitoring conducted for the TNX-Area Groundwater Operable Unit (TNX OU). The annual Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Reports for monitoring years 2007 through 2011 (WSRC 2008, SRNS 2009, SRNS 2010, SRNS 2011, and SRNS 2012) were reviewed. The TNX monitoring well network consists of three background wells, eight primary wells, 18 auxiliary wells, five secondary wells, and four recovery wells, as of September 2011. These wells are monitored semiannually with the exception of those wells that may be dry due to water levels being below the screen zones or wells that are inaccessible due to high river water levels. Elevated concentrations of contaminants are mainly observed in groundwater near historical disposal sites. The primary contaminants that are present as defined plumes in the TNX groundwater include trichloroethylene and nitrate-nitrite (as nitrogen). The distribution of other constituents, including mercury, uranium, gross alpha, and radium, is minimal with the highest concentrations observed primarily in the vicinity of historical sites. The background wells do not have any occurrences of contaminants exceeding MCLs. For the period 2007 through 2011, the contaminant data were reviewed for mercury, uranium, gross alpha and combined radium-226 and radium-228 (Table AAA-3). Table AAA-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. As shown in Table AAA-5 only 5 monitoring wells out of the TAOU monitoring well network have had concentrations of

COCs greater than MCLs during the past 5 years. Of the wells identified in Table AAA-5, TCM5 is the only well located in the Outfall Delta/Inner Swamp, outside the industrial area for this OU. This provides evidence of a localized distribution of uranium and gross alpha in this region of the T-Area OU. The maximum uranium concentration in TCM5 was 77.7 µg/L in 2008 with the maximum concentration in 2011 being 51.5 µg/L. The remaining wells, identified in Table AAA-5, are located within the industrial portion of this OU (Figure AAA-5). The maximum mercury concentration (6.94 µg/L) occurred in well TNX27D in 2007 with all concentrations below the MCL in 2011. The maximum gross alpha concentration (38.8 pCi/L) occurred in well TNX3D in 2008; the maximum gross alpha concentration measured in 2011 (26.7 pCi/L) was from well TBG5. The maximum combined radium concentration (23.13 pCi/L) occurred in well TBG4 in 2008 with all concentrations below the MCL in 2011. No radionuclide, mercury, or uranium plumes were discernible during the 2007 through 2011 period. However, the concentration and extent of these constituents will continue to be monitored and compared to their respective MCLs.

Data for three CMCOCs, uranium-233/234, uranium-235, and uranium-238, were not available for review. These radionuclides are all alpha emitters; thus, gross alpha is a good indicator parameter for their presence. Due to the localized presence of gross alpha near TCM5 in the Outfall Delta/Inner Swamp area, it can be reliably inferred that any presence of these three radionuclides would be in this same area.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on July 24, 2012 and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The TAOU was inspected by SRNS and USDOE personnel on July 24, 2012 and October 22, 2012. No issues were identified for the TAOU during this inspection and interviews.

On January 22, 2013 a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The review of documents, applicable or relevant and appropriate requirements (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 Inner Swamp/ Outfall Delta 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 2007 through 2011 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 standards or 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 Inner Swamp/Outfall Delta, 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.

There have been minor changes in the PRGs for uranium-238, thorium-228 and radium-228 according to the 2012 PRGs. Only uranium -238 is identified as a CM COC. Based on the review of the groundwater data associated with this OU, these changes do not call into question the protectiveness of the remedy. The change in the standards for thorium-228 and radium-228, identified as human health COCs, does not affect the protectiveness of the remedy because the remedy has eliminated the exposure pathway.

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 Inner Swamp/Outfall Delta, 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

The next five-year review is scheduled for no later than January 2019.

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, March 2013, 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, Washington 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*)

WSRC, 2008. *2007 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U)*, WSRC-RP-2008-4040, Washington Savannah River Company, Savannah River Site, Aiken, SC.

SRNS, 2009. *2008 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U)*, SRNS-RP-2009-00593, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2010. *2009 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U)*, SRNS-RP-2010-00933, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2011. *2010 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U)*, SRNS-RP-2011-00980, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2012. *2011 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U)*, SRNS-RP-2012-00192, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

Various - *Inspection Data Sheets – Field Inspection Checklist, T-Area Operable Unit (TAOU) (U)*, ER-IDS-019-032, Inspection period: 2007 through 2011 (annually)

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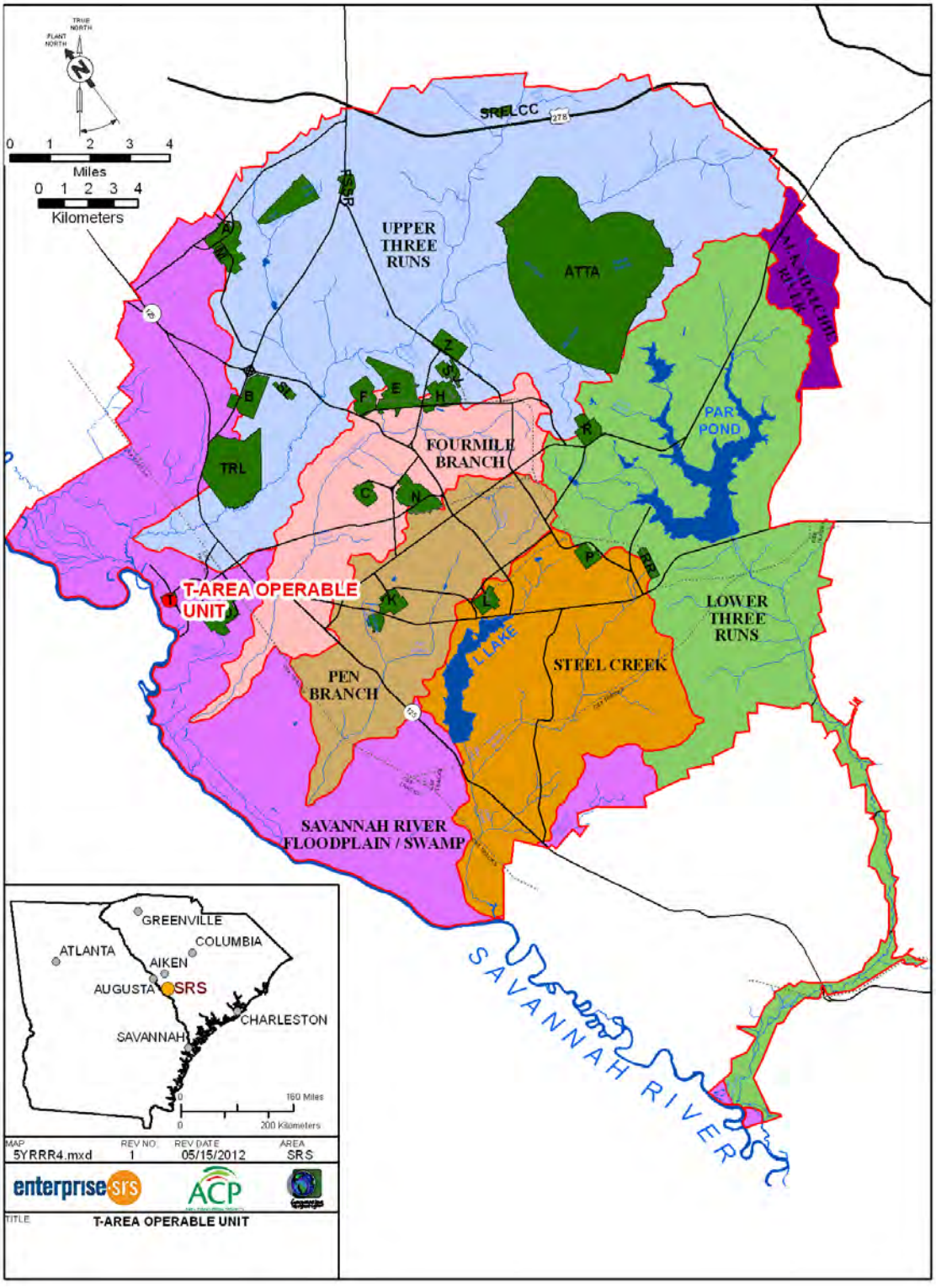


Figure AAA-1. Location of T Area within Savannah River Site

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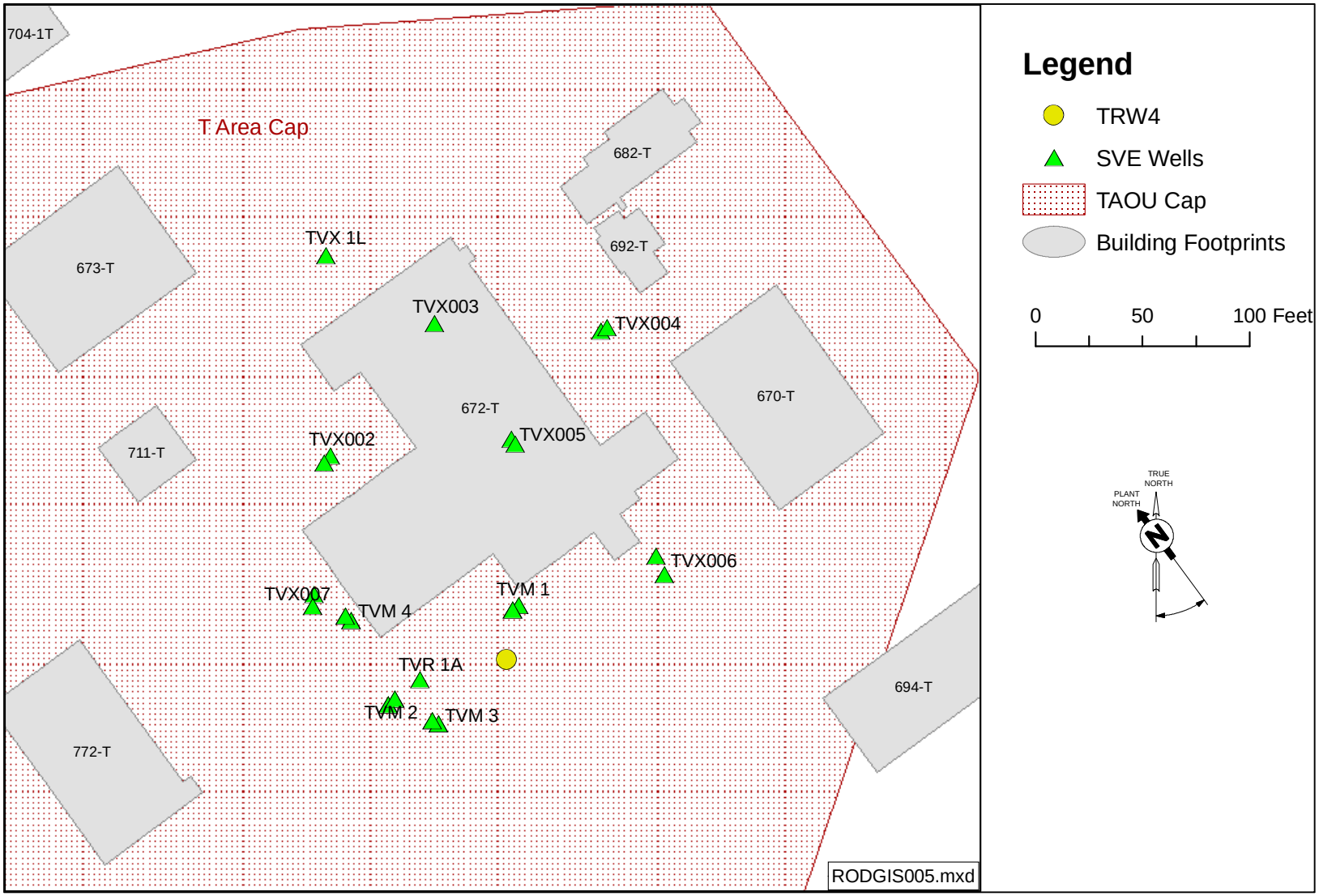


Figure AAA-2. T-Area Operable Unit Pre-Remedial Action Site Plan



Figure AAA-3. 2008 Aerial Photograph of T Area (TNX swamp to the right side of the photo)



Figure AAA-4. Typical MicroBlower™ installed at the TAOU

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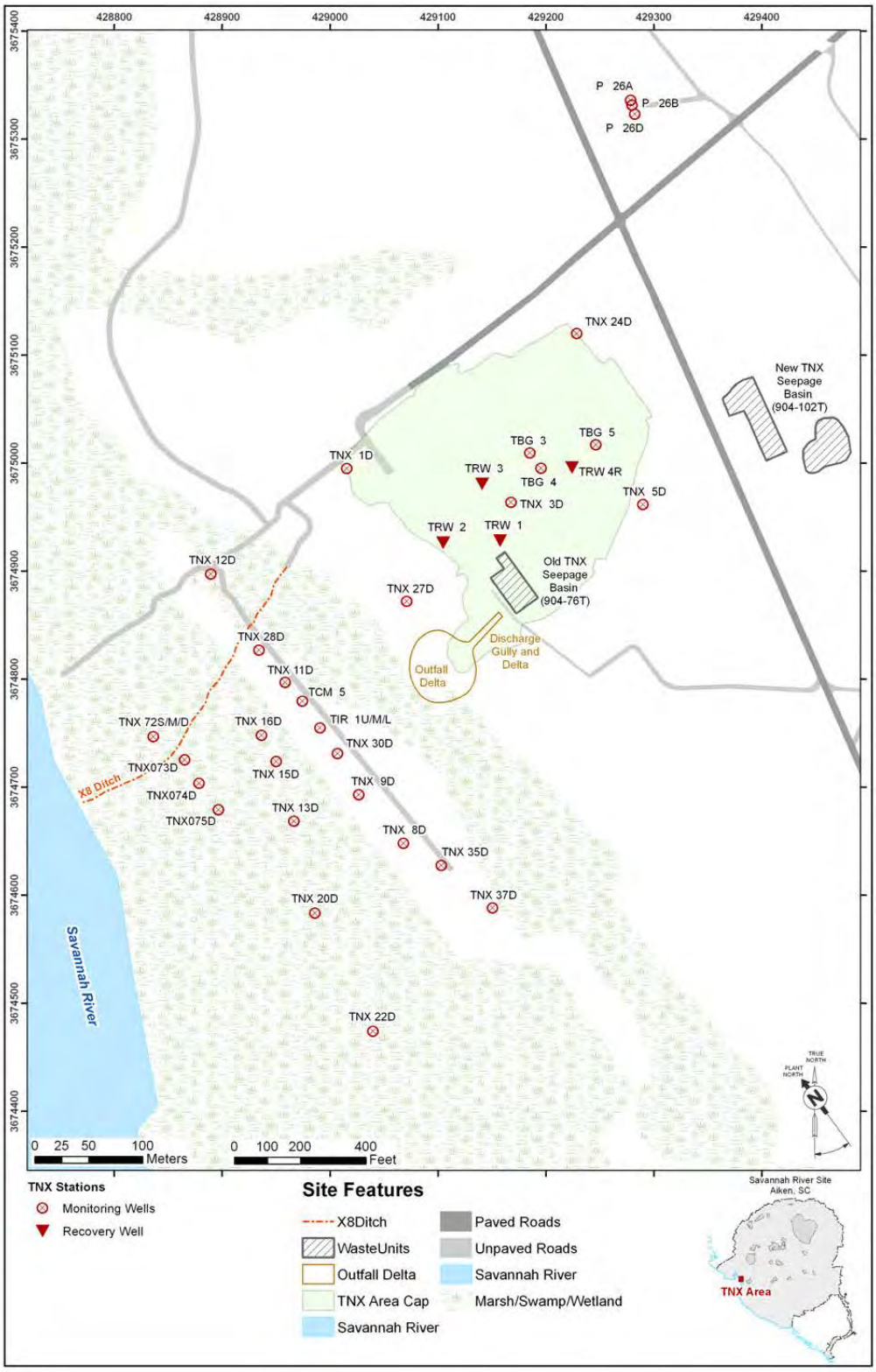


Figure AAA-5. TNX Area Well Location Map, 4Q 2011 (SRNS 2012)

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Table AAA-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	February 7, 1996 / April 1, 2005
Removal Actions (3) Start / Complete	August 17, 2004 / September 15, 2005
Final Record of Decision (ROD) Issuance	December 21,2005
Remedial Action Start/Complete	January 13, 2006 / November 15, 2006
Previous Five-Year Reviews	February 4, 2009

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Table AAA-2. Summary of the Remedial Strategy for T Area (WSRC 2005b)

A	B	C	D	E	F	G
Areas	**Risk**	**Impacted Media**	**Media Addressed under Previous Document**	**Media Addressed Under ROD[1]**	**Remedial or Removal Action Taken Under Other Documents**	**Other Documents**
TNX Area OU						
NTSB/IPSL	ECO, HH	SW, S	•		Draining SW from NTSB, Backfilling NTSB, Grouting IPSL, ICs	TNX Area ROD (WSRC-RP-2003-4017)
TBG/Vadose Zone	CM, $PTSM^{M}$	S	•		SVE	TNX Area ROD (WSRC-RP-2003-4017)
OTSB/IPSL	CM, $PTSM^{T}$	S	•		Excavation and Offsite Disposal of PTSM from OTSB/IPSL, Grouting Unexcavated Portions of IPSL, Backfilling Excavations, Constructing an EC, ICs	TNX Area ROD (WSRC-RP-2003-4017)
DG	CM, HH	S	•		Backfilling DG, Constructing an EC, ICs	TNX Area ROD (WSRC-RP-2003-4017)
TNX GW	HH	GW	•		SVE and Air Stripping (Pump & Treat)	TNX Area ROD (WSRC-RP-2003-4017)
677-T/678-T Suspect Sumps	$PTSM^{T}$	S	•		Excavation and Offsite Disposal of PTSM from 677-T and 678-T Suspect Sumps (includes Neutralization Sump 678-T)	ESD to TNX Area OU ROD (WSRC-RP-2005-4030)
TNXOD OU						
Outfall Delta	CM, HH, $PTSM^{M}$,	S	•	•	Soil Removal and Placement in Industrialized Portion of T Area, Soil Amendments in Excavated Area, Backfilling, ICs	TNXOD OU RSER/EE/CA (WSRC-RP-2004-4055)
Inner Swamp	CM, HH, $PTSM^{M}$,	S	•	•	Soil Removal and Placement in Industrialized Portion of T Area, Soil Amendments in Excavated Area, Backfilling, ICs	TNXOD OU RSER/EE/CA (WSRC-RP-2004-4055)
Swamp High Ground	None	S		•	No problem warranting action[2]	RI/FFS/RA for TAOU (WSRC-RP-2004-4050)
Outer Sample	None	S		•	No problem warranting action[2]	RI/FFS/RA for TAOU (WSRC-RP-2004-4050)
X-001 Outfall Drainage Ditch OU	ARAR, HH	S	•	•	Soil Removal and Soil Placement in Industrialized Portion of T Area, ICs. NFA warranted[2] at unit after excavation because RAOs have been met.	X-001 Outfall Drainage Ditch OU RSER/EE/CA (WSRC-RP-2004-4018)
Tile Field #1	None	S	•		No problem warranting action[2]	TAOU RI/FFS/RA (WSRC-RP-2004-4050)
Tile Field #2	CM	S	•	•	Soil Removal and Soil Placement in Industrialized Portion of T Area, ICs. NFA warranted[2] at unit after excavation because RAOs have been met.	Tile Field #2 RSER/EE/CA (WSRC-RP-2004-4027)

Table AAA-2. Summary of the Remedial Strategy for T Area (WSRC 2005b)

A	B	C	D	E	F	G
Areas	**Risk**	**Impacted Media**	**Media Addressed under Previous Document**	**Media Addressed Under ROD[1]**	**Remedial or Removal Action Taken Under Other Documents**	**Other Documents**
Tile Field #3	None	S	•		No problem warranting action[2]	TAOU RI/FFS/RA (WSRC-RP-2004-4050)
TNX Area Process Sewer Lines	None	S	•		No problem warranting action[2]	TAOU RI/FFS/RA (WSRC-RP-2004-4050)
TBG (Previously Inaccessible Areas)	CM,HH, PTSM^{M}	S		•	None	TAOU RI/FFS/RA (WSRC-RP-2004-4050)
Former Building Slabs	HH	C	•	•	Removal of Buildings, Scabbling of Slabs to Remove PTSM, ICs	DPFRs, TAOU RI/FFS/RA (WSRC-RP-2004-4050)
	PTSM^{T}	S	•	•	None	TAOU RI/FFS/RA (WSRC-RP-2004-4050)

1 The referenced ROD is the 2005 T Area OU ROD (WSRC-RP-2004-4070)

2 No problem warranting action or no further action warranted determinations are supported in the cited documents. These determinations are part of the 2005 T Area OU ROD. (Note: the TAOU includes soil and associated materials (such as concrete and slabs); TNX groundwater is addressed under the TNX Area OU (chapter BBB in the Fourth Five Year Remedy Review report)

Superscripts: T = Toxicity, M = Mobility

Column B Abbreviations: ECO = Ecological, HH = Human Health, CM = Contaminant Migration, PTSM = Principal Threat Source Material,, ARAR = Applicable or Relevant and Appropriate Requirements

Column C Abbreviations: SW = Surface Water, S = Soil, GW = Groundwater, C = Concrete

Column F Abbreviations: SW = Surface Water, ICs = Institutional Controls, SVE = Soil Vapor Extraction, EC = Engineered Cap, NFA = No Further Action

Column G Abbreviations: RI/FFS/RA = RI Focused Feasibility Study/Risk Assessment, DPFR = Decommissioning Project Final Report

Table AAA-3. RCOCs and RGs for Industrial Land Use at TAOU (WSRC, 2005b)

RCOC	Type of RCOC	RG	Units
Outfall Delta (soil)			
Actinium-228	Human Health	3.34	ρCi/g
Lead-212	Human Health	35.34	ρCi/g
Radium-228	Human Health	3.21	ρCi/g
Thorium-228	Human Health	1.73	ρCi/g
Uranium-233/234	Contaminant Migration	6.54	ρCi/g
Uranium-235	Contaminant Migration	0.31	ρCi/g
Uranium-238	Contaminant Migration	6.58	ρCi/g
Inner Swamp (sediment)			
Actinium-228	Human Health	3.34	ρCi/g
Radium-228	Human Health	3.21	ρCi/g
Thorium-228	Human Health	1.73	ρCi/g
Uranium-233/234	Contaminant Migration	5.75	ρCi/g
Uranium-235	Contaminant Migration	0.27	ρCi/g
Uranium-238	Contaminant Migration	5.75	ρCi/g
TNX Burying Ground (soils)			
Uranium-238	Contaminant Migration	1.79	ρCi/g
Stockpiled Soils from X-001 Outfall (soil)			
Aroclor 1260	ARAR	10	mg/kg
Uranium-238	Human Health	1.79	ρCi/g
Stockpiled Soils from Tile Field 2 (soil)			
Mercury	Contaminant Migration	0.078	mg/kg

WSRC 2005b.

Table AAA-4. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	Five-Year Total
Total Actual O&M Costs	49,800	54,400	50,600	57,600	59,400	271,800
Total ROD Estimated Direct O&M Costs	75,600	62,300	62,300	62,300	62,300	324,800

Table AAA-5. Summary of TAOU COCs measured above MCLs in Groundwater

Contaminant (MCL)	Mercury (2.2 µg/L)		Uranium (30 µg/L)		Gross Alpha (15 pCi/L)		Combined Radium-226/Radium-228 (5 pCi/L)	
Year	#Detects>MCL (Total Detects)	Wells>MCL (Events>MCL)*	#Detects>MCL (Total Detects)	Wells>MCL (Events>MCL)*	#Detects>MCL (Total Detects)	Wells > MCL (Events>MCL)*	#Detects>MCL (Total Detects)	Wells > MCL (Events>MCL)*
2007	4 (24)	TBG4 (2) TNX27D (2)	2 (13)	TCM5	4 (15)	TCM5 (2) TBG4 (2)	2 (36)	TBG4
2008	1 (11)	TBG4	2 (17)	TCM5	3 (24)	TCM5 (2) TNX3D (1)	3 (34)	TNX3D (2) TBG4 (1)
2009	2 (17)	TBG4	1 (23)	TCM5	3 (16)	TCM5 (2) TBG4 (1)	3 (51)	TBG4 (2) TNX3D (1)
2010	2 (15)	TRW2	2 (13)	TCM5	2 (27)	TCM5	0 (53)	
2011	0 (22)		2 (11)	TCM5	3 (20)	TCM5 (2) TBG5 (1)	0 (60)	

* When no number is present, the number of events above the MCL is equal to the total number of detects above the MCL recorded in the column to the immediate left.

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit

I. SITE INFORMATION			
Site Name:	**T-Area Operable Unit**	**Date of Inspection:**	**07/24/2012**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**CERCLIS #96**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**96°F and sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Cover system
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Consolidation, soil amendments

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. O&M Site Manager: George Joyner (Name) | Post Closure Manager (Title) | 6/26/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3324

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Richard Feagin (Name) | ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 07/24/2012 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4416

Problems/Suggestions: ☐ Report Attached

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☐ O&M Manual	☐ Readily Available	☐ Up to Date	☒ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☐ Maintenance Logs	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for T-Area Operable Unit*, ER-IDS-019-032._____

_____

Attachment AAA-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 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per ACP training matrix.

4. Permits and Service Agreements:

☐ Air Discharge Permit	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Effluent Discharge	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Waste Disposal; POTW	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Other Permits	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☐ Water (Effluent)	☐ Readily Available	☐ Up to Date	☒ N/A

Remarks:

10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

Attachment AAA-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

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☒ N/A

Remarks:_____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition._____

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area 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: Annual

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/22/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 AAA-1. Five-Year Review Site Inspection Checklist – T-Area 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:

VII. COVER SYSTEMS ☒ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (Low spots)**:** ☐ Location shown on site map ☒ Settlement not evident

Areal extent Depth

Remarks:

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident

Lengths Widths Depths

Remarks:

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent Depth

Remarks:

4. Holes: ☐ Location shown on site map ☒ Holes not evident

Areal extent Depth

Remarks:

5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☐ No signs of stress

Areal extent Depth

Remarks: Vegetation is mowed routinely.

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☒ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

3. Monitoring Wells:
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks:

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☒ N/A
Remarks:

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☒ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☒ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☒ Erosion not evident
Remarks:_____

3. Outlet Works: ☒ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☒ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

2. Deformations: ☐ Location shown on site map ☐ Deformation not evident

Remarks: _____

_____

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation: ☐ Location shown on site map ☐ Siltation not evident

Areal extent _____ Depth _____

Remarks: _____

_____

2. Vegetative Growth: ☐ Location shown on site map ☐ N/A

☒ Vegetation does not impede flow

Areal extent _____ Type _____

Remarks: _____

_____

3. Erosion: ☐ Location shown on site map ☒ Erosion not evident

Areal extent _____ Depth _____

Remarks: _____

_____

4. Discharge Structure: ☐ Location shown on site map ☒ N/A

Remarks: _____

_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement: ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks: _____

_____

2. Performance Monitoring:

Type of Monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching Head Differential _____

Remarks: _____

_____

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Pumps, Wellhead Plumbing, and Electrical: ☐ Good Condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks:_____
2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. Collection Structures, Pumps, and Electrical: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances: ☐ Good Condition ☐ Needs Maintenance Remarks:_____
3. Spare Parts and Equipment: ☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided Remarks:_____

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☐ Applicable ☒ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (e.g., chelation agent, flocculent)_____
☐ Others_____
☐ Good Condition ☐ Needs maintenance
☐ Sampling ports properly marked and function
☐ Sampling/maintenance log displayed and up-to-date
☐ Equipment properly identified
☐ Sampling ports properly marked and function
☐ Quantity of groundwater treatment annually_____
☐ Quantity of surface water treatment annually_____

Remarks:_____

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☐ Good Condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks:_____

4. Discharge Structure Appurtenances:

☐ N/A ☐ Good Condition ☐ Needs maintenance

Remarks:_____

5. Treatment Building(s):

☐ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks:_____

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☐ Applicable ☒ N/A

1. Monitoring Data:

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring Data:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment AAA-1. Five-Year Review Site Inspection Checklist – T-Area Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Remedy for this site is: low-permeability soil cover system; institutional controls, and apply soil amendments in the Outfall Delta and Inner Swamp to attenuate the leachability of radiological contaminants in soils. The cover system is intact, long term grasses have been fully established. Soil cover system remedy appears to be functioning as designed. Drainage channel function adequately. Soil amendments have been applied and results are monitored semi-annually through ground water sampling and the results reported in the annual Groundwater and Effectiveness Monitoring Report for TNX Area OU
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the integrity of the engineered cover, which in turn will maintain the effectiveness of the cover to mitigate leaching. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

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TNX AREA OPERABLE UNIT

I. Introduction

This report is the fourth five-year review for the TNX Area Operable Unit (OU). The review was conducted from August 2012 through October 2012. Contaminants have been left in place at the TNX Area OU at levels that do not allow for unlimited use and unlimited exposure. The purpose of this review is to determine whether the remedy in place at the TNX Area OU is protective of human health and the environment. This report documents the results of the review.

II. OU Chronology

Table BBB-1 lists the chronology of site events for the TNX Area OU.

III. Background

The TNX Area OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for Savannah River Site (SRS). The media of concern is soil, sediment, surface water, and groundwater.

An area-based remedial strategy has been implemented in T Area; remedial decisions for the T-Area waste units and facilities addressed by the TNX Area OU ROD will continue as planned. All other remedial actions are addressed by the T-Area OU (TAOU) ROD.

Physical Characteristics

TNX Area OU is located in T Area in the southwestern portion of SRS, approximately 0.4 km (0.25 mi) east of the Savannah River (Figure BBB-1) between Upper Three Runs Creek to the north and Fourmile Branch to the south. The OU is at an elevation of 45 m (150 ft) above mean sea level (msl). Local topography is relatively flat and slopes westward toward the Savannah River. Almost all of the TNX area was covered by buildings and laboratories. The area was highly congested with structures, overhead

obstructions, and underground obstructions; much of the available ground surface was covered with asphalt.

The TNX Area OU includes these subunits:

- New TNX Seepage Basin (904-102G) (NTSB)/Inactive Process Sewer Line (IPSL);
- TNX Burying Ground (643-5G) (TBG)/ Vadose Zone;
- Old TNX Seepage Basin (904-076G) (OTSB)/IPSL/Upper Discharge Gully (UDG); and
- TNX Groundwater (082-G) (TNXGW).

The NTSB is an unlined earthen basin approximately 78 by 120 m (260 by 400 ft) in size. The NTSB includes an inactive process sewer line, a smaller settling area (Inlet Basin), a larger basin (Main Basin), an Overflow Discharge Area (ODA), and a gravity fed IPSL. The Main Basin is connected to the Inlet basin and received the "decanted" wastewater. The ODA is an irregularly shaped area defined by site topography with an approximate area of 24,300 m^2 (27,000 ft^2). The IPSL is approximately 60 m (200 ft) long, running west-northwest from the Inlet Basin to a manhole located on the west side of Road 4A.

The OTSB was an unlined earthen basin approximately 24 by 52.5 m (80 by 175 ft). The OTSB includes an Inlet Basin, a Main Basin, IPSLs that run east and north, and the UDG.

The TBG/Vadose Zone consisted of four trenches at 1.8 to 2.4 m (6 to 8 ft) below ground surface (bgs) and was created in 1953 to dispose of debris from the accidental explosion of an experimental evaporator. The debris included materials such as conduits, drums, and structural steel.

The TNXGW is the groundwater beneath the TNX Area OU surface units, beneath the TNX Outfall Delta (TNXOD) which is a subunit of the TAOU, and extending to the Savannah River (Figure BBB-2). Groundwater at TNX can be divided into two main aquifer systems, one shallow, and one deep. The shallow system can be further subdivided into an upper unconfined water table aquifer (10.5 to 12 m [35 to 40 ft] thick) that outcrops in the TNX floodplain and a lower semi-confined aquifer. Groundwater flows progressively from deep to shallow aquifers (i.e., upward hydraulic gradient) and to

the Savannah River. No contamination has been found in the deep aquifer, located below the Crouch Branch Confining Unit.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The Land Use Control Assurance Plan (LUCAP) for the SRS (WSRC 1999) designates the TNX Area OU as being within an industrial area. The future land use for the TNX Area OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The TNX Area was a pilot-scale testing and evaluation facility that supported nuclear fuel and target manufacturing chemical processes and the Defense Waste Processing Facility (DWPF). Past operations within the TNX Area resulted in contamination of the vadose zone and groundwater. Potential sources of groundwater contamination included seepage from unlined basins (OTSB, NTSB), leakage from the process sewers, leachate from contaminated media in the TBG, and leachate from other sources at TNX (e.g., a temporary storage facility for 55-gallon drums during the 1950s and an equipment staging area).

The OTSB operated from the mid-1950s until 1980 and received radioactive, organic, and inorganic contaminated process wastewaters generated from TNX facilities.

The NTSB began operation in 1980 after closure of the OTSB. From 1981 to 1988, the basin received water flow from pilot-scale simulations conducted at TNX in support of the DWPF and the Separations Area. Wastewaters consisted primarily of simulated, nonradioactive sludge along with other wastes such as small amounts of glass frit and laboratory sink discharges. In August 1988, the NTSB was removed from operation, at which time wastewaters were routed to the TNX Effluent Treatment Facility. Until the NTSB was covered as part of the TAOU cover system, the main section of the basin accumulated rainwater year-round.

The TBG was created in 1953 to dispose of contaminated debris from an accidental explosion of an experimental evaporator that was being used to concentrate a solution of uranyl nitrate (0.4 Ci) and nitric acid. The debris included materials such as conduits, drums, and structural steel. Between 1982 and 1984, most of the buried material was excavated and sent to the SRS Radioactive Waste Burial Ground. The five small areas that were not excavated contain an estimated 0.02 Ci of uranyl nitrate. In 1996, an additional disposal area was discovered with three buried drums containing materials contaminated with radionuclides and metals, predominantly iron, aluminum, and mercury. The drums were removed and disposed in the SRS Low-Level Radioactive Waste Disposal Facility. At which time, the area was characterized.

Initial Response

The OTSB was closed in 1981 by backfilling the basin with clean sand and clay that was covered with clay. A portion of the cover was vegetated and an asphalt cover was placed over the remainder. The overflow discharge pipe was re-routed to drain stormwater runoff from the vegetated and asphalt surfaces covering the OTSB to the LDG. Monitoring of the TNX groundwater has been performed since the 1980s. The monitoring identified chlorinated volatile organic compound (CVOC) contamination. In January 1999, the RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment (RFI/RI/BRA) report was approved by U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC). In September 2002, the Addendum to the RFI/RI/BRA report was approved by USEPA and SCDHEC.

Basis for Taking Action

The nature and extent of contamination in soil, sediment, surface water, and groundwater at TNX Area OU were characterized. Results from the RFI/RI/BRA demonstrated that the TNXGW exceeded the maximum contaminant levels (MCLs) for chlorinated VOCs, primarily trichloroethylene (TCE), and to a lesser extent, tetrachloroethylene (PCE), carbon tetrachloride, nitrate, mercury, and gross alpha. Groundwater beneath the TNXOD exceeded the MCL for gross alpha, uranium, and mercury. The refined contaminants of concern (RCOCs) and RGs identified in the ROD for human health

(HH), ecological (ECO) receptors, and contaminant migration (CM) are presented in Table BBB-2 for soil and sediment and Table BBB-3 for the groundwater.

IV. Remedial Actions

Remedy Selection

To control and remediate volatile organic carbon (VOC) source material and the groundwater plume, an Interim Action Record of Decision (IROD) for the TNX Area OU was issued on November 16, 1994 (WSRC 1994). The purpose of the interim action was to serve as an incremental step in part of an overall remedy to address groundwater contamination with the Hybrid Groundwater Corrective Action (HGCA). The HGCA consisted of two components: (1) a pump and treat system (recovery well network and low-profile air stripper) to treat and inhibit further migration of the 500 ppb TCE plume core, and (2) an airlift recirculation well, located at the heart of the plume to expedite remediation. Testing performed in 1996 demonstrated that the recirculation well system was ineffective in the TBG area because of geological factors and the nature of the contamination. Furthermore, it was determined that the pump and treat system could adequately achieve the interim remedial goals (RGs). Consequently, the IROD was modified in 1997 with an Explanation of Significant Difference (ESD) to discontinue operation of the recirculation well (WSRC 1997).

A second ESD for the TNX Area OU was signed by USEPA and SCDHEC on May 15, 2013 and May 16, 2013, respectively. This ESD modifies the remedy selected in the ROD for the TNXOU groundwater component as follows:

- Permanent removal of service of the T-1 Air Stripper.
- Addition of edible oil treatment as needed. A sustained rebound lasting over 1 year in excess of 75 µg/L of TCE, PCE, or carbon tetrachloride in any well will represent a viable trigger for injection of edible oil is determined appropriate by the USDOE, USEPA, and SCDHEC.

The basic remedy for the TNX OU groundwater (i.e., pump and treat) remains unaltered, and the cleanup level specified in the ROD will be met by the edible oil treatment. The scope, performance goals, and consistency with ARARs are unchanged and the cost of

the remedy modification is no greater than the known operational costs of the original remedy. (SRNS 2013)

The ROD for the TNX Area OU was issued March 2004 (WSRC 2004). The remedial action objectives (RAOs) were developed as a result of the characterization and risk assessment and screening of remedial alternatives. The RAOs can be summarized as follows:

- Protect future industrial workers from exposure to contaminants in the NTSB/IPSL sediments and LDG soils and groundwater above the MCL;
- Protect biota from exposure to contaminated sediments and surface water of the NTSB;
- Remove or treat contamination exceeding principal threat source material (PTSM) criteria in subsurface soils of the OTSB/IPSL and the 678-T and 677-T sumps to the extent practicable;
- Prevent leaching of contaminants above the MCL from soils of the OTSB/IPSL/DG and LDG;
- Prevent or minimize perched water contact with PTSM or mercury in the OTSB/IPSL/Discharge gully exceeding the CM RG;
- Identify and reduce the secondary source of VOCs representing PTSM in the vadose zone in order to reduce the time to achieve groundwater RAOs;
- Return groundwater to beneficial uses within a reasonable time period by remediating to applicable or relevant and appropriate requirement (ARARs) (i.e., MCLs);
- Prevent, minimize, or eliminate discharge of contaminated groundwater to surface water that would result in unacceptable risk to human or ecological receptors; and
- Minimize adverse impact to the wetland ecosystem of the TNX Area flood plain through careful consideration and implementation of remedial actions.

The remedial actions selected to meet the RAOs for the TNX Area OU are summarized as follows:

- The NTSB is located across a paved road from the OTSB/Discharge Gully and the TBG (Figure BBB-3). Because this facility was not to be placed under the perimeter of the engineered cover, the remedial action involved *in situ* grouting of the IPSL, discharge of any surface water in the NTSB to an approved location, followed by backfill with clean soil.

- The OTSB, associated IPSL, discharge gully, and TBG are located in close proximity and are within the perimeter of the engineered cover for the TAOU. For the OTSB/IPSL/Discharge Gully, actions included excavation of soil, pipelines and sumps, disposal of all PTSM contaminated soil and pipeline at an approved disposal facility, plugging any sections of IPSL remaining, and placement of clean backfill where practical prior to installation of the engineered cover system. In addition groundwater and vadose zone monitoring devices were installed to determine the impact, if any, to groundwater of leaving waste in place. Other than chlorinated VOC contamination in the vadose zone below the TBG that required remedial action, no other actions were required for the TBG.

- Identification of chlorinated VOCs in the vadose zone in the area close to the TBG, resulted in installation and operation of a soil vapor extraction (SVE) system to facilitate removal of an ongoing secondary source of contamination to the groundwater. Testing of SVE units was conducted in 1997 and 1998 followed by operation of a portable SVE unit beginning in 2002. The portable SVE unit was shut down in 2006 during the placement of the engineered cover system. In 2007 this system was replaced by passive MicroBlowers™.

- The groundwater actions have changed overtime in an effort to decrease the time to reach MCLs. A pump-and-treat system (recover well network and air stripper) began operation in 1996 and was part of the remedy identified in the ROD (WSRC 2004). The system operated until 2007 when its operation was suspended to facilitate the treatability study of edible oil technology to address the groundwater contamination. The ROD identified the pump-and-treat system will operate until monitoring determines that passive remediation is appropriate and a mixing zone, if applicable.

- Institutional controls (i.e. land use controls) are in place for this OU. The controls consist of access controls, walkdowns, maintenance, deed restrictions and administrative directives and land use restrictions via the Site Use/Site Clearance Program, prohibiting installation of drinking water wells to prevent use of groundwater beneath TNX where concentrations of contaminants are above MCLs. These controls will remain in effect until the Core Team concurs that COC concentrations in groundwater do not present unacceptable risk to receptors.

Remedy Implementation

The selected remedies met the RAOs at TNX Area OU (WSRC 2007a) by implementing the following activities:

- The NTSB remedial action was initiated by discharge of surface water to the ground in the vicinity of the NTSB after sampling confirmed acceptability. Approximately 690 m^3 (900 yd^3) of stone was placed into the basin bottom prior to backfilling the Main and Inlet Basins with clean surplus soil to grade. The associated IPSL was stabilized in situ.

- The OTSB remedial action was initiated by removing the accessible IPSL and grouting the inaccessible IPSL. The Main Basin of the OTSB was excavated resulting in the removal of approximately 1,670 m^3 (2,180 yd^3) of PTSM with remaining soil retained for use as backfill. The Inlet Basin was excavated to a 3-m (10-ft) depth and soil retained for use as backfill. The excavated suspect soil was placed into the OTSB as backfill, followed by clean common fill to achieve proper grading. To monitor moisture in the vadose zone, a piezometer was installed.

- The sumps associated with 678-T and 677-T, as well as a small area of contamination on the western exterior of Building 678-T had potential PTSM levels of material and were excavated and evaluated (WSRC 2005). Approximately 17 m^3 (22 yd3) of contaminated soil was removed and disposed in an approved off-site disposal facility.

- Confirmatory soil sampling was conducted for all excavations of PTSM identified soil. Results of all samples indicated contaminant levels were below RGs prior to placement of fill materials.

- Groundwater remediation efforts began in 1996 with installation of a pump-and-treat system consisting of four recovery wells feeding an air stripper (WSRC 1994). Based on the successful SVE treatability study, the active SVE network was expanded (WSRC 2001). In 2007, the active SVE system was transitioned to a passive system (MicroBlowers™).

- Land use controls were established for 0.9 hectares (2.24 acres).

A main emphasis during the period 2007 through 2011 has been a treatability study of edible oils to treat the residual VOCs in the source (vadose zone/groundwater interface and near source groundwater). The edible oil treatment was found to be very effective. While the pump-and-treat with SVE system is effective in removing the VOCs, the timeframe is estimated to be at least 30 years before achieving the MCL. The edible oil treatment is expected to reduce the treatment time by approximately 20 years to achieve the MCL.

System Operations/Operation and Maintenance

There are system operation requirements. They include the following activities:

- SVE operations in the high concentration areas of the vadose zone (i.e., SVE) have extracted 28.5 lbs of VOCs from 2002 through 2011. In 2006, the system was shut down temporarily during the placement of the engineered cover system over the former TNX Area. The SVE system remained in operation during the edible oil treatability study.; and

- Continued operation of the pump-and-treat system (i.e., TNX T-1 Air Stripper) until monitoring determines that passive remediation (mixing zone) is appropriate. In order to conduct the edible oil demonstration, operation of the pump-and-treat system was discontinued in 2007. The recovery wells are designed to feed the air stripper at a rate of 80 gpm. The actual operating rate recovery wells (Wells 1 through 4) is

approximately 21, 20, 14, 20 gpm, respectively. As of July 2012, 308.2 million gallons of groundwater have been treated. Thirty-seven pounds of VOCs have been removed during the period 2001 through 2007.

The following maintenance activities are ongoing:

- Groundwater monitoring for support of a mixing zone;
- Annual site inspections are conducted for evidence of damage to the NTSB cover system due to erosion, settlement or intrusion by burrowing animals and also address upkeep of the vegetative cover and access control barriers (e.g., the warning signs);
- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required; and
- Institutional controls are being enforced to preclude access through the SRS Site/Use Site Clearance program and SRS site security.

Maintenance and inspection activities associated with the engineered cover system over the OTSB/Discharge Gully and TBG and the cover system for the NTSB are integrated into the TAOU. Thus, they are presented in the TAOU chapter of this document

The operation and maintenance (O&M) costs associated with the selected remedy for TNX OU include O&M costs of the pump-and-treat and SVE systems, soil cover, and institutional controls has a ROD estimated present worth of $8,053,000 discounted at 3.9% per year for 30 years of maintenance activities. The actual O&M cost since the remedial action was completed in FY01 until FY11 is $2,500,000. The actual O&M costs are as expected compared to the estimated O&M costs (Table BBB-4).

V. Progress Since Last Review

The previous protectiveness statement concluded that the remedy is expected to be protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled by removing TCE from the most concentrated portion of the contaminated plume (> 500 g/L TCE) and through institutional controls. Institutional controls 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.

VI. Five-Year Review Process

The following tasks were performed as part of the review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed the implementation of the remedial action;
- Reviewed all process and performance monitoring data provided by the annual effectiveness monitoring strategy reports (WSRC 2008, SRNS 2009, SRNS 2010a, SRNS 2011, SRNS 2012a) and provided a technical assessment of whether the groundwater remedial actions are performing as expected;
- Inspected the OU and documented the results on the Inspection Checklist provided in Attachment BBB-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

Central to the TNX groundwater remedial efforts has been remediating the chlorinated VOCs (TCE, PCE and carbon tetrachloride) to reach ARARs (i.e., MCLs), which has been conducted in a phased approach. The initial efforts were identified in the IROD as the HGCA, which consisted of pump-and-treat systems: a classic system of pumping followed by treatment in an air stripper; and an in situ system - airlift recirculation well (WSRC 1994). The recirculation well was identified as being ineffective in addressing the interim action goals and was removed from the HGCA system in 1997 (WSRC 1997). The recovery well network and air stripper was the sole engineered remediation system for this OU until 2002. The impact of the pump-and-treat system on the TCE plume was a measureable reduction in the 500 µg/L contour (Figure BBB-4). This system continued to operate until 2007 at which time operation was suspended in order to evaluate the use

of edible oils to address the remaining secondary/residual contaminants in the groundwater.

With the approval of an ESD to the IROD (WSRC 2001), the next phase of the chlorinated VOCs remediation addressed the contaminants in the vadose zone, an ongoing source of contamination to the groundwater representing PTSM, by using SVE technology. At TNX Area OU, the conventional active SVE system was transitioned to a passive system (MicroBlowers™) in 2007 (Figure BBB-5). The only extended shut down of the system was in 2006. Passive SVE systems are most effective at removing low/residual concentrations of volatile in the unsaturated zone. They are considered a polishing technology when active SVE performance no longer warrants its operating costs (SRNS 2010b). As shown in Figure BBB-6, the MicroBlowers™ are effectively removing small volumes of chlorinated VOCs from the vadose.

A main emphasis during the period 2007 through 2011 has been a treatability study of edible oils to treat the residual VOCs in the source (vadose zone and near source groundwater). The TNX groundwater is aerobic making degradation by reductive processes unlikely and leading to a longer time to complete remedial activities and meet RAOs. While the pump-and-treat with SVE system is effective in removing the VOCs, the timeframe is estimated to be at least 30 years. Data associated with the edible oil treatability study to address residual VOCs in the source was reviewed. The edible oil treatment using a combination of neat and emulsified vegetable oils injected into the subsurface creates an environment for reductive dechlorination of TCE. The neat oil creates a thin layer on the water table to intercept and reduce future VOC loading (via partitioning) and reduce oxygen inputs (via biostimulation). The emulsified oil forms an active bioremediation reactor zone(s) within the plume footprint to degrade the existing contaminants and stimulate long-term attenuation in the distal plume (Figure BBB-7). By creating an anaerobic zone encompassing the secondary source (in the capillary fringe of the water table and within the water table), the rate of degradation of contaminants in that zone should increase; thus, shortening the time to depletion. The impact will be a decreased loading of contaminants to the distal aerobic zone where the aerobic co-metabolic mechanisms will be the dominant attenuation processes.

The treatability study was conducted with two phases (February to April 2008 and May 2010) of oil injection. Effectiveness monitoring of this remedial technology treatability study continued through 2011. During this period the T-1 Air Stripper was in standby mode. However, the SVE system remained in operation. The results of the treatability study indicate:

- The dissolved TCE plume has decreased in size and mass. The estimated mass in plume has decreased approximately 90% from 2.73 kg in 4Q07 (prior to treatment) to 0.27 kg in 4Q11 (Figure BBB-8). The half-life of TCE in the plume was calculated to be 1.4 years. Statistical tests indicate the TCE concentrations in the majority of the wells are decreasing. The estimated time for the plume to be less than the MCL for TCE is seven to ten years.
- The central zone biogeochemistry is continuing to develop and appears sustainable to support reductive dechlorination and co-metabolism of TCE.
- Reductive dechlorination is evident based on daughter products and ethane.
- Co-metabolites are being generated and distributed to stimulate aerobic attenuation (co-metabolism) in the distal plume zone.
- There may be some isolated higher concentration zones (TRW-3 and TVM-1M) that may warrant further treatment with edible oils.

Based on the positive results of this treatability study (SRNS 2012b), an ESD to the ROD (SRNS 2013) has been approved by SCDHEC and USEPA to change the groundwater remedy from extraction in high VOC concentration areas (i.e., T-1 Air Stripper) with monitoring/mixing zone and institutional controls to edible oil treatment as needed with natural attenuation. The ESD (SRNS 2013) changes will be addressed in future ROD evaluations. The passive SVE system, groundwater monitoring, and institutional controls will remain as identified in the ROD (WSRC 2004).

The combination of the cover system, pump-and-treat with air-stripping, passive soil vapor extraction (PSVE) and edible oil has had a positive impact on the TCE plume by eliminating the TCE 500 µg/L isocontour (Figure BBB-9). In addition, the 5 µg/L

isocontour no longer intercepts the X8 ditch, which intersects the water table; thus, having a channeling effect on groundwater flow, as was projected in Figure BBB-4. Figure BBB-10 presents the change in concentrations over a five-year period, 2007 through 2011 for TCE. As shown, the greatest changes are in the source area within the edible oil demonstration zone.

The most recent TCE and PCE data from the X-008C NPDES sampling location confirm that TCE and PCE are not present in the outfall (WSRC 2007b). PCE, carbon tetrachloride and cis-1,2-dichloroethene are detected within the footprint of the TCE plume and are removed via the T-1 Air-Stripper, edible oils, and passive SVE. The remaining RCOCs (Table BBB-3) are found localized with no discernible plumes.

Summary of Inspections and Interviews

Interviews were conducted with Richard Feagin, O&M staff member, on May 25, 2012 at the TNX Area OU and with George Joyner, O&M Site Manager, on June 26, 2012 at the O&M organization offices. The TNX Area OU was inspected by SRNS and USDOE personnel on July 24, 2012 and October 22, 2012. No issues were identified for the TNX Area OU during this inspection and interviews.

On January 22, 2013, a site inspection was conducted by USEPA and SCDHEC personnel, accompanied by USDOE and SRNS personnel. No significant problems regarding this OU were identified during the inspection.

VII. Technical Assessment

Is the Remedy Functioning as Intended by the Decision Document?

The remedy is functioning as intended as demonstrated below:

- The removal of PTSM soils associated with the OTSB and the sumps has achieved the remedial objectives to remove or treat contamination exceeding PTSM criteria in subsurface soils.
- The removal and consolidation under a geosynthetic cover system is effective in protecting future industrial and ecological receptors from exposure to contaminants. Additionally, the cover system, which is discussed in Appendix AAA (TAOU), has

the effect of decreasing contaminant loading by reducing surface water loading and transport through the contaminated vadose zone directly under the cover to the groundwater; thus, positively impacting the groundwater treatment.

- The combined groundwater treatment approaches of pump-and-treat and passive SVE are effective in decreasing the volume of contaminants in the groundwater and vadose zone, eliminating the 500 µg/L TCE contour, and facilitating a receding of the distal portion of the TCE plume. The results of the edible oil treatability study indicate the technology supports the generation of an anaerobic zone in the groundwater that will foster reductive dechlorination of the chlorinated VOCs. As reductive dechlorination of TCE and the other chlorinated VOCs is a faster degradation mechanism than the aerobic mechanisms, the shrinkage of the TCE plume and other chlorinated VOCs is expected to accelerate.

Are Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives still valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection are still valid. There have been no changes in standards or to-be-considered guidance identified in the ROD (WSRC 2004) that call into question the protectiveness of the remedy.

Fact sheets provided on the US EPA webpage regarding emerging contaminants were reviewed for applicability to this site. Due to the presence of chlorinated solvents at the site, there is a potential that 1,4-dioxane may also exist because it is often added to chlorinated solvents as a stabilizer and corrosion inhibitor. The presence of 1,4-dioxane is not likely to change the protectiveness of the remedial action that includes LUCs (at a minimum) which consequently renders the exposure pathway to human receptors incomplete. An evaluation of the effectiveness of the remedy is premature until such time that a formal MCL is established. SRS has performed a historical review of groundwater data. Seventy-four 1,4-dioxane records were reviewed from the OU. All were non-detects and 1,4-dioxane is not expected at this OU. However, before the next Five-Year Remedy Review, groundwater samples at the TNXOU will include the

analysis of 1,4-dioxane to provide more recent information. The 1,4-dioxane results will be reported in the subsequent groundwater monitoring reports, as well as summarized in the next Five-Year Remedy Review.

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

One issue has been identified for the TNX Area OU and is listed in Table BBB-5.

IX. Recommendations and Follow-up Actions

Recommendations and follow-up actions concerning TNX Area OU are listed in Table BBB-6. The success of the edible oil treatability study warrants review of the current approved treatment system and consideration of modification of the ROD (WSRC 2004) so the treatment approach incorporates the use of the edible oils and natural attenuation with removal of the pump-and-treat via air stripping. SRS has submitted an ESD to the TNX Area OU ROD to recommend a remedy change to Edible Oil Injection. In addition, a recommendation is made to monitor 1, 4-dioxane in all of the TNX Area OU wells during the 4Q2013 sampling event.

X. Protectiveness Statements

The remedy at the TNX Area OU is protective of human health and the environment.

Exposure pathways that could result in unacceptable risks are being controlled by removing TCE from the most concentrated portion of the contaminated plume (> 500 µg/L TCE) and through institutional controls (i.e., land use controls). Land use controls 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

The next five-year review is scheduled for no later than January 2019.

XII. Documents Reviewed

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket No. 89-05-FF (Effective Date: August 16, 1993)

SRNS, 2009. *2008 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U),* SRNS-RP-2009-00593, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010a. *2009 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U),* SRNS-RP-2010-00933, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010b. *Enhanced Attenuation Technologies: Passive Soil Vapor Extraction*, SRNL-STI-2009-00571, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2011. *2010 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U),* SRNS-RP-2011-00980, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNL, 2012. *Treatability Study for Edible Oil Deployment for Enhanced cVOC Attenuation for T-Area*, SRNL-STI-2012-00290, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012a. *2011 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U),* SRNS-RP-2012-00192, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012b. *Treatability Study for Edible Oil Deployment for Enhanced cVOC Attenuation for T-Area, Savannah River Site*, SRNL-STI-2012-00290, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2013. *Second Explanation of Significant Differences (ESD) for the Revision 1 TNX Area Operable Unit Record of Decision (U),* SRNS-RP-2012-00205, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

WSRC, 1994. *Interim Action Record of Decision, Remedial Alternative Selection - TNX Groundwater Operable Unit (U),* WSRC-TR-94-0375, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1997. *Explanation of Significant Differences for the TNX Area Groundwater Operable Unit (U),* WSRC-RP-97-169, 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, March 2013, Savannah River Nuclear Solutions, LLC Savannah River Site, Aiken, SC

WSRC, 2001. *Explanation of Significant Differences (ESD) to the Revision 1 Interim Record of Decision (IROD) for the TNX Area Operable Unit Groundwater (U),* WSRC-RP-2001-00764, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Record of Decision Remedial Alternative Selection for the TNX Area Operable Unit (U)*, WSRC-RP-2003-4017, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2005. *Explanation of Significant Differences (ESD) to the Record of Decision for the TNX Area Operable Unit (U)*, WSRC-RP-2005-4030, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007a. *Post-Construction Report (PCR) for the TNX Area Operable Unit (U)*, WSRC-RP-2005-4007, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007b. *Savannah River Site Environmental Report for 2007*, WSRC-STI-2008-00057, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *2007 Comprehensive TNX Area Annual Groundwater and Effectiveness Monitoring Strategy Report (U),* WSRC-RP-2008-4040, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist, T-Area Operable Unit (U)*, ER-IDS-019-032, Inspection Period 2007 to 2011 (annually)

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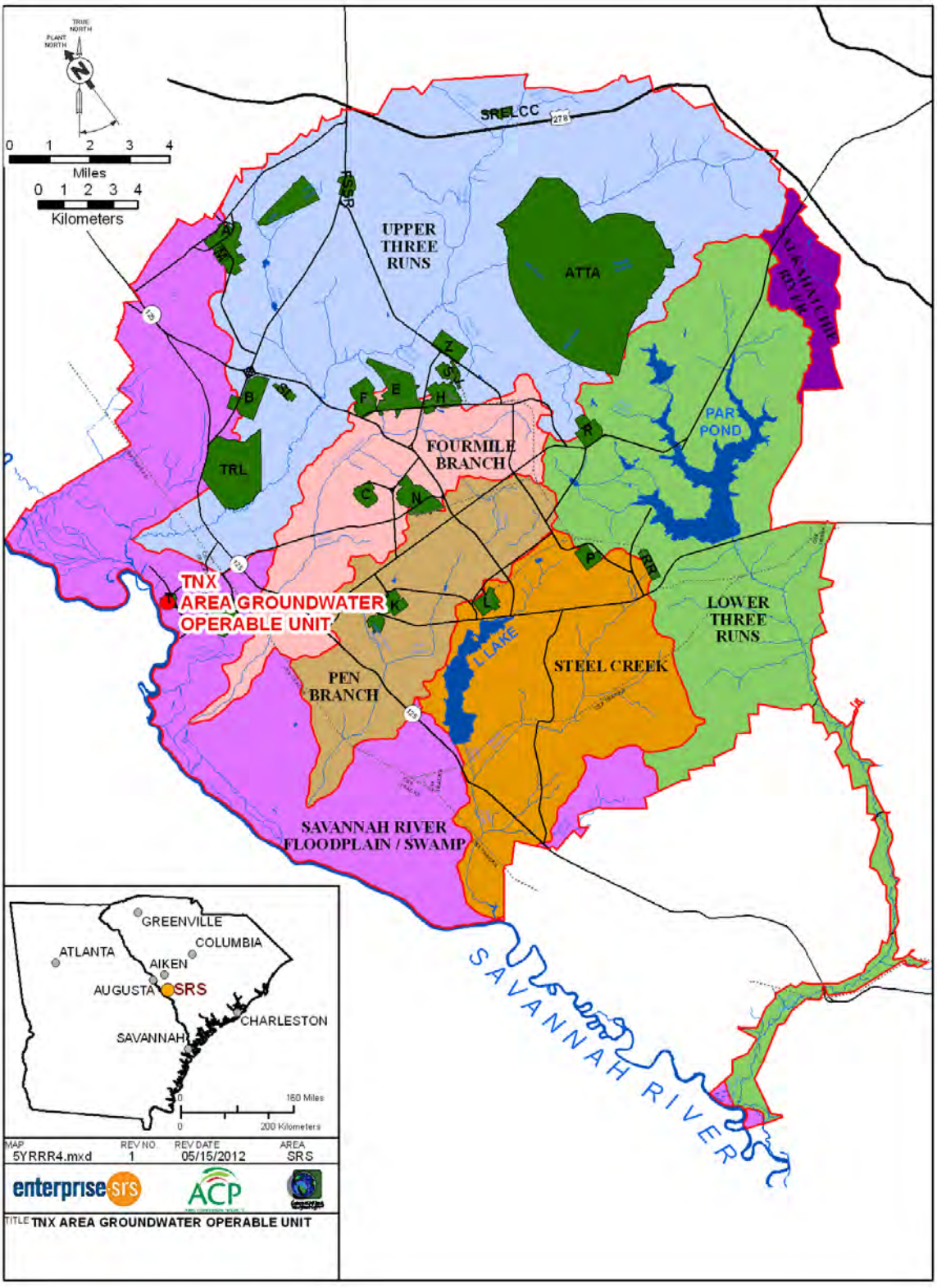


Figure BBB-1. Location of TNX Area OU at Savannah River Site

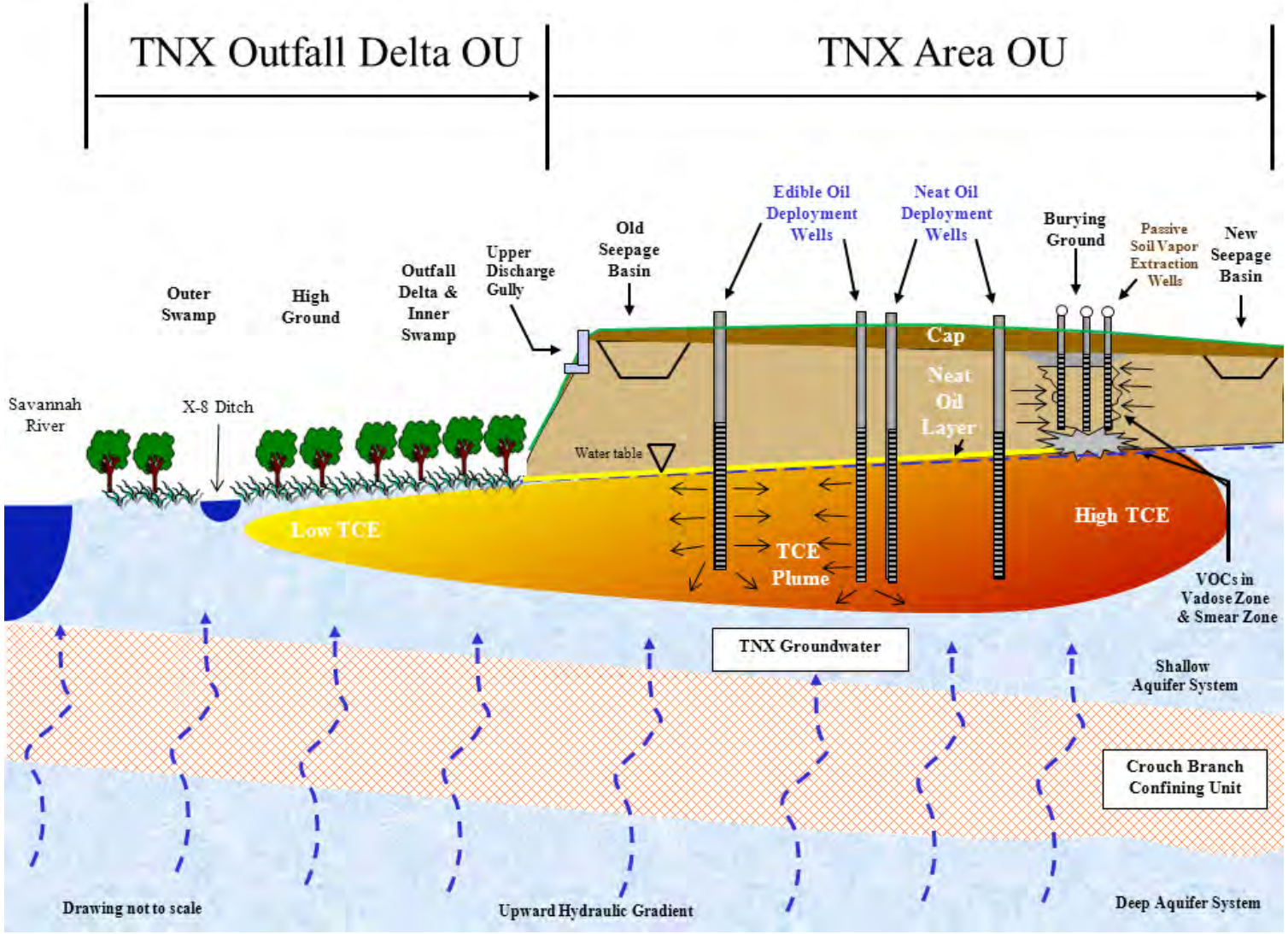


Figure BBB-2. Schematic Cross Section of TNX Area OU and Interim Action

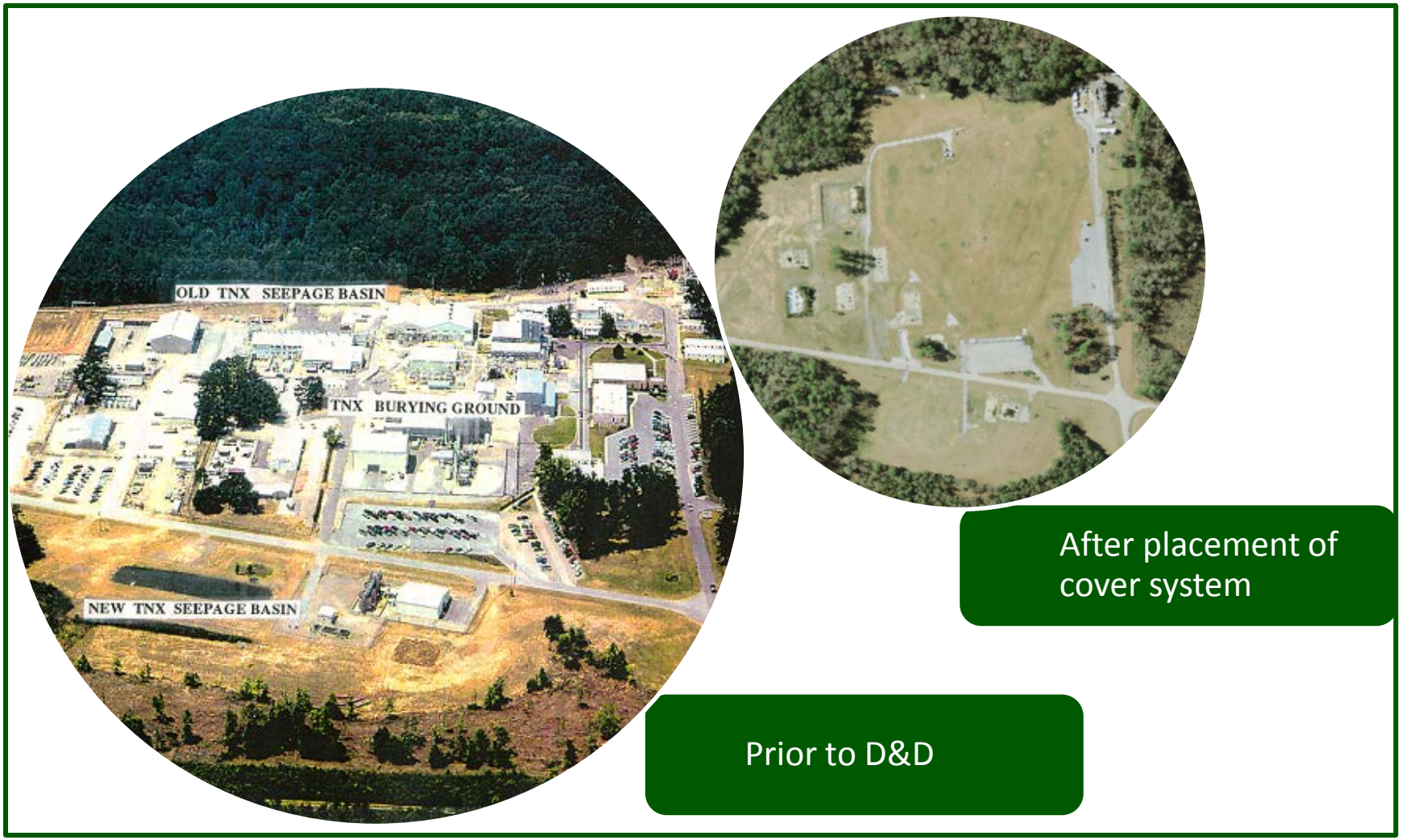


Figure BBB-3. Layout of the TNX Area OU before and after D&D and remedial actions

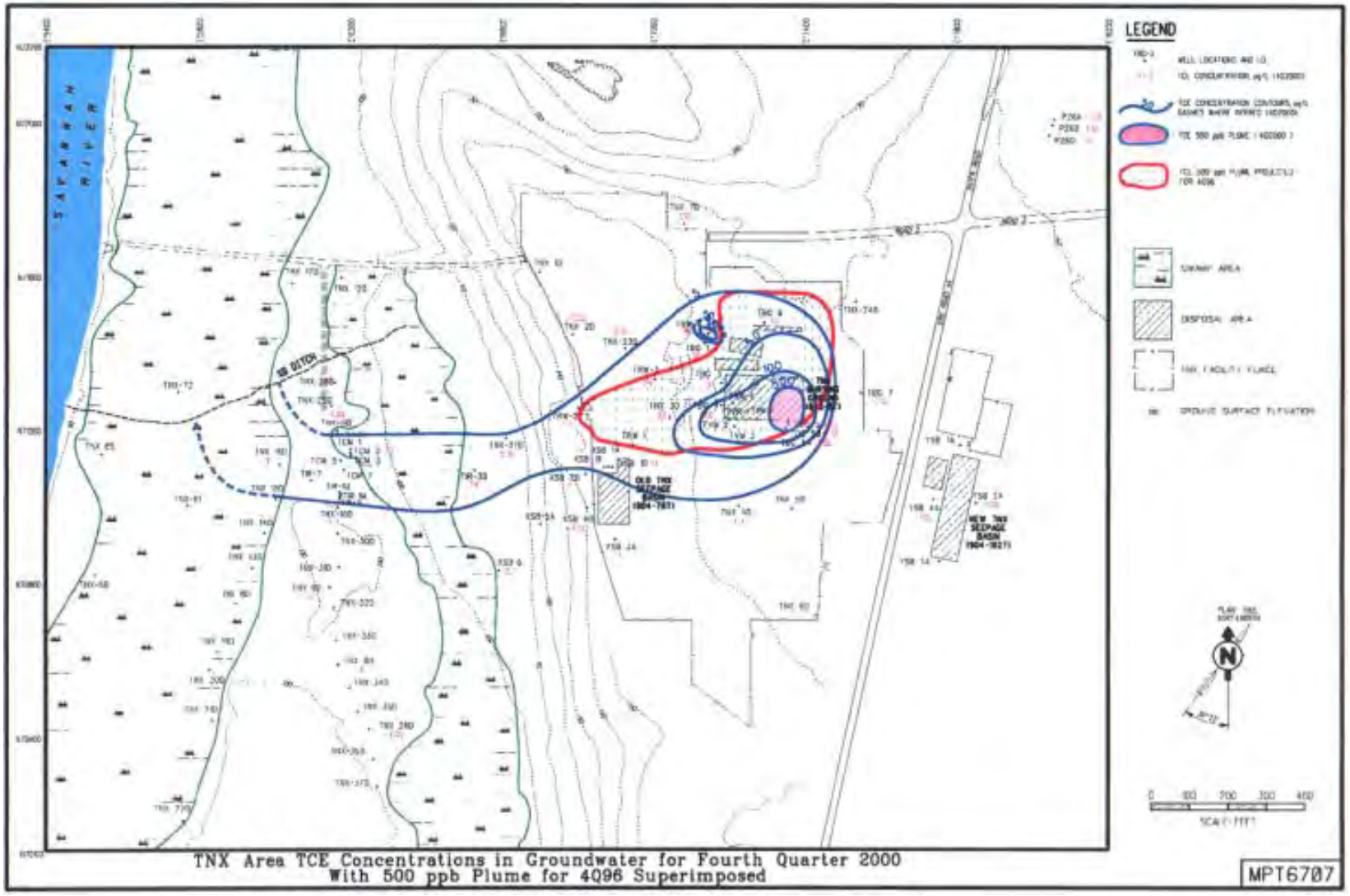


Figure BBB-4. 2000 TCE Contours with 4Q96 500 ppb TCE Contour

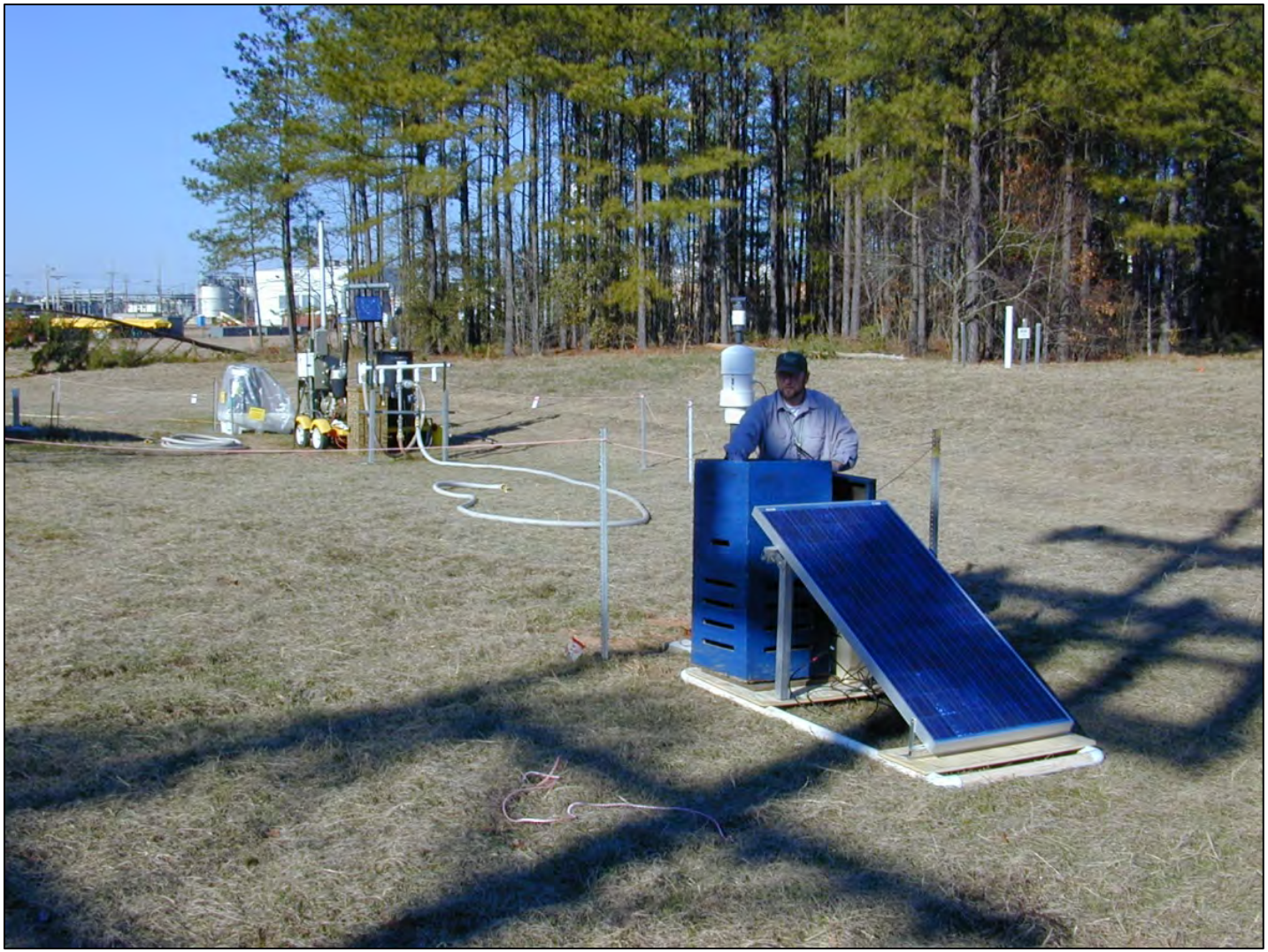


Figure BBB-5. Photograph of a MicroBlower™ Field Setup powered by a Solar Panel

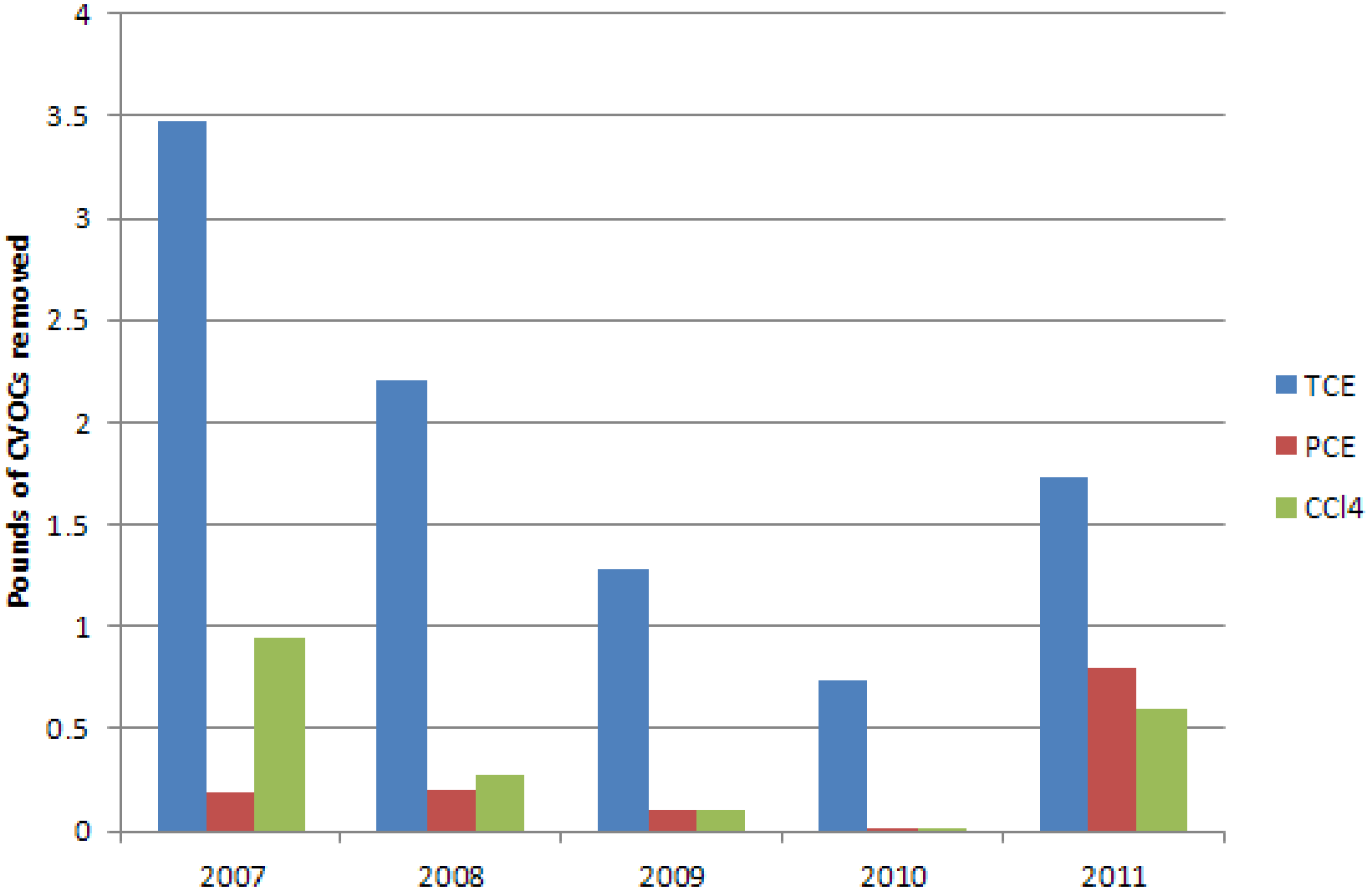


Figure BBB-6. Mass Removal Rates by Year for the TNX Area OU PSVE (MicroBlower™) System

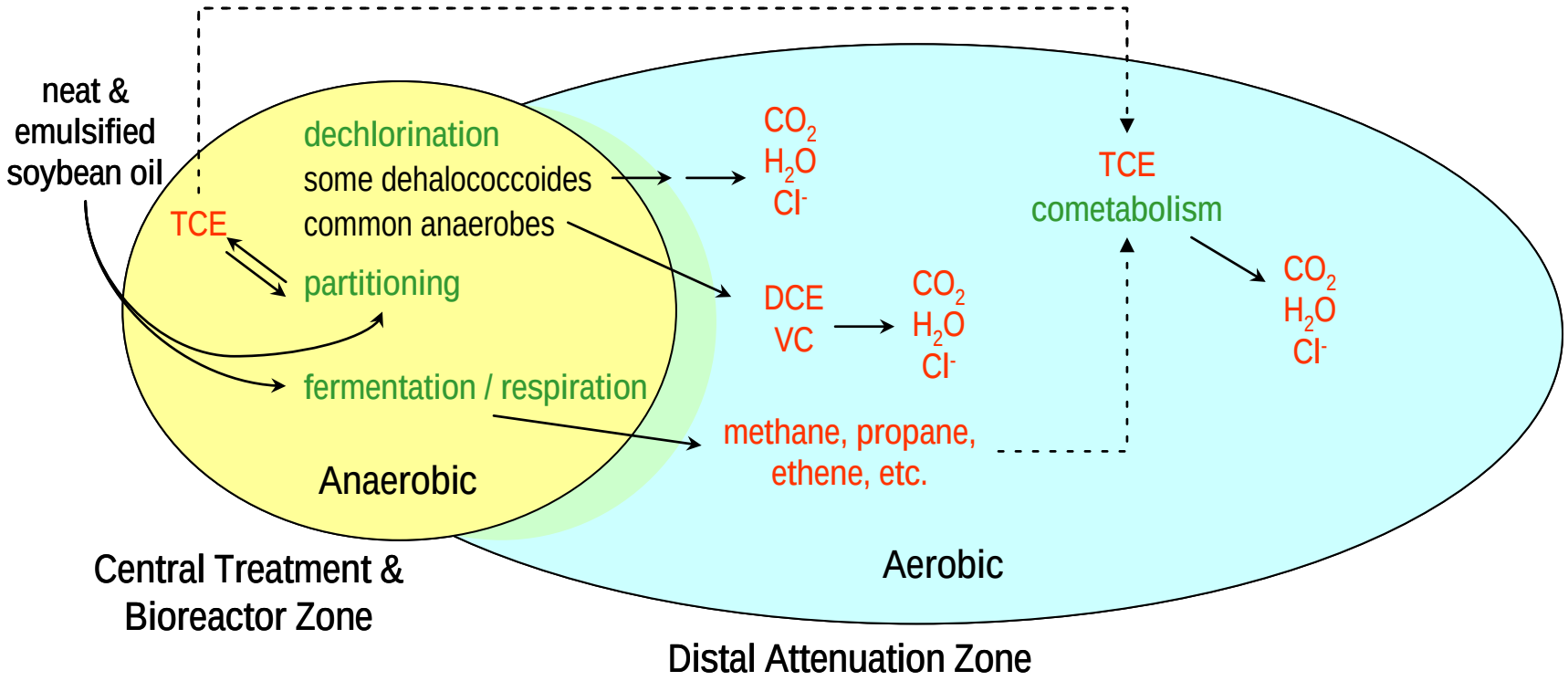


Figure BBB-7. Schematic of Edible Oil Reduction Processes (SRNL 2012)

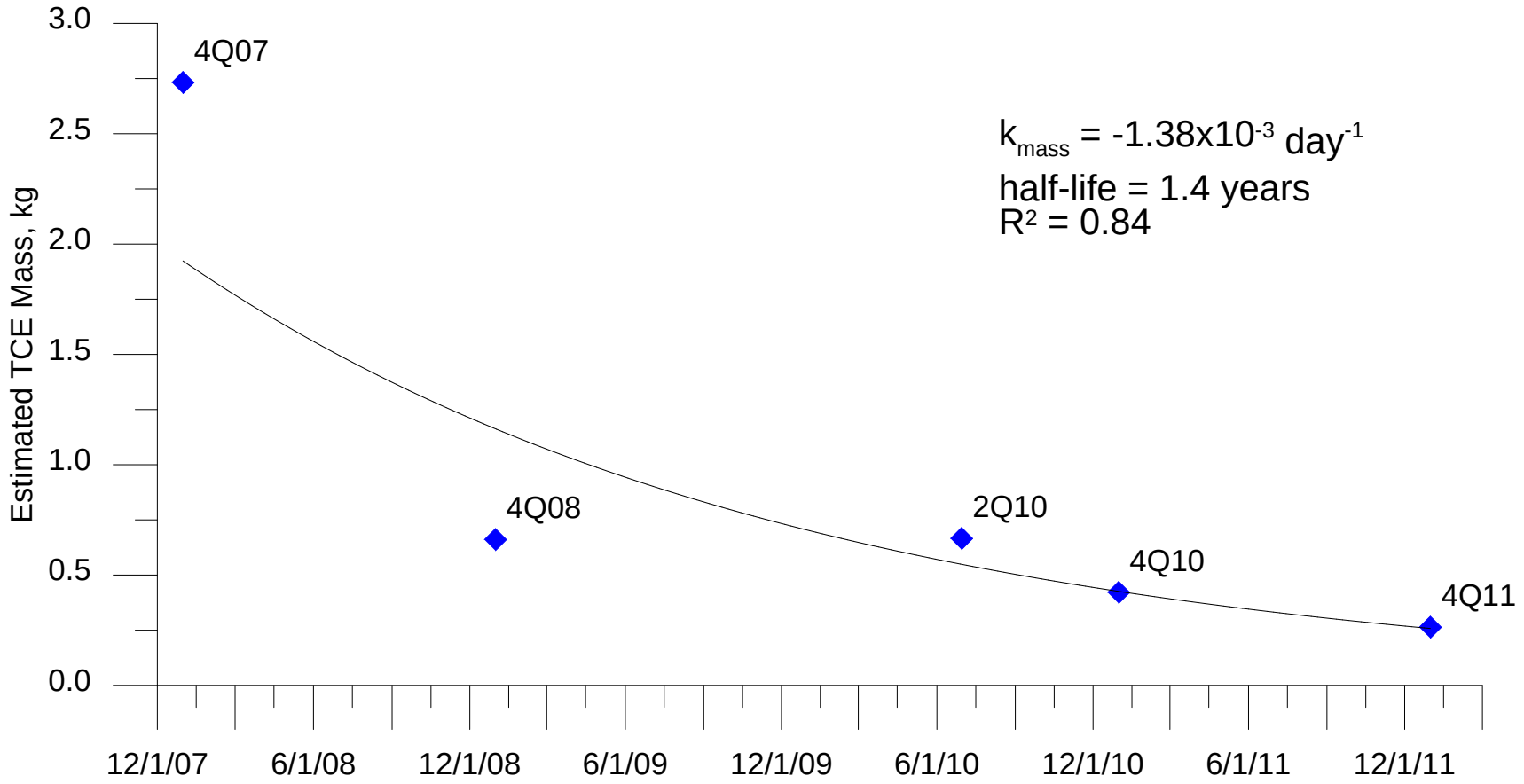


Figure BBB-8. Estimate of TCE Plume Mass Reduction and Rate (SRNL 2012)

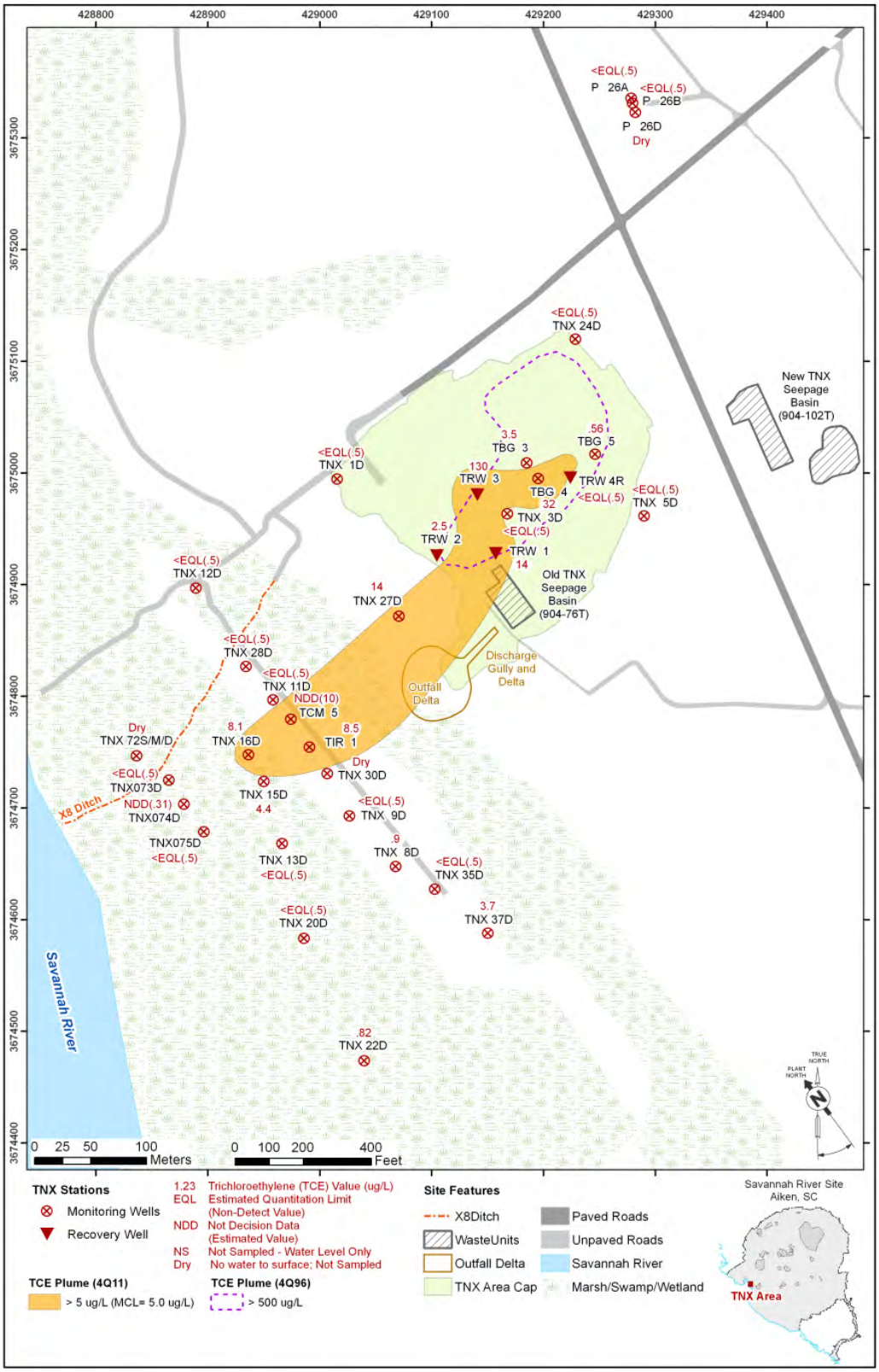


Figure BBB-9. 2011 TCE Plume (SRNS 2012)

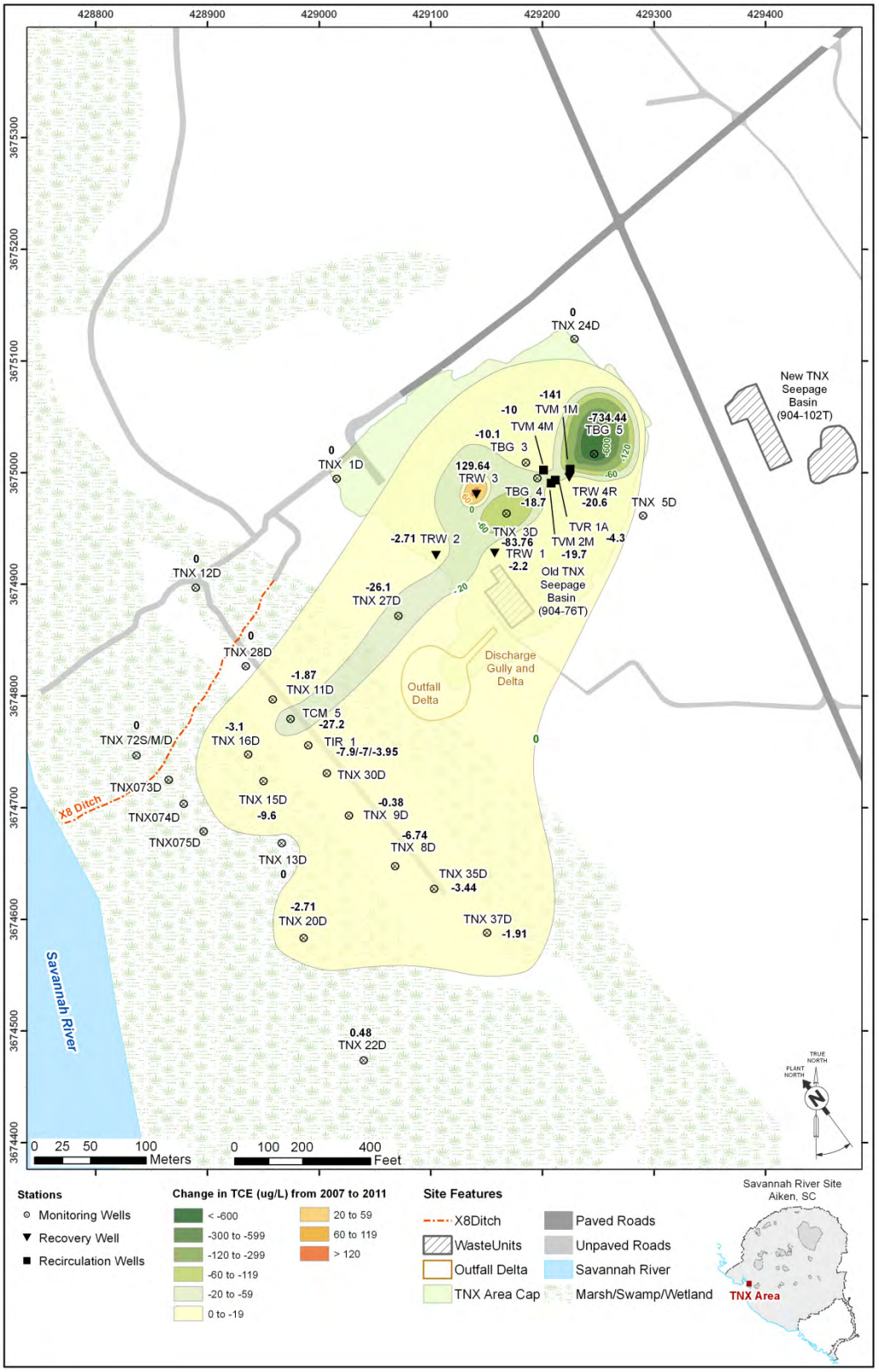


Figure BBB-10. Change in TCE Concentration between 4Q07 and 4Q11 (SRNL 2012)

Table BBB-1. Chronology of OU Events

Event	Date
Interim Record of Decision (IROD) Issuance for TNX Area Groundwater OU	November 16, 1994
Interim Remedial Action start	September 16, 1996
Explanation of Significant Differences (ESD) Issuance for the TNX Area Groundwater OU	September 22, 1997
ESD Issuance to the Rev. 1 IROD for the TNX Area Groundwater OU	February 19, 2002
ROD Issuance for TNX Area OU	March 25, 2004
ESD Issuance for TNX Area OU ROD	September 2, 2005
Remedial Action Start/Finish	August 12, 2004/May 4, 2006
Previous Five-Year Reviews	June 30, 1997 / February 12, 2004 / February 4, 2009

Table BBB-2. Soil and Sediment RCOCS and RGs

Media (subunit)	RCOC	Type of RCOC	RG
Sediment (NTSB)	Radium-226	HH-future worker	0.16 pCi/g
	Arsenic	ECO	8.2 mg/kg
	Chromium	ECO	80 mg/kg
	Copper	ECO	70 mg/kg
	Lead	ECO	35 mg/kg
	Mercury	ECO	0.15 mg/kg
	Nickel	ECO	30 mg/kg
	Silver	ECO	1.0 mg/kg
	Zinc	ECO	150 mg/kg
Soil (OTSB/IPSL)	Mercury	CM	0.078 mg/kg
Soil (UDG)	Mercury	CM	0.13 mg/kg
Soil (LDG)	Uranium -233/234	CM	1.31 pCi/g
	Uranium-235	CM	0.06 pCi/g
	Uranium -238	CM	1.31 pCi/g
	Actinium-228	HH-future worker	0.07 pCi/g
	Cesium-137	HH-future worker	0.10 pCi/g
	Lead-212	HH-future worker	0.73 pCi/g
	Radium-228	HH-future worker	0.07 pCi/g
	Thorium-228	HH-future worker	0.04 pCi/g
	Thorium -234	HH-future worker	45.43 pCi/g
	Uranium -233/234	HH-future worker	68.80 pCi/g
	Uranium-235	HH-future worker	0.82 pCi/g
	Uranium -238)	HH-future worker	3.13 pCi/g

Table BBB-3. Groundwater RCOCs and RGs for Future Industrial Worker at TNX Area OU

RCOC	RG/MCL
Carbon tetrachloride	5 µg/L
Tetrachloroethylene	5 µg/L
Trichloroethylene	5 µg/L
Gross alpha	15 ρCi/L
Total uranium	30 µg/L
Total radium (226 + 228)	5 PCi/L
Mercury	2 µg/L

Table BBB-4. Actual versus Estimated O&M Costs

	FY07	FY08	FY09	FY10	FY11	5-Year Total
Total Actual O&M Costs	$372,000	$225,000	$218,000	$137,000	$314,000	$1,267,000
Total ROD Estimated Direct O&M Costs	$343,000	$290,000	$290,000	$290,000	$290,000	$1,504,000

Table BBB-5. Issues Identified for TNX Area OU

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1,4-Dioxane has been identified as being a potential contaminant at TNX Area OU based on its possible association with other solvents that are present at TNX Area OU. However, there is a lack of groundwater data to dismiss 1,4-dioxane as being present at levels which would be harmful to human health or the environment.	N	N

Table BBB-6. TNX Area OU Recommendations and Follow-up Actions

Issues	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
N/A	Incorporate demonstrated technology into remedy	USDOE	USEPA/ SCDHEC	ESD to TNX Area OU ROD submitted June 2012	N	N
1,4-Dioxane has not been monitored recently in the TNX Area OU wells.	1,4-Dioxane will be monitored in all of the TNX Area OU wells during the 4Q2013 sampling event. The data results will be presented in the subsequent annual groundwater monitoring report that will be submitted in June 2014, as well as in the next Five-Year Remedy Review. Based on the results, the USEPA, SCDHEC, and USDOE will decide whether or not 1,4-dioxane should be permanently added to the list of monitored constituents.	USDOE	SCDHEC/ USEPA	June 2014	N	N

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Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit

I. SITE INFORMATION			
Site Name:	**TNX Area Operable Unit**	**Date of Inspection:**	**07/24/2012**
Location and Region	**SRS, USEPA Region 4**	**CERCLIS #:**	**#21 and 29**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**95°F and sunny**

Remedy Includes: *(Click all that apply)*

- ☐ Cover system
- ☐ Access Controls
- ☒ Institutional Controls
- ☒ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

Attachments: ☐ Inspection team roster attached ☐ Inspection team roster attached

II. INTERVIEWS *(Click all that apply)*

1. **O&M Site Manager:** **George Joyner** (Name) Post Closure Manager (Title) 6/26/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: **803-952-3324**
   Problems/Suggestions: ☐ Report Attached _____

2. **O&M Staff:** **Richard Feagin** (Name) **ACP Post Closure Waste Site** Inspector/Maintenance Coord. (Title) 5/25/2012 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.:803-952-4416
   Problems/Suggestions: ☐ Report Attached _____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

II. INTERVIEWS *(Click all that apply)(Continued)*

3. Local Regulatory Authorities and Response Agencies (i.e., State and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds or other city and county offices, etc.). Fill in all that apply.

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

Agency: _____

Contact: _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)

Problems/Suggestions: ☐ Report Attached _____

_____

4. Other Interviews *(Optional):* ☐ Report Attached _____

_____

_____

_____

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(Click all that apply)*

1. O&M Documents:

☒ O&M Manual	☒ Readily Available	☒ Up to Date	☐ N/A
☒ As-Built Drawings	☒ Readily Available	☒ Up to Date	☐ N/A
☒ Maintenance Logs	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks: _____

_____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX 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 1910.1201.HAZWOPER

3. O&M and OSHA Training Records: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Training Records are complete and up to date per 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: SCDHEC Air Quality Permit, NPDES Permit SC 0000175

5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

7. Groundwater Monitoring Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks:

9. Discharge Compliance Records:

☐ Air	☐ Readily Available	☐ Up to Date	☒ N/A
☒ Water (Effluent)	☒ Readily Available	☒ Up to Date	☐ N/A

Remarks:

10. Daily Access/Security Logs: ☒ Readily Available ☒ Up to Date ☐ N/A

Remarks: Daily operation logs

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX 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
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached
From:_____ (Date) To:_____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: _____

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A

Remarks: Signs at this site are in good condition. _____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area 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.) Field Walkdown

Frequency: Annually

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Federal Deputy Project Director (Title) | 10/22/12 (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 wooden stakes were located. Several had been damaged due to control burn in the area.

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 BBB-1. Five-Year Review Site Inspection Checklist – TNX Area 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: Vegetation around air stripper is mowed routinely._____

VII. COVER SYSTEMS ☐ Applicable ☒ N/A
A. Landfill Surface
1. Settlement (Low spots)**:** ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☐ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Holes: ☐ Location shown on site map ☐ Holes not evident Areal extent_____ Depth_____ Remarks:_____
5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A

Remarks:_____

7. Bulges: ☐ Location shown on site map ☐ Bulges not evident

Areal extent_____ Depth_____

Remarks:_____

8. Wet Areas / Water Damage: ☐ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks:_____

9. Slope Instability: ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent_____

Remarks:_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

2. Flows Bypass Bench: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

3. Bench Breached: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

4. Bench Overtopped: ☐ Location shown on site map ☐ N/A or okay

Remarks:_____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

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)

1. Settlement: ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks:_____

2. Material Degradation: ☐ Location shown on site map ☐ No evidence of degradation
Material Type_____ Areal extent_____
Remarks:_____

3. Erosion: ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks:_____

4. Undercutting: ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks:_____

5. Obstructions: Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____ Size_____
Remarks:_____

6. Excessive Vegetative Growth: Type_____
☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks:_____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents: ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

2. Gas Monitoring Probes:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

3. Monitoring Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

4. Leachate Extraction Wells:
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good Condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks:_____

5. Settlement Monuments: ☐ Located ☐ Routinely Surveyed ☐ N/A
Remarks:_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities:
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks:_____

2. Gas Collection Wells, Manifolds, and Piping:
☐ Good condition ☐ Needs maintenance
Remarks:_____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*

3. Gas Monitoring Facility *(e.g., gas monitoring of adjacent homes or buildings)***:**
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks:_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected: ☐ Functioning ☐ N/A
Remarks:_____

2. Outlet Rock Inspected: ☐ Functioning ☐ N/A
Remarks:_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation:
Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks:_____

2. Erosion:
Areal extent_____ Depth_____ ☐ N/A
☐ Erosion not evident
Remarks:_____

3. Outlet Works: ☐ Functioning ☐ N/A
Remarks:_____

4. Dam: ☐ Functioning ☐ N/A
Remarks:_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations: ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks:_____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

VII. COVER SYSTEMS *(Continued)*
2. Deformations: ☐ Location shown on site map ☐ Deformation not evident Remarks:_____
I. Perimeter Ditches/Offsite Discharge ☐ Applicable ☐ N/A
1. Siltation: ☐ Location shown on site map ☐ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☐ N/A Remarks:_____
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
1. Settlement: ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Performance Monitoring: Type of Monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Head Differential_____ Remarks:_____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical:

☒ Good Condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks: TRW 1,2,3, and 4R

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☒ Good Condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment:

☒ Readily Available ☒ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. Collection Structures, Pumps, and Electrical:

☐ Good Condition ☐ Needs Maintenance

Remarks:

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances:

☐ Good Condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

C. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (Check components that apply)**:**

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ Air stripping ☐ Carbon adsorbers
☐ Filters
☐ Additive (e.g., chelation agent, flocculent)
☐ Others
☒ Good Condition ☐ Needs maintenance
☒ Sampling ports properly marked and function
☒ Sampling/maintenance log displayed and up-to-date
☒ Equipment properly identified
☒ Quantity of groundwater treatment annually 100 gpm maximum, 75 gpm average
☐ Quantity of surface water treatment annually

Remarks: The discharge is associated with the air stripper in the pump-and-treat system. The water discharged from the basins area is surficial storm water drainage or water discharged from the TAOU Cap drain layer. All basins in the T-Area were backfilled as part of the remedy, so no water moves from the basin to outfall X-08C.

2. Electrical Enclosures and Panels *(properly rated and function)***:**

☐ N/A ☒ Good Condition ☐ Needs maintenance

Remarks:

3. Tanks, Vaults, Storage Vessels:

☐ N/A ☒ Good Condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks:

4. Discharge Structure Appurtenances:

☒ N/A ☐ Good Condition ☐ Needs maintenance

Remarks:

5. Treatment Building(s):

☒ N/A ☐ Good Condition (especially roof and doorways ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks:

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

IX. GROUNDWATER/SURFACE WATER REMEDIES *(Continued)*

6. Monitoring Wells *(pump and treatment remedy)***:**

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

D. Monitoring Data ☒ Applicable ☐ N/A

1. Monitoring Data:

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data:

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☐ Applicable ☒ N/A

1. Monitoring Wells *(natural attenuation remedy)***:**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

X. OTHER REMEDIES

If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Soil Vapor Extraction System ☐ Applicable ☒ N/A

1. Blowers, Wellhead Plumbing, and Electrical:

☐ Good Condition ☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks:_____

2. Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances:

☐ Good Condition ☐ Needs maintenance

Remarks:_____

3. Spare Parts and Equipment:

☐ Readily Available ☐ Good Condition ☐ Requires Upgrade ☐ Needs to be provided

Remarks:_____

Attachment BBB-1. Five-Year Review Site Inspection Checklist – TNX Area Operable Unit *(continued)*

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). Remedy for this site is: removal of PTSM; pump-and-treat and SVE; and institutional controls to attenuate the leachability of VOCs and radiological contaminants in soils. The treatment systems remedy appears to be functioning as designed and the results are reported in the annual Groundwater and Effectiveness Monitoring Report for TNX Area OU.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures are adequately maintaining the integrity of the pump-and-treat and SVE systems, which in turn maintains the effectiveness of the systems to mitigate leaching. The O&M procedures consisting of annual site inspections and site maintenance (repair of erosion damage, cover maintenance, and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. There are no issues requiring corrective actions.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Optimization opportunities are presented in Table BBB-5 of this OU specific report.

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