Savannah River NUCLEAR SOLUTIONS℠

Seventh Five-Year Remedy Review Report for Savannah River Site Operable Units with Groundwater Remedies (U)

Aiken, South Carolina

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Aiken, South Carolina

Date	~~Angelia D. Adams,~~ Karen D. Morrow, Acting Director Office of Closure and Project Management Savannah River Operations Office Office of Environmental Management U. S. Department of Energy
Date	Juli E. Blalock, Chief Bureau of Land and Waste Management South Carolina Department of Environmental Services
Date	Caroline Y. Freeman, Director Superfund and Emergency Management Division U. S. Environmental Protection Agency - Region 4

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This report documents the Seventh Five-Year Remedy Review for the second OU grouping, OUs with groundwater remediation selected as the remedy, and includes a review of remedy decision documents for six USEPA Superfund Enterprise Management System (SEMS) units at the SRS. SEMS is a database maintained by the USEPA as part of the Superfund program that assigns a unique tracking number to hazardous waste sites considered for cleanup under CERCLA. Remedy decision documents may include more than one SEMS unit and/or SRS OU.

The SRS OUs evaluated in this document were grouped together principally because of similar groundwater remedies including Monitored Natural Attenuation (MNA) or a Groundwater Mixing Zone permit as well as interim remedial actions. Figure 1 identifies the location of the SRS OUs evaluated in this document. The data evaluation and visual inspections for the SRS OUs with groundwater remedies were conducted from June 2024 through December 2024.

This report was prepared using the *Comprehensive Five-Year Review Guidance* (USEPA 2001) and is supplemented by the *Recommended Evaluation of Institutional Controls: Supplement to the "Comprehensive Five-Year Review Guidance"* (USEPA 2011), *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA 2012), and *Five-Year Review Recommendation Template* (USEPA 2016). This report summarizes common elements for the entire SRS. The remedy reviews are included as Appendix C through Appendix H.

Site Chronology

A summary of the regulatory history of the SRS is provided below beginning with the 1988 National Resource Defense Council (NRDC) Consent Decree (Civil Action No. 1:85-2583-6). The Consent Decree was an agreement between the NRDC and other interested parties, SCDES, and USDOE to amend Parts A and B of the Resource Conservation and Recovery Act (RCRA) Permit Application to include the Metallurgical Laboratory Basin (904-11G) and associated Carolina Bay, the Acid/Caustic Basins (904-74G, 904-75G,

904-78G, and 904-80G), and the Mixed Waste Management Facility (904-28G) to include closure, groundwater monitoring, and post-closure activities. The Savannah River Laboratory Seepage Basins (904-53G, 904-54G, and 904-55G) and the New TNX Basin (904-120G) were also included in the Consent Decree for closure in a RCRA-like manner. The Consent Decree was signed on May 26, 1988. On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established RCRA Facility Investigation (RFI) program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 U.S. Code Section 9620, the USDOE has negotiated a Federal Facility Agreement (FFA) (FFA 1993) with the USEPA and the SCDES 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 SCDES.

~~A chronology of site events including the effective dates for the Consent Decree, the FFA, and the NPL Listing is provided in Appendix A.~~ A summary status of SRS is provided in ~~Table 1 is~~ the Five-Year Summary Review Form in Table 1~~, which provides a summary status of SRS~~. A chronology of site events including the effective dates for the Consent Decree, the FFA, and the NPL Listing is provided in Appendix A. ~~Table 2 provides a chronology of the decision documents for the SRS OUs with groundwater remedies evaluated in this report.~~ Chronologies of significant activities and regulatory milestones for individual OUs are included in the site-specific remedy review reports (Appendix C through Appendix H).

Background

The SRS was constructed during the 1950s to produce materials used in the fabrication of nuclear weapons, primarily tritium and plutonium, in support of our nation's defense programs. Production of nuclear materials for the defense program was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored,

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

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

Status of Implementation

The remedial actions listed in Table 2 have been implemented. Except for C-Area Groundwater (CAGW) OU, LUCs are ongoing at all OUs discussed in this five-year remedy review report. Because the remedy for the CAGW OU is an interim remedy, LUCs will be addressed (if needed) as a component of the remedy in the final Record of Decision (ROD). The status of all response actions or remedial actions for each of the groundwater remedies is discussed in greater detail in the OU-specific appendices (Appendix C through Appendix H). These actions include final actions, removal actions, and remedial actions conducted prior to a final ROD.

Systems Operation and Maintenance

A site-wide maintenance program is in place to care for cover systems, signs, monitoring wells, and other infrastructure associated with environmental remediation. Groundwater monitoring networks require maintenance. Identifying signs must be legible and locks and wells 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, abandoned, or replaced.

Groundwater monitoring is an important component of operation and maintenance (O&M) at SRS. Groundwater monitoring includes well installation, sample collection, sample

analysis, data verification, data validation, data interpretation, and document production and reporting. Individual OUs may require groundwater monitoring reports to be produced and submitted to USEPA and SCDES. Enhancements to the groundwater sampling systems are part of a continual groundwater monitoring well O&M improvement program. For example, Purge Water Management System (PWMS) units were installed at wells that require containerization to decrease the amount of purge water requiring treatment, thus lowering O&M (sampling and disposal) costs. As reported in Table 4, Operation and Maintenance Cost Comparison for SRS OUs with Groundwater Remedies, any cost savings from the PWMS units are captured in the actual costs.

The costs of the O&M activities for the individual OUs have been compiled as part of this five-year remedy review. As part of the process of selecting the most appropriate action for each OU, the cost of implementing each of the remedies was estimated and reported in the respective remedy decision documents. Table 4 compares the actual costs incurred at SRS OUs with groundwater remedies over the period from fiscal year (FY) 2020 to FY2024 to the estimated costs from the remedy decision documents over the same period. The review for the actual costs incurred (i.e., FY2020 to FY2024) is based on the time-period since the last review five-year remedy review (SRNS 2020~~b~~). Specific details concerning costs incurred are included for each OU in Appendix C through Appendix H.

III. PROGRESS SINCE LAST REVIEW

For the OUs evaluated in this review, the previous protectiveness statements from the Sixth Five-Year Remedy Review Report (SRNS 2020~~b~~) concluded that all OUs were found to be protective (Table 5). The remedy at CAGW OU was implemented as an interim action. However, exposure pathways that could lead to unacceptable risk were controlled through the interim action. There have been no new remedial actions implemented since the Sixth Five-Year Remedy Review Report (SRNS 2020) was signed by USDOE, SCDES, and USEPA and issued to the public.

There were no recommendations or follow-up actions from the Sixth Five-Year Remedy Review Report that impact the OUs with groundwater remedies evaluated in this report.

The following actions have been completed since the Sixth Five-Year Remedy Review Report (SRNS 2020) for the OUs with groundwater remedies evaluated in this report:

- Reviewed the most recent regulatory submittals pertaining to each of the OUs;
- Confirmed the implementation of the remedial actions and interim remedial actions;
- Reviewed groundwater monitoring data to determine if MCLs were exceeded;
- Inspected the OUs, interviewed maintenance personnel and documented the results on the Inspection Checklist, as required, 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.

IV. FIVE-YEAR REMEDY REVIEW PROCESS

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

- Submitted a scoping summary to USDOE, USEPA, and SCDES on August 13, 2024 and conducted a scoping meeting on August 27, 2024. The USDOE, USEPA, and SCDES agreed to the scope and schedule of the remedy review report, which is discussed in the scoping summary.
- Published an announcement on September 12, 2024 that the USDOE is conducting the Seventh Five-Year Remedy Review in phases. The announcement stated that the second phased submittal will focus on OUs with groundwater remedies. The public was notified through mailings of *The Savannah River Site Environmental Bulletin*, a newsletter sent to citizens in South Carolina and Georgia on an extensive mailing list, including landowners adjacent to SRS, which is updated in July, and through notices in the *Aiken Standard* (Aiken, SC), *The Augusta Chronicle* (Augusta, GA), *The People Sentinel* (Allendale and Barnwell, SC), and *The State* (Columbia, SC) newspapers. The

Environmental Bulletin and newspaper affidavits of publication are available in the Administrative Record File.

- Reviewed appropriate data, and documentation (i.e., including RODs, Early Action RODs [EARODs], Interim RODs [IRODs], Explanation of Significant Differences [ESDs]), LUCIP required field inspection checklists, etc.). The specific data and document references used to review each remedy decision are listed in the OU-specific reports located in Appendix C through Appendix H.
- 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 H.
- Reviewed changes in standards and to-be-considered guidance including federal and state promulgated standards (i.e., chemical-specific applicable or relevant and appropriate requirements [ARARs]) that would call into question whether the prescribed remedy was meeting the newer standards or guidance. Any problems or discrepancies are reported in Section V (Technical Assessment) and Section VI (Issues/ Recommendations) of the OU-specific appendices.
- Submitted draft Fact Sheet to USEPA and SCDES for review with Revision 0 of the Seventh Five-Year Remedy Review Report for SRS OUs with Groundwater Remedies.

Community Notification and Involvement

USDOE will address any comments received from USEPA and SCDES and provide a Revision 1 report, if necessary, for USEPA and SCDES approval. After the USEPA and SCDES approve this report and USDOE, USEPA, and SCDES sign this report, a notice of its availability will be published in the *Aiken Standard* (Aiken, SC), *The Augusta Chronicle* (Augusta, GA), *The People Sentinel* (Allendale and Barnwell, SC), and *The State* (Columbia, SC) newspapers. Additionally, the availability of the report will be announced in *The Savannah River Site Environmental Bulletin*, which will be sent (postal service and

email) to the SRS mailing list. The SRS mailing list consists of USDOE and SRS contractor personnel, SRS Citizens Advisory Board, members of the public surrounding SRS, community leaders and organizations, etc. The report and Fact Sheet will be posted on the SRS external webpage and will be made available to the public at four information repositories listed in the *Environmental Bulletin*.

Data Review, Site Inspections, and Interviews

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

SRS was greatly impacted by Hurricane Helene and closed in response during the period of September 27, 2024 through October 6, 2024 with the exception of emergency and essential personnel. The site resumed normal operations on October 7, 2024. Environmental Compliance and Area Completions Projects (EC&ACP) Operations and Monitoring personnel are evaluating the impacts of Hurricane Helene to all SRS OUs, and post-hurricane damage assessments and cleanup activities are ongoing. Impacts from Hurricane Helene will be discussed in OU-specific reports and/or the next five-year remedy review report for SRS OUs with groundwater remedies, as applicable. No damages have been identified at the OUs evaluated in this report that would affect the protectiveness of the remedies.

~~USEPA and SCDES are expected to perform site inspections of OUs with groundwater remedies with issued decision documents prior to submittal of the Revision 1 report.~~ The Revision 0 report ~~will be~~was submitted on ~~or before~~ December 19, 2024. USEPA and SCDES performed site inpsections of OUs with groundwater remedies with issued decision documents on February 27, 2025. No problems regarding protection of the remedies for the OUs were identified during the inspections.

V. TECHNICAL ASSESSMENT

The technical assessment of the environmental cleanup program at SRS and each of the OU-specific remedies evaluated in this report (Appendix C through Appendix H) is described by answers to the following three questions posed by the USEPA guidance.

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

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

Answer: Yes. SRS groundwater remedies and related activities are functioning as intended as demonstrated below.

- Passive and Low Energy soil vapor extraction (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 (e.g., electrical resistance heating [ERH]) have been successful in removing very high concentrations of VOCs from subsurface zones.
- Groundwater data at MNA remedy plumes indicates that groundwater concentrations are generally decreasing, and plumes are not expanding.
- None of the expected timeframes to achieve cleanup levels in groundwater as identified in the respective RODs have been exceeded.
- Contaminated material has been excavated and consolidated or left in place under protective cover systems breaking the pathway for worker exposure. The remedial actions associated with the RAOU (in situ decommissioning) and the R-Area Reactor Seepage Basins (RRSB) (asphalt and concrete covers) also serve to mitigate the

migration of contaminants to groundwater. No other units in this five-year remedy review report with groundwater remedies have an engineered low permeability cap.

- For all final remedial actions, LUCs are in place and are effective in preventing unauthorized access to groundwater and include physical access controls to SRS (e.g., fences, guards, security patrols, etc.) and administrative controls (SRS is a secured government facility with land use restrictions and a Site Use/Site Clearance program). LUCs may be part of the final remedial action at CAGW OU. In the interim, the CAGW OU is included in the FFA Annual Progress Reports to demonstrate long-term protectiveness through the SRS facility security and administrative controls that restrict unauthorized access.

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

Answer: Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid for all OUs included in this report. An evaluation of chemical and radiological standards including federal and state promulgated standards (i.e., chemical-specific ARARs) that were in place when the last five-year remedy review was initiated in 2020 to the current 2024 standards was conducted to determine if there were any changes that would affect the protectiveness of the selected remedies. There were no changes in chemical- and radiological-specific standards that would affect the protectiveness of the remedies. Although new MCLs and regional screening levels (RSLs) were established for per- and polyfluoroalkyl substances (PFAS) compounds, an evaluation of PFAS for the six OUs with groundwater remedies indicated no impact to remedy protectiveness. 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. No other information that could call into question the protectiveness of the selected remedies and no outstanding issues have been identified in this Seventh Five-Year Remedy Review.

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

VI. ISSUES/RECOMMENDATIONS

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

There are no recommendations or follow-up actions (Table 7).

VII. PROTECTIVENESS STATEMENT(S)

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

For OUs evaluated in this Five-Year Remedy Review, the groundwater remedies were determined to be protective of human health and the environment (Table 8). For the CAGW OU , unit-specific LUCs were not part of the interim remedy. In the *Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Groundwater Remedies* (SRNS ~~2017a~~2020), USDOE recommended including the CAGW OU in the list of LUC OUs in the FFA Annual Progress Report~~s (SRNS 2023a)~~. Since November 2020, USDOE has included the CAGW OU in the FFA Annual Progress Reports, which demonstrate long-term protectiveness by ~~that~~ recognize~~e~~ing SRS facility security and administrative controls that restrict unauthorized access ~~as providing long-term protection~~

~~of human health and the environment~~. The FFA Annual Progress R~~r~~eport is required by the FFA and includes an annual certification by the USDOE Savannah River Operations Manager that the listed OUs ~~are in compliance~~comply with land use requirements.

LUCs are part of all remedial actions where hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unlimited use and unrestricted exposure. The type of LUCs and implementation and reference to OU-specific LUCIPs are described in detail in Section VII of the OU-specific appendices. For the OUs evaluated in this report, pathways for contaminants to reach human and ecological receptors have been successfully broken by the selected remedies including LUCs with the exception of the CAGW OU. Because the remedy for the CAGW OU is an interim remedy, LUCs will be addressed (if needed) as a component of the remedy in the final ROD.

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

VIII. NEXT REVIEW

As established in Section 121 of CERCLA, as amended by the SARA and the NCP, periodic reviews are required at least every five years for sites where hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure following the completion of all remedial actions. Barring a change in the governing laws, another review should be completed within five years from the signature date of this document. The final signature date for the last grouping of the Seventh Five-Year Remedy Review Report is due no later than December 31, 2028.

IX. OU-SPECIFIC FIVE-YEAR REMEDY REVIEW REPORTS

The OU-specific Five-Year Remedy Reviews for the remedies evaluated in this document are included in Appendix C through Appendix H.

X. REFERENCES

FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket Number 89-05-FF, WSRC-OS-94-52, Effective Date: August 16, 1993

SRNS, 2008. *Third Five-Year Remedy Review Report for the Savannah River Site (U)*, WSRC-RP-2007-4063, Revision 1.1, Savannah River Nuclear Solutions, LLC, 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. *Fourth Five-Year Remedy Review Report for the Savannah River Site (U) Aiken, South Carolina,* SRNS-RP-2012-00011, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

SRNS, 2016. *R-Area Groundwater (NBN) Effectiveness Monitoring Report in Support of R-Area Operable Unit (U) January 2015 through December 2015*, SRNS-RP-2016-00347, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

SRNS, 2017b. *K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G) (KBRP), L-Area Burning/Rubble Pit and Rubble Pile (131-L, 131-1L, and 131-2L) (LBRP), and P-Area Burning/Rubble Pit (131-P) (PBRP) Operable Units (OUs) Detailed Combined*

Table 2. SRS OUs with Groundwater Remedies

#	Appendix	Operable Unit	SEMS No.	Decision Document Issuance Year[a]	Remedial Action[b]	Area with Groundwater Plumes (contaminant-acres)	LUCs (acres)
1	C	C-Area Groundwater	82	2004	ERH with SVE[c]	456.3	TBD
2	D	Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, and 080-183G)	24	2000, 2002, 2003, 2005	Enhanced Bioremediation, ERH, SVE, Passive SVE, Soil Cover, MNA, and Land Use Controls (LUCs)	39.7	62.6
3	E	D-Area Oil Seepage Basin (631-G)	27	1995, 1999	~~Removal~~ Interim Remedial Action (Excavation), Final Action (Groundwater Mixing Zone [(~~GWMZ~~)], LUCs)	14.7	23.2
4	F	L-Area Southern Groundwater	77	2007, 2014	MNA, LUCs	211.1	952.2
5	G	R-Area Operable Unit	95	2009, 2011	Removal Actions (In Situ Decommissioning of R-Reactor Building [105-R], Excavation, Cover), MNA, LUCs	49.7	450.4
6	H	R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, and 904-104G) and 108-4R Overflow Basin	25	2004	Concrete Intruder Barrier, Excavation, On-Site Disposal, GWMZ, LUCs	34.7	37.8

a Reflects the year the decision document (i.e., RODs, EARODs, IRODs, and ROD Amendments) was issued or the year of the last signature on the decision document.
b The OUs were grouped together because of similar groundwater remedies and monitoring activities. Some OUs may also include subunits with contaminants in soils or building material (i.e., concrete) that are addressed by the remedy decision document.
c LUCs are not a component of the interim remedy and will be addressed (if needed) by the final remedial action for the CAGW OU.
TBD – to be determined

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

Operable Unit	Main Remedy	Remedy Decision Document Year[a]	FY2020-FY2024 O&M Estimated Cost	FY2020-FY2024 O&M Actual Cost	% of Estimate	Comments
C-Area Groundwater	Electrical Resistance Heating (ERH) with Soil Vapor Extraction (SVE)[a],	2004[b]	$0	$113,759	0%	Actual costs for performance/ groundwater monitoring was more than expected because on-going groundwater monitoring and five-year remedy review costs beyond FY2013 were not included in the original IROD cost estimate.
Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G)	Enhanced Bioremediation, ERH, SVE, Passive SVE, Soil Cover, MNA, LUCs	2005	$197,793	$1,066,730	539%	Actual costs were higher than expected because the current number of monitoring wells and surface water sampling locations (76) is much larger than the ROD estimate (12) requiring increased maintenance activities.
D-Area Oil Seepage Basin (631-G)	~~Removal~~ Interim Remedial Action (Excavation), Final Action (Groundwater Mixing Zone ~~([~~GWMZ~~),~~], LUCs)	1999	$16,666	$259,587	155%	Actual costs are higher than expected because groundwater monitoring and reporting costs have continued beyond FY2009 as estimated in the ROD. The ROD estimate was based on 12 locations verses 23 wells that are currently being monitored.
L-Area Southern Groundwater	MNA, LUCs	2007	$188,040	$639,467	340%	Actual costs are higher due to the Effectiveness Monitoring Reports not being included in the estimated costs.
R-Area Operable Unit	Removal Actions (ISD of R-Reactor Building [105-R], Excavation, Cover), MNA, LUCs	2011	$291,500	$1,183,697	406%	Actual costs are higher than expected because groundwater monitoring reports are being submitted annually. Additional maintenance activities were also required.
R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin	Concrete Intruder Barrier, Excavation, On-Site Disposal, GWMZ, LUCs	2004	$1,613,432	$1,371,042	85%	Actual costs are lower than expected due to optimization of the groundwater monitoring program.

a Document which included the O&M estimated costs.

b LUCs are not a component of the interim remedy for CAGW OU and will be addressed (if needed) by the final remedial action for CAGW OU.

Table 5. Protectiveness Determinations/Statements from the Sixth Five-Year Remedy Review for the SRS OUs with Groundwater Remedies (SRNS 2017a)

SEMS No.	Operable Unit	Protectiveness Determination	Protectiveness Statement
82	C-Area Groundwater	Protective	The interim remedy at the CAGW OU is protective of human health and the environment.
24	Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G)	Protective	The remedy at CMP Pits OU is protective of human health and the environment.
27	D-Area Oil Seepage Basin (631-G)	Protective	The remedy at the DOSB OU is protective of human health and the environment.
77	L-Area Southern Groundwater	Protective	The remedy at the LASG OU is protective of human health and the environment.
95	R-Area Operable Unit	Protective	The remedy at RAOU is protective of human health and the environment.
25	R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin	Protective	The remedy at the RRSB OU is protective of human health and the environment.

indicate rapidly decreasing TCE concentrations since the completion of the ERH with SVE interim action remedy from 2006 to 2014, but slowly decreasing TCE concentrations since 2014 (Figure C-8).

Summary of Inspections and Interviews

Interviews were conducted with Eric Barron, O&M staff member, and with Brian Hanshew, O&M Site Manager, on October 22, 2024 at the O&M organization offices. No issues were identified for the CAGW OU during these interviews. The CAGW OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on September 04, 2024. No issues were identified during these inspections.

The CAGW OU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2024. No issues were identified for the CAGW OU during this inspection that would affect the protectiveness of the remedy. However, SRS was greatly impacted by Hurricane Helene and closed in response during the period of September 27, 2024 through October 6, 2024 with the exception of emergency and essential personnel. The site resumed normal operations on October 7, 2024. EC&ACP O&M personnel are evaluating the impacts of Hurricane Helene and post-hurricane damage assessments and cleanup activities are ongoing. ~~No s~~Storm damages to two wells (CSB020B and CSB020C) have been identified ~~at the~~in the distal portion of the CAGW OU ~~that would~~ monitoring network, but these damages do not affect the protectiveness of the TCE source area ERH-SVE remedy.

A regulatory inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Environmental Services (SCDES) ~~will be scheduled after submittal of the revision 0 of this document~~was held on February 27, 2025. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of CAGW OU and ~~will be~~were provided an opportunity to walk down the OU. The USEPA and SCDES elected not to perform a walk down because the drone video provided them better views of the OU. No significant

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

VII. TECHNICAL ASSESSMENT

Is the Remedy Functioning as Intended by the Decision Document?

The selected interim action remedy of ERH with SVE is effective in preventing human health exposure to the RCOCs and is functioning as intended as demonstrated below:

- The ERH with SVE system was effective at reducing TCE concentrations in the vadose zone to a level that prevents TCE leaching from its MCL in the groundwater. The ERH with 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 shut down, SVE continued operating for an additional 21 days, to further decrease TCE levels. ERH with 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 monitoring data indicate the TCE plume in the source area is slowly decreasing in concentration since the last five-year remedy review (Figure C-8), and TCE concentrations have significantly decreased relative to the RFI/RI characterization data (TCE maximum concentration = 13,100 µg/L) collected from 1998 to 2002. In 2024, the maximum groundwater TCE concentration was 82 µg/L.

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

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 interim remedy selection are still valid. There have been no changes in standards or physical conditions of the CAGW OU that would affect the protectiveness of the interim action remedy.

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

Fact sheets provided on the USEPA webpage (https://19january2021snapshot.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern_.html) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dintrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these emerging contaminants, except for PFAS, were identified as applicable to this OU based on the OU history of contamination.

In October 2010, a piece of forestry equipment (feller buncher) caught fire in the woods south of C Area, which was put out by the SRS Fire Department. The University of Georgia Savannah River Ecology Laboratory sampled Castor Creek and discovered detected elevated levels of PFAS compounds in 2022. In 4Q2024, limited PFAS sampling was conducted at nearby C Area wells and Castor Creek surface water stations that could have potentially been contaminated by PFAS. This potential contamination is not directly related to C Area operations. Results will be reported in next submittal of the CAGW OU

monitoring report in 2025. PFAS characterization will be included and discussed in the documents to support the final ROD for the CAGW 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 interim action remedy for the CAGW 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 interim action remedy at the CAGW OU is protective of human health and the environment. Although unit-specific land use controls (LUCs) were not part of the interim remedy, the CAGW OU is included in the FFA Annual Progress Report (SRNS 2023b) with the list of OUs that recognize SRS facility security and administrative controls that restrict unauthorized access as providing long-term protection of human health and the environment. The report is required by the FFA and includes an annual certification by the USDOE Savannah River Operations Manager that the listed OUs are in compliance with land use requirements. For the CAGW OU, additional remedial actions, including unit-specific LUCs may need to be implemented by the final ROD. The final ROD for CAGW OU is scheduled for issuance in April 2030.

Exposure pathways that could result in unacceptable risks are being controlled by LUCs. All threats to the CAGW OU are being addressed through 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, warning signs and use

Attachment C-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: N/A	
VII. LANDFILL COVER/CONTAINMENT ☐ **APPLICABLE** ☒ **N/A**	
VIII. VERTICAL BARRIER WALLS ☐ **APPLICABLE** ☒ **N/A**	
IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **APPLICABLE** ☒ **N/A**	
X. OTHER REMEDIES	
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 with SVE operations are 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: N/A	
4. Monitoring Wells (ERH with 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-1D, CRW 020D and CRW 021DR.	

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

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 with SVE was successful in preventing further groundwater impact. Until the final CAGW ROD is issued, the exposure pathways that could lead to unacceptable risk are being restricted through the SRS Site Use/Site Clearance Program and 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 with 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. Unauthorized access to the CAGW OU is restricted by 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 Programs). Within a month after Hurricane Helene occurred all monitoring wells were re-inspected for damages. All damages, if any, were repaired prior to the scheduled well sampling events, with the exception of wells CSB020B and CSB020C, which require replacement. The well sampling schedules were not impacted for all CAGW OU wells except CSB020B and CSB020C, which could not be sampled in 4Q2024.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

End of Checklist

installations were completed in 2019 and 2021. This includes six borings with VOC soil headspace sampling at various depths and the installation of GA wells CMP010A, CMP011A, CMP055A, Lower Aquifer Zone (LAZ) well CMP035B. The 2019 and 2021 soil and groundwater monitoring results were included in subsequent EMRs and have been included on plume maps.

GA well CMP010A unexpectedly started to show groundwater contamination above MCLs for both VOCs and lindane. It was subsequently determined that the well had been compromised and appeared that contaminated groundwater was seeping into the well through damaged well casing joints. The CMP010A well was abandoned in 2024 and a replacement well CMP010AR was installed. Additionally, 11 shallow wells (CMP-PB-001D1, CMP-PB-002D1, CMP-PB-002-D2, CMP-PB-003-D1, CMP-PB-003-D2, CMP-PB-004-D1, CMP-PB-004-D2, CMP-PB-005-D1, CMP-PB-005-D2, CMP-PB-006-D1, and CMP-PB-006-D2) were installed in 2024 within the Pen Branch Stream to aid in the groundwater/surface water interface and wetland investigations. The locations of all of these new stations are provided in Figure D-7. Data collected from the replacement well and the 11 Pen Branch wells will be supplied in future EMRs.

Summary of Inspections and Interviews

Interviews were conducted with Eric Barron, O&M staff member, and Brian Hanshew, O&M Post-Closure Manager, on October 22, 2024 at the O&M organization offices. No issues were identified during these interviews. The CMP Pits OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on September 04, 2024.

The CMP Pits OU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2024. No issues were identified for the CMP Pits OU during the inspection that would affect the protectiveness of the remedy. However, SRS was greatly impacted by Hurricane Helene and closed in response during the period of September 27, 2024 through October 6, 2024 with the exception of emergency and essential personnel. The site resumed normal operations on October 7, 2024. EC&ACP O&M personnel are evaluating the impacts of

Hurricane Helene and post-hurricane damage assessments and cleanup activities are ongoing. No storm damages have been identified at the CMP Pits OU that would affect the protectiveness of the remedy.

A regulatory inspection meeting with USDOE, USEPA, and SCDES ~~will be scheduled after submittal of the revision 0 of this document~~was held on February 27, 2025. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of CMP Pits OU and ~~will be~~ were provided an opportunity to walk down the OU. The USEPA and SCDES elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to be~~were identified during the inspection.

Scheduled annual site inspections conducted from FY2020 to FY2024 identified active ant mounds on the soil cover, overgrown vegetation in the drainage ditch, and sediment in the drainage culvert needing removal. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. TECHNICAL ASSESSMENT

Is the Remedy Functioning as Intended by the Decision Document?

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

- The selected remedy component of LUCs is effective in preventing human exposure to groundwater above MCLs. The Land Use Control Implementation Plan for the CMP Pits governs LUC implementation, maintenance, monitoring, reporting and enforcement of LUCs (WSRC 2007). All LUC objectives are being met.
- Soil treatment via enhanced bioremediation was 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 cleanup levels were achieved as

shown in Table D-5. Further information on the enhanced bioremediation can be found in the Interim Post-Construction Report (WSRC 2006b).

- The ERH/SVE and passive SVE were 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 cleanup levels. 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 cleanup level of 30.7 mg/kg. Additionally, the maximum PCE concentration collected during the 2021 soil sampling effort was 1.14 mg/kg, also well below the RG o 30.7 mg/kg. Confirmation dichloromethane (DCM) soil sample results were at a maximum of 0.0111 mg/kg, well below the cleanup level of 0.2 mg/kg.

- Groundwater results at the CMP Pits OU have shown a general decreasing trend with time, but some wells near the source area or at greater depths do show some increasing trends (e.g., maximum PCE concentration of 2,600 µg/L in 2023 [Table D-4]). However, the overall horizontal plume size has not increased and core concentration areas show decreases in overall size. Wells CMP 34D and CMP 35D near the source area has shown localized increases in recent years. The increase in VOCs and lindane at these wells appears to be related to water elevation rising into contamination trapped in the vadose zone. VOC and lindane concentrations in nearby wells indicate that the contaminants are minimal and highly localized near the CMP 34D and CMP 35D location (Figures D-3 and D-8). DCM groundwater results have been below the MCL (5 µg/L) since the ERH/SVE shutdown. The 2023 DCM maximum result was 1.1 µg/L. Table D-4 compares the pre-ERH/SVE groundwater concentrations with current (2023) concentrations.

- Monitoring wells were analyzed using GSI Mann-Kendall trend analysis for data post-ERH/SVE remediation (2010-2022 data, as available) and updated to include 2023 data if data indicated changes to those trends. Most of the monitoring wells (85%) show a

declining or steady (including consistent non-detects and no-trend) trend for PCE and TCE and (93%) for lindane of the past 13 years.

- Lindane contamination in groundwater continues to stay near the source area and has not impacted the Pen Branch stream. Lindane samples in surface water are not required as part of the EMP. The number of groundwater wells exceeding the lindane MCL (0.2 µg/L) has decreased from seven monitoring wells in 2008 to four monitoring wells in 2023.
- The Field A cover system is effective in preventing residential exposure to surface soils above cleanup levels. 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.
- LUCs are effective in preventing human exposure to contaminated groundwater.
- MNA has shown effectiveness in preventing discharge of contaminated groundwater to surface water. The CMP Pits VOC and 1,4-dioxane groundwater plume effects on Pen Branch surface water are negligible as they are generally not detected, with any detections remaining below regulatory levels of concern. Dispersion, advection, and wetland area VOC degradation are all contributing factors that reduce the groundwater plume impact to Pen Branch.
- Although not widespread throughout CMP Pits, biological processes in the wetland area near Pen Branch are degrading VOCs to degradation products. Cis-1,2-dichloroethylene was detected in 2023 in groundwater at a maximum of 7.8 µg/L, which is below the 70 µg/L MCL. It was not detected in surface water. Vinyl chloride was detected in groundwater during 2023 at a maximum of 1.1 µg/L, which is below the 2 µg/L MCL. Vinyl chloride was not detected in surface water.

The above remedial activities are meeting the RAOs 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, cleanup levels, and RAOs used at the time of remedy selection are still valid. There have been no changes in standards or physical conditions of the CMP Pits OU that would affect the protectiveness of the remedy.

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

Fact sheets provided on the USEPA webpage (https://19january2021snapshot.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern_.html) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dintrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. Except for PFAS, ~~N~~none of these emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

There are no disposal or excavation records that indicate that PFAS containing chemicals or materials were disposed of at the CMP Pits. However, due to the various types of wastes that were disposed of at the CMP Pits, SRS acknowledges that older chemicals could have contained these compounds. In 4Q2023, three samples were taken from two CMP Pits wells (CMP011A and CMP 35D) and were analyzed for PFAS analytes using EPA method 1633 for the two regular samples at each well and EPA Method 533 for one split sample at CMP011A. Well CMP011A is an upgradient Gordon Aquifer well that does not exhibit chlorinated solvent or lindane contamination. CMP 35D is a shallow well and is located

directly downgradient of the CMP Pits trenches. This well shows the highest levels of chlorinated solvents (e.g., trichloroethylene and tetrachloroethylene) and lindane contamination and, therefore, would be the most likely well to display any potential PFAS contamination.

Both the regular and split sample results from CMP011A were non-detect for PFAS constituents. At CMP 35D, five PFAS constituents including perfluoro-n-butanoic acid [PFBA], perfluoro-3-methoxypropanoic acid [PFMPA], perfluorohexanoic acid [PFHxA], perfluorooctanesulfonic acid [PFOS], and perfluorobutanesulfonic acid [PFBS]) were detected at very low estimated (J-qualified) concentrations less than 1 ng/L and less than the constituents corresponding MCLs/RSLs (Table D-6).

Since the results are non-detect or less than 1 ng/L and below the RSLs, no additional sampling will be required.

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 CMP Pits OU from being protective.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations and follow-up actions have been determined for the CMP Pits OU.

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 LUCs. All threats to the CMP Pits OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative

Table D-6. 4Q2023 CMP Pits PFAS Results (ng/L) (ppt)

Station	**Method**	11CL-PF3OUDS	3:3FTCA	4:2 FTS	5:3FTCA	6:2 FTS	7:3FTCA	8:2 FTS
USEPA MCL/RSL (ng/L)		--	--	--	--	--	--	--
CMP-011-A	1633	ND	ND	ND	ND	ND	ND	ND
CMP-011-A (Split)	533	ND	--	ND	--	ND	--	ND
CMP-035-D	1633	ND	ND	ND	ND	ND	ND	ND

Station	**Method**	9CL-PF3ONS	ADONA	GENX	MEFOSA	NEtFOSA	NETFOSAA	NEtFOSE
USEPA MCL/RSL (ng/L)		--	--	10	--	--	--	--
CMP-011-A	1633	ND	ND	ND	ND	ND	ND	ND
CMP-011-A (Split)	533	ND	ND	ND	--	--	--	--
CMP-035-D	1633	ND	ND	ND	ND	ND	ND	ND

Station	**Method**	NFDHA	NMEFOSAA	NMeFOSE	PFBA	PFBS	PFDA	PFDoA
USEPA MCL/RSL (ng/L)		--	--	--	18,000	6,000	--	1,000
CMP-011-A	1633	ND	ND	ND	ND	ND	ND	ND
CMP-011-A (Split)	533	ND	--	--	ND	ND	ND	ND
CMP-035-D	1633	ND	ND	ND	[0.77]	[0.13]	ND	ND

Station	**Method**	PFDoS	PFDS	PFEESA	PFHpA	PFHPS	PFHxA	PFHxS
USEPA MCL/RSL (ng/L)		--	--	--	--	--	9,900	10
CMP-011-A	1633	ND	ND	ND	ND	ND	ND	ND
CMP-011-A (Split)	533	--	--	--	ND	ND	ND	ND
CMP-035-D	1633	ND	ND	ND	ND	ND	[0.5]	ND

Station	**Method**	PFMBA	PFMPA	PFNA	PFNS	PFOA	PFOS	PFOSA
USEPA MCL/RSL (ng/L)		--	--	10	--	4	4	--
CMP-011-A	1633	ND	ND	ND	ND	ND	ND	ND
CMP-011-A (Split)	533	ND	ND	ND	--	ND	ND	--
CMP-035-D	1633	ND	[0.72]	ND	ND	ND	[0.29]	ND

Station	**Method**	PFPeA	PFPES	PFTA	PFTrDA	PFUnA
USEPA MCL/RSL (ng/L)		--	--	20,000	--	6,000
CMP-011-A	1633	ND	ND	ND	ND	ND
CMP-011-A (Split)	533	ND	ND	--	ND	ND
CMP-035-D	1633	ND	ND	ND	ND	ND

[##] = Estimated J-qualified result
ND = Not detected
-- = Analyte not included in method

PFAS Acronyms

11-CHLOROEICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID	11CL-PF3OUDS
3-PERFLUOROPROPYL PROPANOIC ACID	3:3FTCA
1H,1H,2H,2H-PERFLUOROHEXANE SULFONIC ACID	4:2 FTS
2H,2H,3H,3H-PERFLUOROOCTANOIC ACID	5:3FTCA
1H, 1H, 2H, 2H-PERFLUOROOCTANE SULFONIC ACID	6:2 FTS
3-PERFLUOROHEPTYL PROPANOIC ACID	7:3FTCA
1H, 1H, 2H, 2H-PERFLUORODECANE SULFONIC ACID	8:2 FTS
9-CHLOROHEXADECAFLUORO-3-OXANONE-1-SULFONIC ACID	9CL-PF3ONS
4,8-DIOXA-3H-PERFLUORONONANOIC ACID	ADONA
HEXAFLUOROPROPYLENE OXIDE DIMER ACID	GENX
N-METHYLPERFLUORO-1-OCTANESULFONAMIDE	MEFOSA
N-ETHYL PERFLUOROOCTANE SULFONAMIDE	NEtFOSA
N-ETHYLPERFLUORO-1-OCTANESULFONAMIDOACETIC ACID	NETFOSAA
N-ETHYL PERFLUOROOCTANE SULFONAMIDOETHANOL	NEtFOSE
NONAFLUORO-3,6-DIOXAHEPTANOIC ACID	NFDHA
N-METHYLPERFLUORO-1-OCTANESULFONAMIDOACETIC ACID	NMEFOSAA
N-METHYL PERFLUOROOCTANE SULFONAMIDOETHANOL	NMeFOSE
PERFLUORO-N-BUTANOIC ACID	PFBA
PERFLUOROBUTANESULFONIC ACID	PFBS
Perfluorodecanoic acid	PFDA
Perfluorododecanoic acid	PFDoA
PERFLUORODODECANESULFONIC ACID	PFDoS
PERFLUORO-1-DECANESULFONIC ACID	PFDS
PERFLUORO(2-ETHOXYETHANE)SULFONIC ACID	PFEESA
PERFLUOROHEPTANOIC ACID	PFHpA
PERFLUORO-1-HEPTANESULFONIC ACID	PFHPS
PERFLUOROHEXANOIC ACID	PFHxA
PERFLUOROHEXANESULFONIC ACID	PFHxS
PERFLUORO-4-METHOXYBUTANOIC ACID	PFMBA
PERFLUORO-3-METHOXYPROPANOIC ACID	PFMPA
PERFLUORONONANOIC ACID	PFNA
PERFLUORO-1-NONANESULFONIC ACID	PFNS
PERFLUOROOCTANOIC ACID (PFOA)	PFOA
PERFLUOROOCTANESULFONIC ACID (PFOS)	PFOS
PERFLUORO-1-OCTANESULFONAMIDE	PFOSA
PERFLUORO-N-PENTANOIC ACID	PFPeA
PERFLUORO-1-PENTANESULFONIC ACID	PFPES
PERFLUOROTETRADECANOIC ACID	PFTA
PERFLUOROTRIDECANOIC ACID	PFTrDA
Perfluoroundecanoic acid	PFUnA

APPENDIX E. D-AREA OIL SEEPAGE BASIN (631-G) OPERABLE UNIT

I. INTRODUCTION

This report is the seventh five-year remedy review for the D-Area Oil Seepage Basin (631-G) (DOSB) Operable Unit (OU). DOSB currently meets unrestricted land use criteria for soils, sediment, and surface water. However, groundwater contaminants at the DOSB OU are at levels that do not allow for unlimited use and unrestricted exposure. The review was conducted from June 2024 through December 2024. 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 E-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 unit listed in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media associated with this OU is 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, the Savannah River (Figure E-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 E-2). During an interim remedial action (IRA) conducted at the unit in 1996, 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 composed of the sands of Dry Branch, Santee, and Clinchfield Formations and is in the lower aquifer zone (LAZ) of the Upper Three Runs Aquifer (UTRA). Locally, the LAZ of the UTRA is subdivided into three aquifer zones: AQ1, AQ2, and AQ3. The Gordon Aquifer Unit (GAU) lies beneath the Gordon Confining Unit. The Gordon Confining Unit is below the LAZ. 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 E-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 E-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 E-1). Upper Three Runs Creek, a tributary to the Savannah River, is located 2.6 km (1.6 mi) to the north-northwest, and Fourmile Branch, another tributary, is located 2.4 km (1.5 mi) to the south-southeast (Figure E-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 for the Savannah River Site* (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 E-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 (RFI) / Remedial Investigation (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 (DCE), total 1,2-DCE, cis-1,2-dichloroethylene (cDCE), dichloromethane, tetrachloroethylene (PCE), trichloroethylene (TCE), and vinyl chloride (VC). Removal of methylene chloride, benzene, 1,1-DCE, trans-1,2-DCE, and total 1,2-DCE from the list of GWMZ constituents to be monitored was recommended in the Revision 1.5 GWMZ Application (SRNS 2009). Monitoring for 1,2-DCE was discontinued in 2010 as documented in the Fourth Five Year Remedy for the Savannah River Site (SRNS 2013). 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 contaminants 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 drinking water sources, the potential for unacceptable human exposure to contaminated groundwater exists as long as contaminants remain at levels above MCLs.

IV. REMEDIAL ACTIONS

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 1998), the selected remedy for the DOSB OU is ~~monitored natural attenuation (MNA)/~~groundwater mixing zone (GWMZ) with institutional controls. The ROD identifies COCs for groundwater only because the remedial action objectives (RAOs) for deep soil were 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. In addition, no COCs were identified for shallow soil, surface water, and sediment during the RFI/RI and BRA (WSRC 1997a). Cleanup levels for groundwater COCs were determined

to be equivalent to their respective MCL values in all monitoring wells. The groundwater contaminants at the DOSB OU and their corresponding cleanup levels are provided in Table E-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 cleanup levels.

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 and 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 - ~~MNA/~~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.

The following DOSB land use control (LUC) objective is necessary to ensure protectiveness of the remedy:

- Prevent unauthorized access to the DOSB contaminated groundwater plume.

Remedy Implementation

The final remedial action consisted of the following activities:

- Accepting the interim actions of removing 612 m^3 (800 yd^3) of debris, including 58 drums, 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 to GWMZ processes (dispersion, dilution, and radioactive decay) which are occurring at the DOSB OU and are effective in reducing contaminant concentrations below remedial goals in accordance with the Corrective Measures Implementation/ Remedial Design/Remedial Design Report/Remedial Action Work Plan (WSRC 1999b). The GWMZ monitoring network includes two background wells, nine plume compliance wells, and seven boundary compliance wells (i.e., distal plume monitoring wells. In addition to the approved GWMZ monitoring network, SRS samples four additional wells (near the source) and one surface water location to provide plume detail. These wells are used to monitor contaminant concentrations in background wells, near the DOSB OU source, beneath the existing plume, in the plume, and at the downgradient compliance boundary;
- 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 of restrictions via the SRS Site Use/Site Clearance Program; and
- Establishing LUCs for 9.35 hectares (23.04 acres) (WSRC 1997b) (Figure E-4).

Figure E-5 is a current photograph of the OU in 2024.

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. However, groundwater contaminants at the DOSB OU are at levels that do not allow for unlimited use and unrestricted exposure. LUCs are in place for the groundwater. 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 are performed for the monitoring wells and the Five-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 are 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 $259,587, which was discounted at 5% per year for 30 years of maintenance activities (WSRC 1998). The estimated O&M costs applicable to Fiscal Year (FY) 2020 through FY2024 are $16,666, which is the estimated cost of writing the five-year remedy review. The actual O&M cost from FY2020 until FY2024 is $259,587. The actual O&M costs (Table E-3) are higher than expected because groundwater monitoring and reporting costs have continued beyond FY2009 as estimated in the ROD. Additionally, the ROD estimate was based on monitoring twelve locations for VOC analyses, while 23 wells are monitored for VOC analyses and additional natural attenuation field parameters.

Groundwater monitoring well network was expanded as documented in the Fourth Five Year Remedy for the Savannah River Site (SRNS 2013). Table E-4 provides a list of these 22 groundwater wells and the one surface water sampling location. Surface water sampling is not required at DOSB but is conducted when sufficient water is available.

V. PROGRESS SINCE LAST REVIEW

This is the seventh five-year remedy review for the DOSB OU. The previous protectiveness statement concluded that because the remedial actions at DOSB OU are protective, the DOSB OU 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;
- Confirmed effective operation of the implemented remedial actions;

- Reviewed the groundwater data to determine the suitability of the mixing zone in evaluating whether ~~MNA~~ GWMZ 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 E-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

For evaluating the ~~MNA/~~GWMZ effectiveness, recent groundwater data from 2019 through 2023, the Revision 1.5 to the groundwater mixing zone application (SRNS 2009), the RFI/RI with BRA report (WSRC 1997a), and the annual mixing zone reports for 2019 through 2023 (SRNS 2020, SRNS 2022, SRNS 2024), which includes time series plots and hydrographs, were reviewed.

Per the flow and transport modeling effort (WSRC 2004), the contaminated plumes were simulated for 50-years with no continuing sources contributing to groundwater contamination (consistent with source removal in 1996). The model predicted that PCE, TCE, DCE, and VC concentrations in the plume would be below their respective MCLs in 2027. Per the *2023 Annual Mixing Zone Monitoring Report for the D-Area Oil Seepage Basin (631-G) (U)* (SRNS 2024), groundwater contaminant data continues to exist within the parameters predicted in the modeling.

To evaluate the remainder of the contaminants and the effectiveness of the ~~MNA~~ GWMZ remedy, the data were reviewed from several perspectives. The 1996 plume maps (WSRC 1997a) for PCE, TCE, and VC were compared with the 2023 plume maps (SRNS 2024) (Figures E-6 through E-~~14~~11). Figures E-12 and E-13 depict the ratio of PCE vs TCE and TCE vs cDCE, respectively. Time series plots for PCE, TCE, and 1,4-dioxane are shown in Figures E-14 through E-16. The following were determined from this review:

- Concentrations of PCE in the AQ1/2, AQ3, and GAU aquifers continue to slowly decrease or remain similar to concentrations from previous sampling with the exception of plume compliance well DOB 15, which~~. The most recent data at the DOSB from the year 2023 shows that PCE exceeded~~ had an exceedance of PCE above the MCL (5µg/L) in 2023~~at only DOB 15, a plume compliance well~~. There was no exceedance of the MCL at any of the boundary compliance wells;

- Concentrations of TCE in the AQ1/2, AQ3, and GAU aquifers appear to slowly decrease compared to concentrations from previous sampling. The TCE plume in AQ3 continues to slowly decrease or remain similar compared to concentrations from previous sampling. Those concentrations that exceed the TCE MCL (5 µg/L) are considerably less than the MZCL (200 µg/L);

- The VC 2 µg/L contour in the AQ1/2 aquifer appears relatively stable with little movement downgradient. Concentrations in AQ1/2 continue to decrease compared to results from previous sampling. No detects of VC are found in the GAU. Those concentrations that exceed the VC MCL (2 µg/L) are significantly less than the MZCL (147 µg/L).

Based on comprehensive sampling performed as part of the recommendation from the Fifth Five-Year Remedy Review Report (SRNS 2016), 1,4-dioxane was added to the annual groundwater monitoring at the DOSB. All wells were sampled for 1,4-dioxane during the second quarters of 2019, 2020, 2021, 2022, and 2023 (SRNS 2024). 1,4-Dioxane was only detected in one out of the three monitoring wells (DOB 15, DOL2,and DOB 16) in DOB 16. Results from these wells are shown in Figure E-15. 1,4-Dioxane will continue to be sampled at wells DOB 15, DOL 2, and DOB 16 to collect sufficient trend data. There is currently no MCL for 1,4-dioxane, but the current U. S. Environmental Protection Agency (USEPA) tap water regional screening level is 0.46 µg/L.

Overall, the groundwater data presented in 2023 GWMZ Report (SRNS 2024) show that the DOSB OU contaminant plumes continued to remain below the respective MZCLs and

MCLs for each well. Based on these results, the 2023 groundwater data confirm that the existing GWMZ boundaries remain adequate for the DOSB OU plume.

Summary of Inspections and Interviews

Interviews were conducted with Eric Barron, O&M staff member, and with Brian Hanshew, O&M Site Manager, on October 22, 2024 at the O&M organization offices. No issues were identified for the DOSB OU during these interviews. The DOSB was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on September 10, 2024. No issues were identified during these interviews.

The DOSB OU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2024. No issues were identified for the DOSB OU during this inspection that would affect the protectiveness of the remedy. However, SRS was greatly impacted by Hurricane Helene and closed in response during the period of September 27, 2024 through October 6, 2024 with the exception of emergency and essential personnel. The site resumed normal operations on October 7, 2024. EC&ACP O&M personnel are evaluating the impacts of Hurricane Helene and post-hurricane damage assessments and cleanup activities are ongoing. No storm damages have been identified at the DOSB OU that would affect the protectiveness of the remedy.

A regulatory inspection meeting with USDOE, USEPA, and South Carolina Department of Environmental Services (SCDES) ~~will be scheduled after submittal of the revision 0 of this document~~was held on February 27, 2025. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of DOSB OU and ~~will be~~ were provided an opportunity to walk down the OU. The USEPA and SCDES elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to be~~were identified during the inspection.

VII. TECHNICAL ASSESSMENT

Is the Remedy Functioning as Intended by the Decision Document?

The remedies selected for the DOSB OU are functioning 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 the DOSB is discussed in Appendix B of the Corrective Measures Implementation/Remedial Design/Remedial Design Report/Remedial Action Workplan and governs LUC implementation, maintenance, monitoring, reporting and enforcement of LUCs (WSRC 1999b). All LUC objectives are being met.
- 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 cleanup levels. The timeframe for reaching cleanup levels may be optimistic due to the effect of matrix diffusion.

As stated in the ROD (WSRC 1998), the following conditions at the DOSB support that the selected remedy is adequate to meet the cleanup levels within a reasonable timeframe:

- The source of contamination at the DOSB was removed during the IRA in conjunction with the biovent testing and is no longer contributing to groundwater contamination;
- Naturally occurring mechanisms will continue to reduce contaminant concentrations;
- There are no receptors of groundwater at the DOSB; therefore, the potential for exposure is low;
- The UTRA aquifer is limited in thickness and yield, and the groundwater is not targeted for residential or commercial use; therefore, projected demand for future groundwater use is low; and

- Modeling indicates that contaminant concentrations in the DOSB groundwater would be reduced to below MCLs prior to reaching surface water.

Institutional controls (i.e., LUCs) are effective in preventing exposure to groundwater and its vapor. The DOSB currently meets unrestricted land use criteria for soils, sediment, and surface water. Site inspections are performed for the monitoring wells and the Five-Year Remedy Review Reports. The results of the inspection for this five-year remedy review indicate the controls are effective and no problems have occurred. The original gate and fencing around the DOSB perimeter, although still present, is not required. The fencing is a holdover from previous operations.

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

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. There have been no changes in standards or physical conditions of the DOSB OU that would affect the protectiveness of the remedy.

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

Fact sheets provided on the USEPA webpage (https://19january2021snapshot.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern_.html) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-

trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dintrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

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

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

VIII. ISSUES

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

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

There are no recommendations or follow-up actions for the DOSB 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 by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater. All threats to contaminated groundwater at the DOSB OU have been addressed through implementation of ~~MNA/~~GWMZ, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the DOSB OU for industrial use only and use restrictions via the SRS Site Use/Site Clearance Program.

XI. NEXT REVIEW

The eighth five-year remedy review for SRS OUs with Groundwater Remedies is scheduled for December 2030.

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. *Groundwater Mixing Zone Application for the D-Area Oil Seepage Basin (631-G) (U)*, WSRC-RP-97-422, Revision 1.5, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2016. *Fifth Five-Year Remedy Review Report for Savannah River Site Operable Units with Groundwater Remedies (U)*, Aiken, South Carolina, SRNS-RP-2015-00419, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

SRNS, 2013. *Fourth Five-Year Remedy Review Report for the Savannah River Site*, SRNS-RP-2012-00011, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *2019 Groundwater Mixing Zone Monitoring Report for the D-Area Oil Seepage Basin (631-G) (U)*, SRNS-RP-2020-00362, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *2021 Groundwater Mixing Zone Monitoring Report for the D-Area Oil Seepage Basin (631-G) (U)*, SRNS-RP-2022-00396, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2024. *2023 Groundwater Mixing Zone Monitoring Report for the D-Area Oil Seepage Basin (631-G) (U)*, SRNS-RP-2024-01008, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 2015. *2011 D-Area Oil Seepage Basin (631-G) Groundwater Mixing Zone Letter Report for Calendar Year 2014 Data*, CERCLIS Number: 27, IACD-15-164, U.S. Department of Energy, Savannah River Operations Office, Aiken, SC

USDOE, 2019. *Calendar Year 2018 D-Area Oil Seepage Basin Operable Unit (631-G) Groundwater Mixing Zone Letter Report (U)*, SEMS Number: 27, IACD-19-175 U.S. Department of Energy, Savannah River Operations Office, 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

WSRC, 1997b. *Post Construction Report for D-Area Oil Seepage Basin Interim Action (U)*, WSRC-RP-00859, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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

WSRC, 1998. *Record of Decision Remedial Alternative Selection for the D-Area Oil Seepage Basin (631-G) (U),* WSRC-RP-97-402, 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, 1999b. *Corrective Measures Implementation/Remedial Design/Remedial Design Report/Remedial Action Work Plan (CMI/RD/RDR/RAWP) for the D-Area Oil Seepage Basin (631-G) (U) (includes Land Use Control Implementation Plan)*, WSRC-RP-99-4006, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 1999c. *Sixth Semi-Annual Groundwater Monitoring Report for the D-Area Oil Seepage Basin Interim Remedial Action (U)*, WSRC-RP-99-4207, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Flow and Transport Modeling for Reanalysis for the D-Area Oil Seepage Basin (631-G) Operable Unit Mixing Zone*, WSRC-RP-2004-4104, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2013. *Groundwater Mixing Zone Application for the D-Area Oil Seepage Basin (631-G) (U)*, WSRC-RP-97-422, Revision 1.5, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

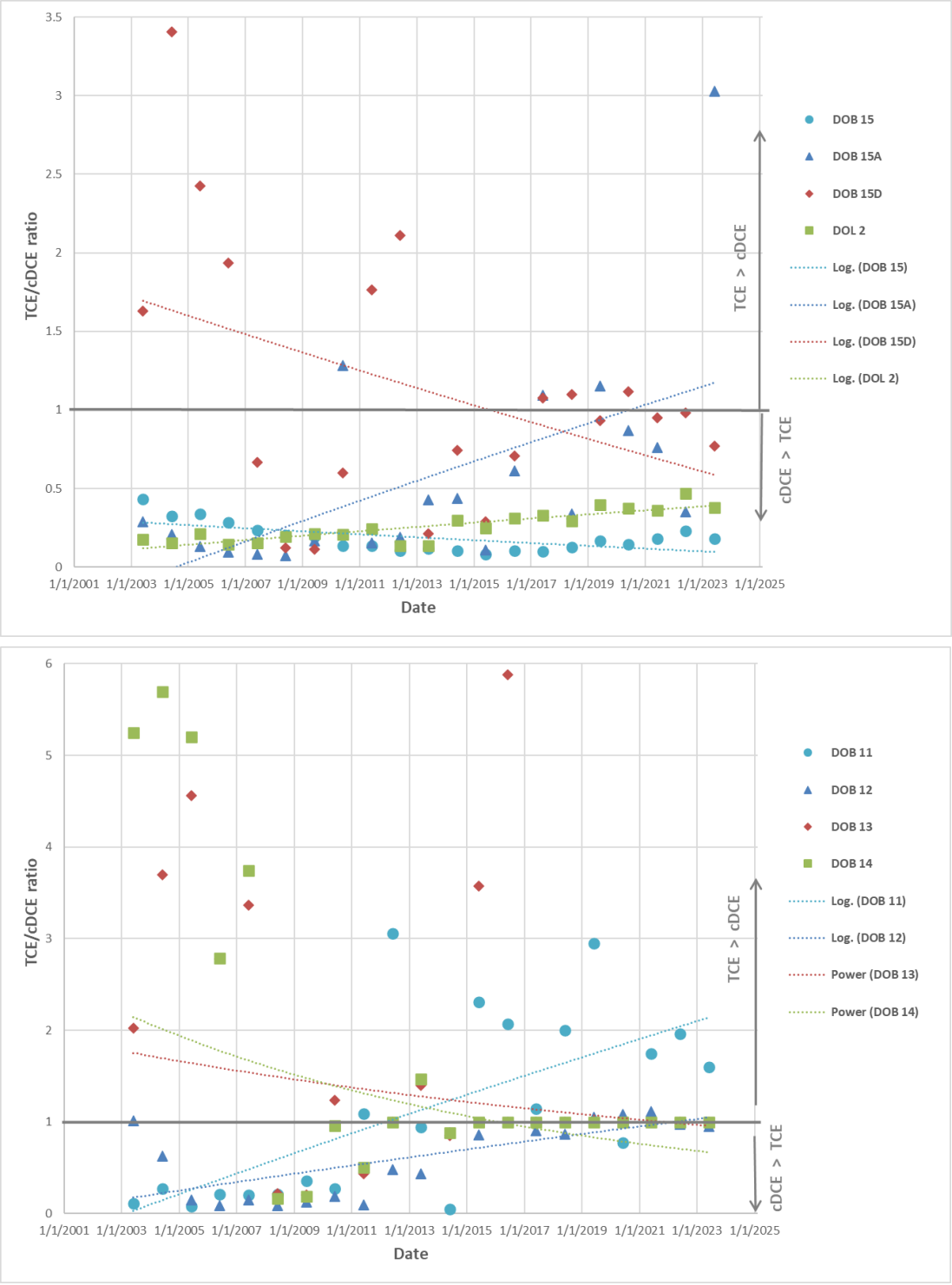

Figure E-13. Ratio of TCE verses cDCE Concentrations for Plume Compliance Wells (DOB 15, 15A, 15D, and DOL 2) and Additional Wells (DOB 11, 12, 13, 14) at the DOSB OU

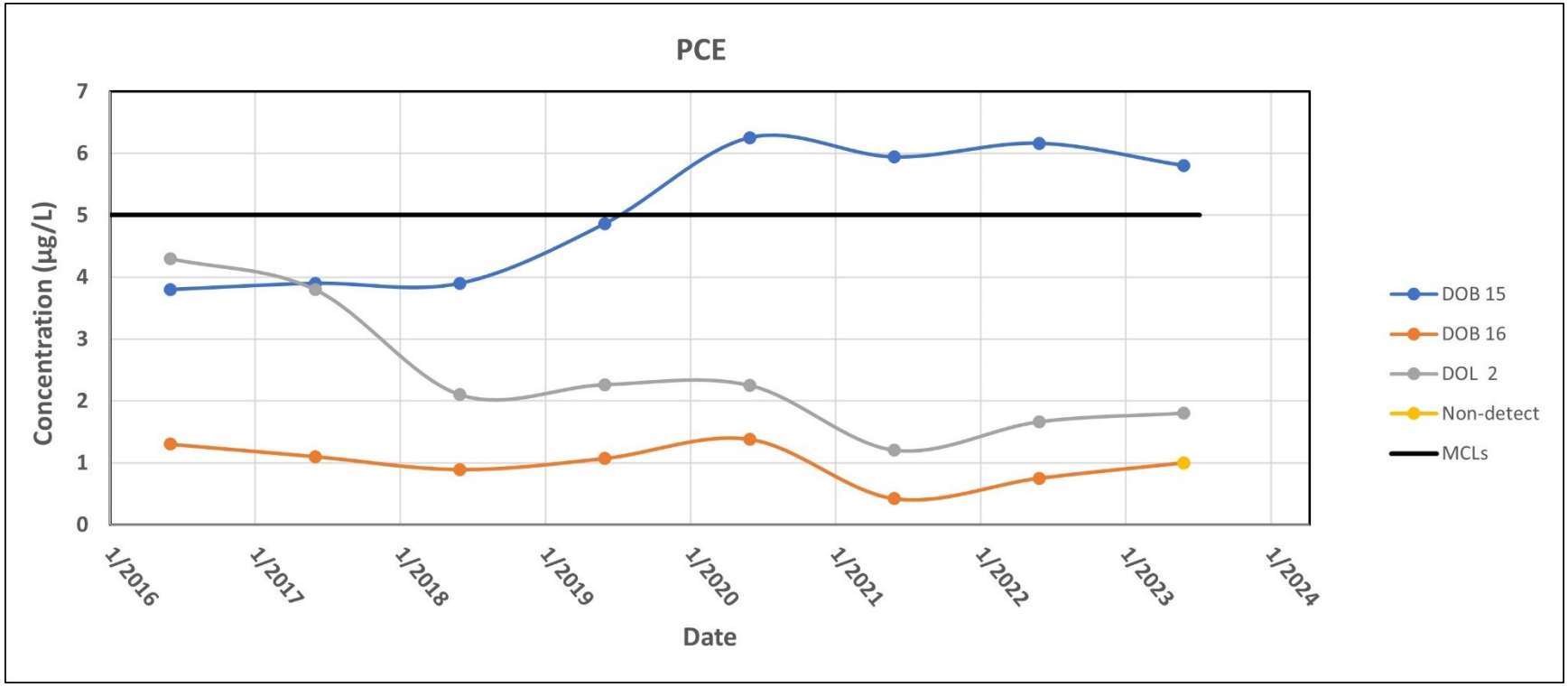

Figure E-14. Time Series Plots of PCE at Wells DOB 15, DOB 16, and DOL 2 at the DOSB OU

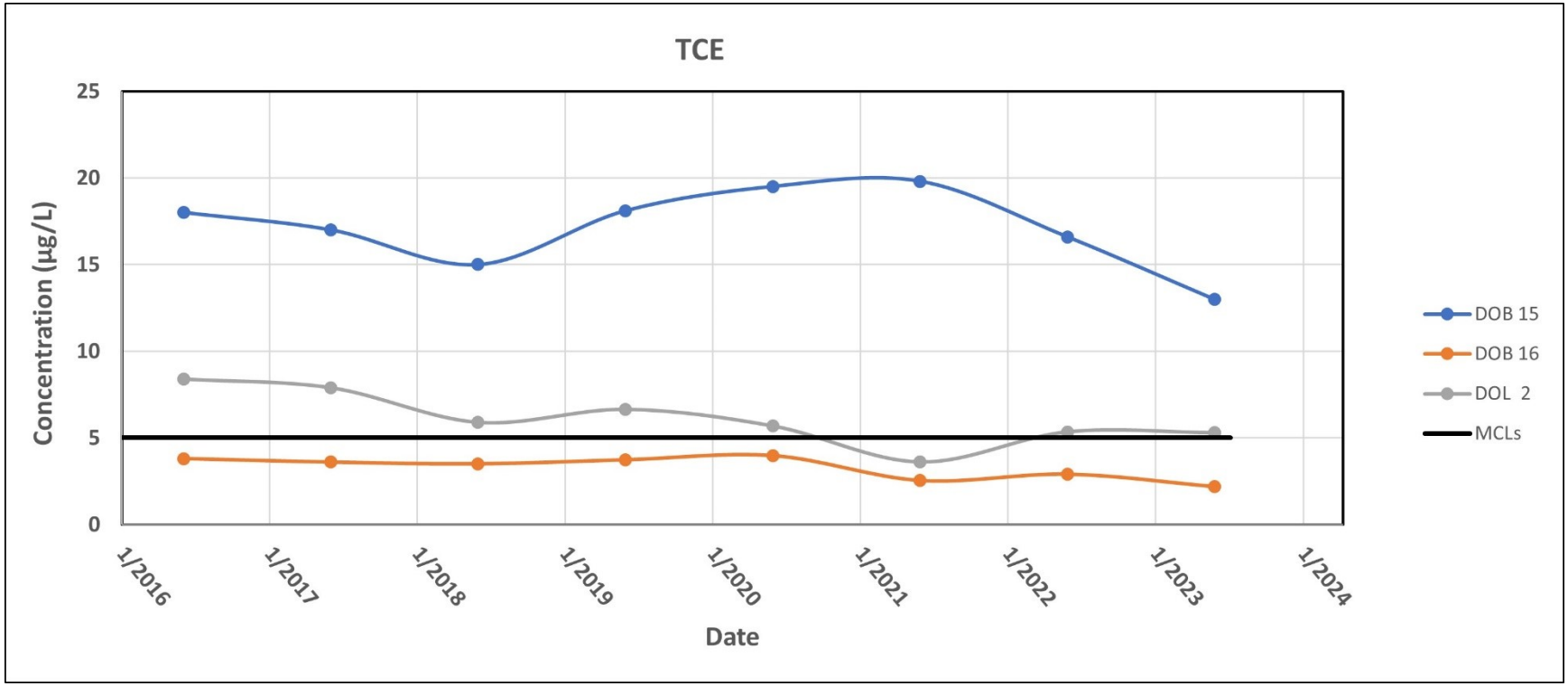

Figure E-15. Time Series Plots of TCE at Wells DOB 15, DOB 16, and DOL 2 at the DOSB OU

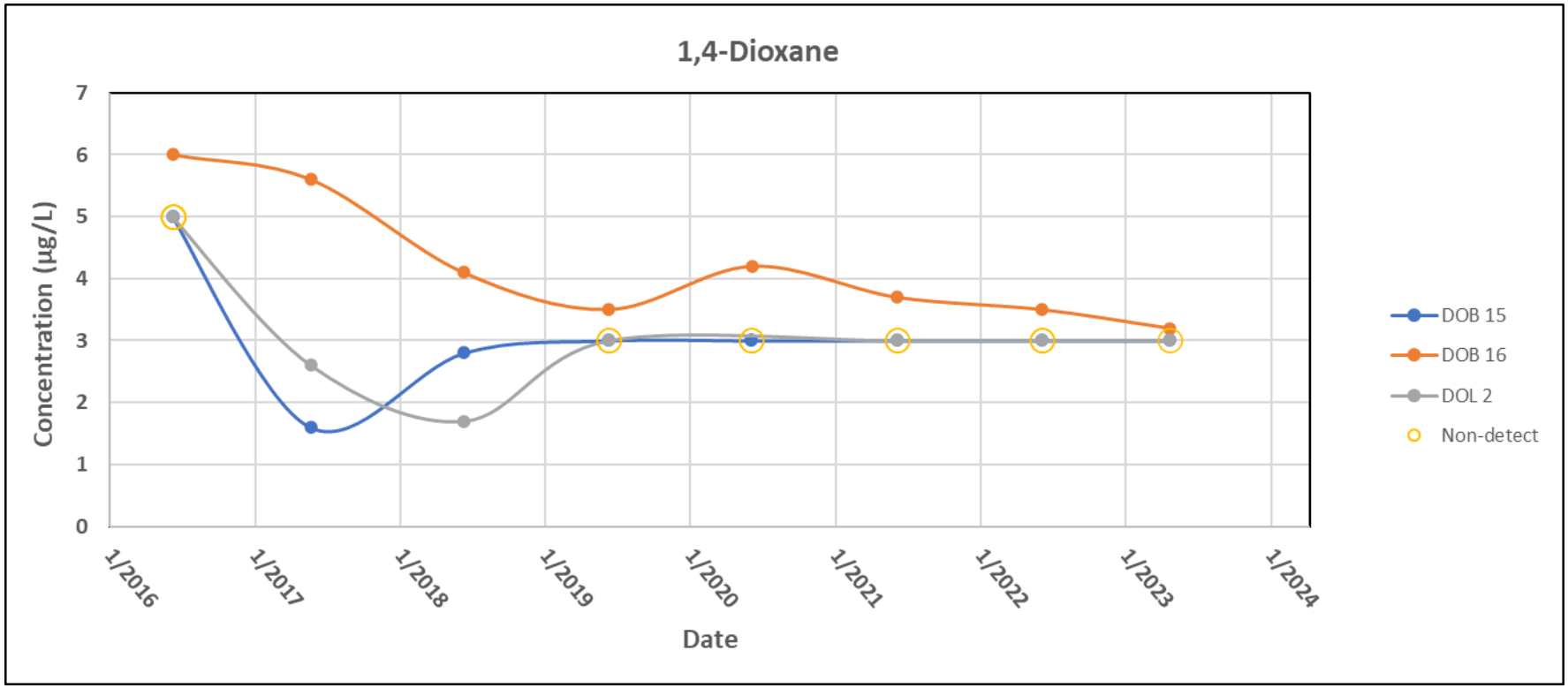

Figure E-16. Time Series Plots of 1,4-Dioxane at Wells DOB 15, DOB 16, and DOL 2 at the DOSB OU

Table E-4. Details of DOSB Monitoring Wells and Surface Water Location

Well	Monitoring Category	Screen Zone Top *(ft msl)*	Screen Zone Bottom *(ft msl)*	Aquifer Zone
DOL 1	Background Well	119.2	109.2	AQ3
DOB 9	Background Well	148.5	128.5	AQ1/2
DOB 11	Additional Well	131.1	126.1	AQ2
DOB 12	Additional Well	138.8	133.8	AQ2
DOB 13	Additional Well	131.0	126.0	AQ2
DOB 14	Additional Well	137.6	132.6	AQ2
DOL 2	Plume Compliance Well	123.6	113.6	AQ3
DOB 15	Plume Compliance Well	115.7	110.6	AQ3
DOB 15A	Plume Compliance Well	132.7	122.7	AQ2
DOB 15D	Plume Compliance Well	72.35	62.3	GAU-AQ1
DOB 15PZ	Plume Compliance Well	54.8	49.8	GAU-AQ2
DOB 16	Plume Compliance Well	108.2	103.0	AQ-Unnamed
DOB 19	Plume Compliance Well	114.5	104.5	AQ3
DOB 19A	Plume Compliance Well	129.5	119.5	AQ2
DOB 23	Plume Compliance Well	81.02	76.0	GAU-AQ1
DOB 20	Boundary Compliance Well	112.7	102.7	AQ3
DOB 20A	Boundary Compliance Well	129.5	119.5	AQ2
DOB 21	Boundary Compliance Well	113.3	103.4	AQ3
DOB 21A	Boundary Compliance Well	128.9	118.9	AQ2
DOB 21PZ	Boundary Compliance Well	46.3	41.3	GAU-AQ2
DOB 22	Boundary Compliance Well	111.8	101.8	AQ3
DOB 22A	Boundary Compliance Well	127.5	117.5	AQ2
DOBSW1	Surface Water	NA	NA	NA

NA = Not Applicable

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Completion Projects (EC&ACP) on September 04, 2024. No issues were identified during these inspections.

The LASG OU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2024. No issues were identified for the LASG OU during this inspection that would affect the protectiveness of the remedy. However, SRS was greatly impacted by Hurricane Helene and closed in response during the period of September 27, 2024 through October 6, 2024 with the exception of emergency and essential personnel. The site resumed normal operations on October 7, 2024. EC&ACP O&M personnel are evaluating the impacts of Hurricane Helene and post-hurricane damage assessments and cleanup activities are ongoing. No storm damages have been identified at the LASG OU that would affect the protectiveness of the remedy.

A regulatory inspection meeting with USDOE, U.S. Environmental Protection Agency (USEPA) and SCDES ~~will be scheduled after submittal of the revision 0 of this document~~was held on February 27, 2025. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of LASG OU and ~~will be~~ were provided an opportunity to walk down the OU. The USEPA and SCDES elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of the remedy for this OU as implemented ~~are anticipated to be~~were identified during the inspection.

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 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 and groundwater data summary letter reports. The sources of the groundwater contamination have been depleted. The processes of dispersion, dilution, and radioactive decay are lowering contaminant levels at LASG OU, such that groundwater will be restored to concentrations below MCLs in a reasonable timeframe.

Tritium levels have decreased in source zone monitoring wells dramatically over the last 20 to 25 years with values dropping from over 1,000 pCi/mL to currently under the MCL of 20 pCi/mL. These decreasing tritium levels are shown in the time-series plot for well LAW 2 (Figure F-6). The surface water data from station SC27 in Table F-3 further demonstrates that contaminated groundwater discharging to L-Lake quickly mixes with the surface water and tritium levels exiting L-Lake are well below the MCL. All LUC boundary wells remain non-detect, or of low concentrations below the MCL. All three tritium plumes (Figure F-2) are shrinking and migrating as expected from modeling (WSRC 2004).

The PCE and TCE plumes have decreased in size over the last 20 years. Contaminant levels are generally not increasing, with the exception of one increase in 2023 at well LAC 8DL for PCE and TCE (Figures F-7 and F-8), 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 be found in the previous biennial EMR s from 2020 (SRNS 2020) and 2024 (SRNS 2024), and the 2022 biennial data summary letter report (SRNS 2022.

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.

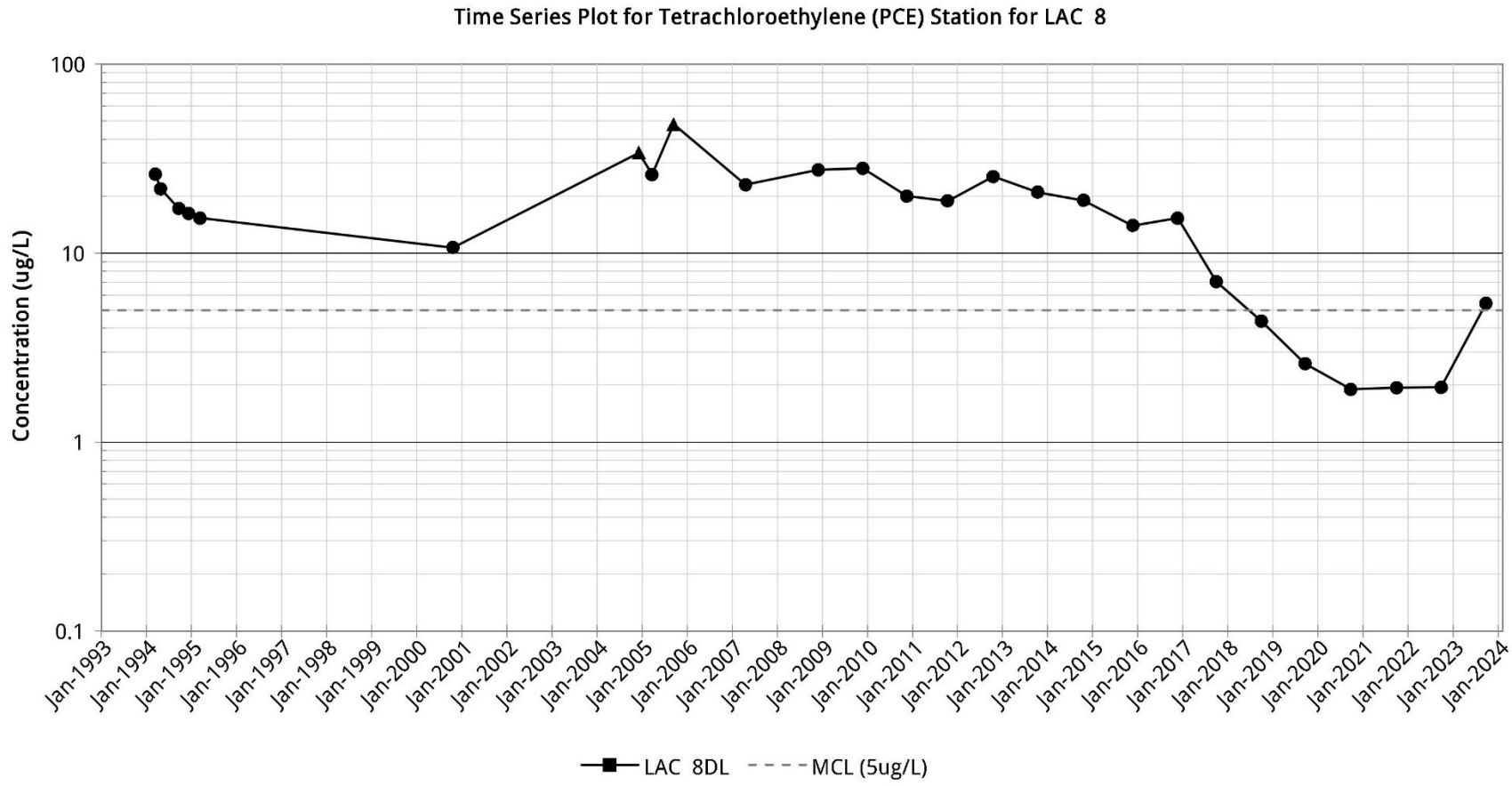

Figure F-7. Time Series Plot for PCE for Source Zone Well LAC 8DL

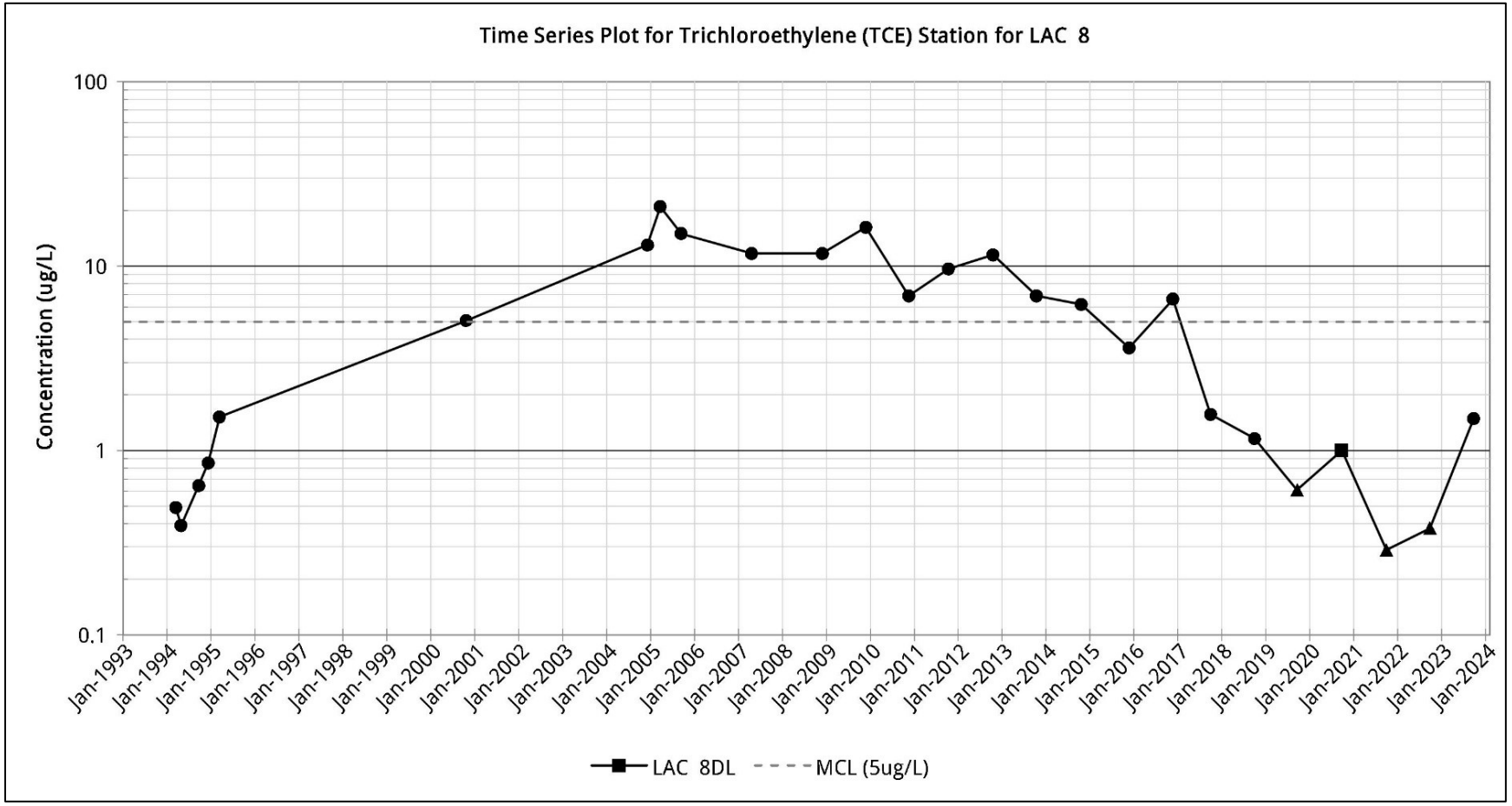

Figure F-8. Time Series Plot for TCE for Source Zone Well LAC 8DL

Table F-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	Oct 2012	Nov 2013	Nov 2014	Nov 2015	Dec 2016	Oct/ Nov 2017	Oct 2018/ Feb 2019	Oct 2019	Oct 2020	Oct 2021	Dec 2022	Oct 2023
SC20	16.5	14.2	58.1	14.2	18.9	20.5	58.2	49.2	54.5	11.1	11.2	7.36	6.32	21.7	8.64	3.06	3.88	3.76	3	19.1	7.98
SC21	14.3	13.9	14.2	13.8	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SC22	J 0.984	2.14	J 2.1	4.27	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SC23	30	19.5	234	33.5	11.6	54.9	ND	J 0.558	1.34	ND	3.38	ND	NS	NS	2.36	6.06	3.41	2.78	3.29	2.55	2.05
SC24	22.1	53.2	257	34.3	30.7	47.7	78.3	145	28.9	105	7.24	4.63	5.78	J 0.753	3.95	20.6	3.27	2.92	2.49	2.2	2.13
SC25	13.3	9.8	12	11.9	8.98	5.17	6.41	7.2	6.49	5.11	3.93	4.06	3.14	1.87	3.43	2.03	3.23	2.3	2.64	2.25	1.74
SC26	11.3	12.9	12.8	12.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SC27	11.9	11.9	9.24	12	10	8.17	6.22	6.94	6.88	5.96	4.79	4.77	3.44	3.79	3.24	2.99	2.94	2.53	2.23	2.3	2.01

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 F-4. Actual versus Estimated O&M Costs

	FY2020	FY2021	FY2022	FY2023	FY2024	Five-Year Total
Total Actual O&M Costs ($)	116,754	105,652	114,843	132,450	169,769	639,467
Total ROD Estimated Direct O&M Costs ($)	0	81,520	0	81,520	25,000[a]	188,040

a FY2024 estimated costs include costs associated with the seventh five-year remedy review.

Table F-5. LAOCB and LRSB Performance Monitoring Results (~~20164~~Q2020)

	CARBON-14	COBALT-60	GROSS ALPHA	NONVOLATILE BETA	STRONTIUM-90	TRITIUM
LAOCB Results						
Units	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/mL
MCL/PRG	2,000	100	15	50	8	20
LCO 2DL (~~8/24/2016~~10/13/2020)	4.6 U ~~ND~~	-3.17 U ~~ND~~	3.49 J ~~ND~~	1.66 U ~~4.84 J~~	0.633 U ~~ND~~	0.155 U ~~ND~~
LCO 6DL (~~8/25/2016~~10/12/2020)	358 ~~352~~	0.239 U ~~ND~~	2.31 U ~~2.81 J~~	1.02 U ~~ND~~	0.939 U ~~ND~~	0.78 J ~~1.5~~
LCO 6DL Lab Dup	NA	NA	NA	NA	0.124 U	0.871 J
LRSB Results						
LSB 4 (~~8/24/2016~~10/12/2020)	NA	NA	NA	NA	0.971 U~~ND~~	NA
LSB 4 Lab Dup	NA	NA	NA	NA	-1.26 U	NA

U – Non-Detect

J – Estimated Value

Detection without a qualifier

Exceeds MCL/Preliminary Remediation Goal

~~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.~~

NA: Not Applicable

~~ND: Not Detected~~

The selected final remedy components met the RAOs at RAOU by implementing the following activities:

- MNA for the RAGW Subunit (SRNS 2010c),
- Performance evaluation groundwater monitoring for ISD of the R-Reactor Building (105-R) Complex, and
- LUCs for 183 hectares (450 acres) comprising the RAOU (Figure G-6).

System Operations/Operation and Maintenance

Currently, there are no systems in operation at the RAOU. Operations are complete for the evaporation systems, which removed 17 to 18.9 million L (4.5 to 5 million gal) of R-Reactor Disassembly Basin water. The remaining 1.1 million L (380,000 gal) 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. ISD monitoring is conducted every five years due to the long time-frame estimates for potential impacts to groundwater based on groundwater modeling. The first round of ISD groundwater monitoring was conducted in 2012; the second round of sampling occurred in 2017.
- Annual 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 based on data collected in 2007 to 2008 (SRNS 2010c) 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 R-Reactor Disassembly Basin cover to ensure that excessive deterioration has not occurred, and that no woody vegetation is growing on the cover,
- The R-Area 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, and
- Inspection and maintenance of access control warning signs

Since implementation of the remedy, SRS has optimized surveillance/maintenance of the closed R-Reactor Building (105-R) Complex by employing aerial drones to perform these activities.

The operation and maintenance (O&M) costs associated with the selected remedy for RAOU include maintenance costs, as described above, groundwater monitoring, and 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 (SRNS 2010a). The O&M cost estimated in the ROD that are applicable for Fiscal Year (FY)2020 to FY2024 is $291,500. The actual O&M cost for this same period is $1,183,697. Table G-4 shows the annual comparison of O&M actual and ROD estimated costs. The actual costs are higher than expected because groundwater monitoring reports are being submitted annually. The ROD estimate only included reporting in an Effective Monitoring Report every five years to coincide with the remedy review.

V. PROGRESS SINCE LAST REVIEW

This is the third five-year remedy review for the RAOU. The previous protectiveness statement concluded that because the remedial actions are protective, the RAOU is protective of human health and the environment.

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 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 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

Recent data (2020 to 2023) have been reviewed for the RAOU Groundwater subunit and ISD monitoring of the R-Reactor Building (105-R) Complex. The Eastern VOC, Eastern Tritium, Western Tritium, and Northern Tritium plumes all indicate decreasing concentrations over this time period.

ISD monitoring is conducted every five years due to the long time-frame estimates for potential impacts to groundwater based on groundwater modeling (Figure G-7). The first round of ISD groundwater sampling was conducted in 2012. In 2017, ISD monitoring identified carbon-14 (141 pCi/L) above its sampling quantitation limit (78.9 pCi/L) for the first time in the R-Area groundwater at well RDB 3D, but below the carbon-14 MCL (2,000 pCi/L). Additionally, well RDB 3D also had the highest tritium result (1,930 pCi/L)

sampled to date. The results were verified by reanalysis and resampling. The Core Team was notified on January 18, 2018 and decided carbon-14 and tritium should be monitored annually for five years at RDB 3D and four other nearby wells (RDB 1D, RDB 2D, RDB003DU, and RDB005C) (Figure G-8). The elevated tritium appears to be from a small historic spill near the R-Reactor Disassembly Basin as carbon-14 has only been detected at well RDB 3D and groundwater concentrations have remained about the same for both carbon-14 and tritium at well RDB 3D.

Wells RDB 1D, RDB 2D, RDB 3D, RDB003DU, and RDB005C were sampled annually and analyzed for carbon-14 and tritium ~~until 2022 to ensure the observed carbon-14 is only an isolated problem~~. Results of the sampling indicated that tritium and carbon-14 concentrations appear to be decreasing (Figure G-9). The maximum tritium concentration over the last 20 years was sampled for well RDB 2D in 2017. The maximum carbon-14 concentration was sampled for well RDB 3D in 2020. No other RAOU ISD monitoring wells have had detectable carbon-14 concentrations.

Summary of Inspections and Interviews

Interviews were conducted with Eric Barron, O&M staff member, and Brian Hanshew, O&M Site Manager, on October 22, 2024 at the O&M organization offices. No issues were identified for the RAOU during these interviews. The RAOU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on July 31, 2024. No issues were identified during these inspections.

The RAOU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2024. No issues were identified for the RAOU during this inspection that would affect the protectiveness of the remedy. However, SRS was greatly impacted by Hurricane Helene and closed in response during the period of September 27, 2024 through October 6, 2024 with the exception of emergency and essential personnel. The site resumed normal operations on October 7, 2024. EC&ACP O&M personnel are evaluating the impacts of Hurricane Helene and post-hurricane damage assessments and cleanup activities are

ongoing. No storm damages have been identified at the RAOU that would affect the protectiveness of the remedy.

A regulatory field inspection meeting with USDOE, USEPA, and SCDES ~~will be scheduled after submittal of the revision 0 of this document~~was held February 27, 2025. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of RAOU and ~~will be~~were provided an opportunity to walk down the OU. The USEPA and SCDES elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of this remedy for this OU as implemented ~~are anticipated to be~~were identified during the inspection.

Scheduled annual site inspection conducted from FY2020 through FY2024, various maintenance activities completed at the RAOU included cutting vegetation around waste unit warning signs, vegetation removal from stone armament and drainage ditches, vegetation removal from roofs, and repairing soil damage from feral hog rutting. These findings were documented on the field inspection checklist and resolved soon after discovery.

VII. TECHNICAL ASSESSMENT

Is the Remedy Functioning as Intended by the Decision Document?

The 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 G-1).
- Based on the results of the second ISD sampling event in 2023, tritium (nine of ten samples) and carbon-14 (one of ten samples) were detected, no other radionuclide results were above detection limits (Table G-2). Nine of the ten tritium samples had concentrations exceeding the MCL (20 ρCi/mL) with the maximum concentration

being 1,930 ρCi/mL. The 2017 carbon-14 result (141 ρCi/mL) at well RDB 3 was the first-time carbon-14 was detected in the groundwater near the R-Reactor Building (105-R) Complex, but below the MCL (2000 ρCi/mL). SRS notified the Core Team and agreed to sample for carbon-14 and tritium annually for five years at five monitoring wells (RDB 1D, RDB 2D, RDB 3D, RDB003DU, RDB005C) near the R-Reactor Building (105-R) Complex. The third ISD sampling event was in March 2022, tritium (nine of ten samples) and carbon-14 (one of ten samples) were detected, no other radionuclide results were above detection limits. Only five of the ten tritium samples had concentrations exceeding the MCL (20 ρCi/mL) and the maximum concentration had decreased to 376 ρCi/mL. The 2022 carbon-14 result at well RDB 3 had decreased to 35.4 ρCi/mL), which is below the MCL (2000 ρCi/ mL). The elevated C-14 and H-3 results in 2017 are likely from a small legacy spill detected during a period of higher average rainfall and a rising water table. The decreasing C-14 and H-3 trends support this conceptual model, and the 2023 results indicate C-14 is no longer detectable at any of the 5 ISD wells, and the elevated tritium concentrations (866 pCi/mL) remain limited to well CDB 3D (Table G-2).

- The annual site inspection confirmed that the roof structure and R-Area Disassembly Basin cover are functioning properly, the doors are sealed, and the R-Area Ash Basin cover is in good condition (Attachment G-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, including 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 trespassers, 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.

For groundwater contaminated with VOCs and tritium, MNA is the selected remedy. The last two Effectiveness Monitoring Reports were reviewed to support this assessment (SRNS 2022, SRNS 2024). This remedy continues to be an effective remedy based on the following:

- Per the EMP (SRNS 2010c) and subsequent recommendation in the EMRs, groundwater monitoring takes place annually at thirty-seven wells and nine surface water/seep locations for the RAGW (Figure G-~~9~~10). These stations monitor four contaminant plumes (one VOC and three tritium). Source well concentrations are decreasing, no exceedances of the source well action limits have ever occurred. Surface water concentrations in 2015 to 2023 were non-detect for VOCs, and well below the MCL (20 ρCi/mL) for tritium with maximum values in 2022 of 1.68 ρCi/mL at MCSW-04), and 0.752 ρCi/mL at MCSW-04 in 2023. The results indicate that the plumes are still on track to be below MCLs in the time frames predicted. All wells monitoring the Northern Tritium Plume have been below the MCL (20 ρCi/mL) since 2019.
- A new horizontal boundary well was added in 2014 to monitor the eastern VOC plume in the deeper aquifer. The maximum TCE result at this well was 1.69 µg/L in 2015, and TCE concentrations have remained below this level since then, indicating limited migration of the TCE plume.
- A new vertical boundary well was added in 2021 to monitor the eastern VOC plume in the deeper aquifer. TCE results at this well have all been below the detection limit (1 µg/L), indicating no vertical migration of the TCE plume.
- As discussed earlier, LUCs are preventing any human health exposure to contaminated groundwater.

Overall the early remedial actions, removal actions, and final remedial action are meeting the RAOs 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, preventing the exposure of

contaminated media or structures to residential receptors, and demonstrating that the plume concentrations are trending downward without impact to surface water.

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

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

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

Fact sheets provided on the USEPA webpage (https://19january2021snapshot.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern_.html) regarding emerging contaminants were reviewed for applicability to this site. The USEPA webpage provides a link to fact sheets for the following emerging contaminants: 1,2,3-trichloropropane (TCP), 1,4-dioxane, 2,4,6-trinitrotoluene (TNT), 2,4-dintrotoluene (DNT), hexahydro-1,3,5-tri-nitro-1,3,5-triazine (RDX), nanomaterials, N-nitroso-dimethylamine (NDMA), perchlorate, perfluorooctane sulfonic acid (PFOS) and other per- and polyfluoroalkyl substances (PFAS), polybrominated biphenyls, polybrominated diphenyl ethers (PBDEs), and tungsten. None of these emerging contaminants were identified as applicable to this OU based on the OU history of contamination.

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

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

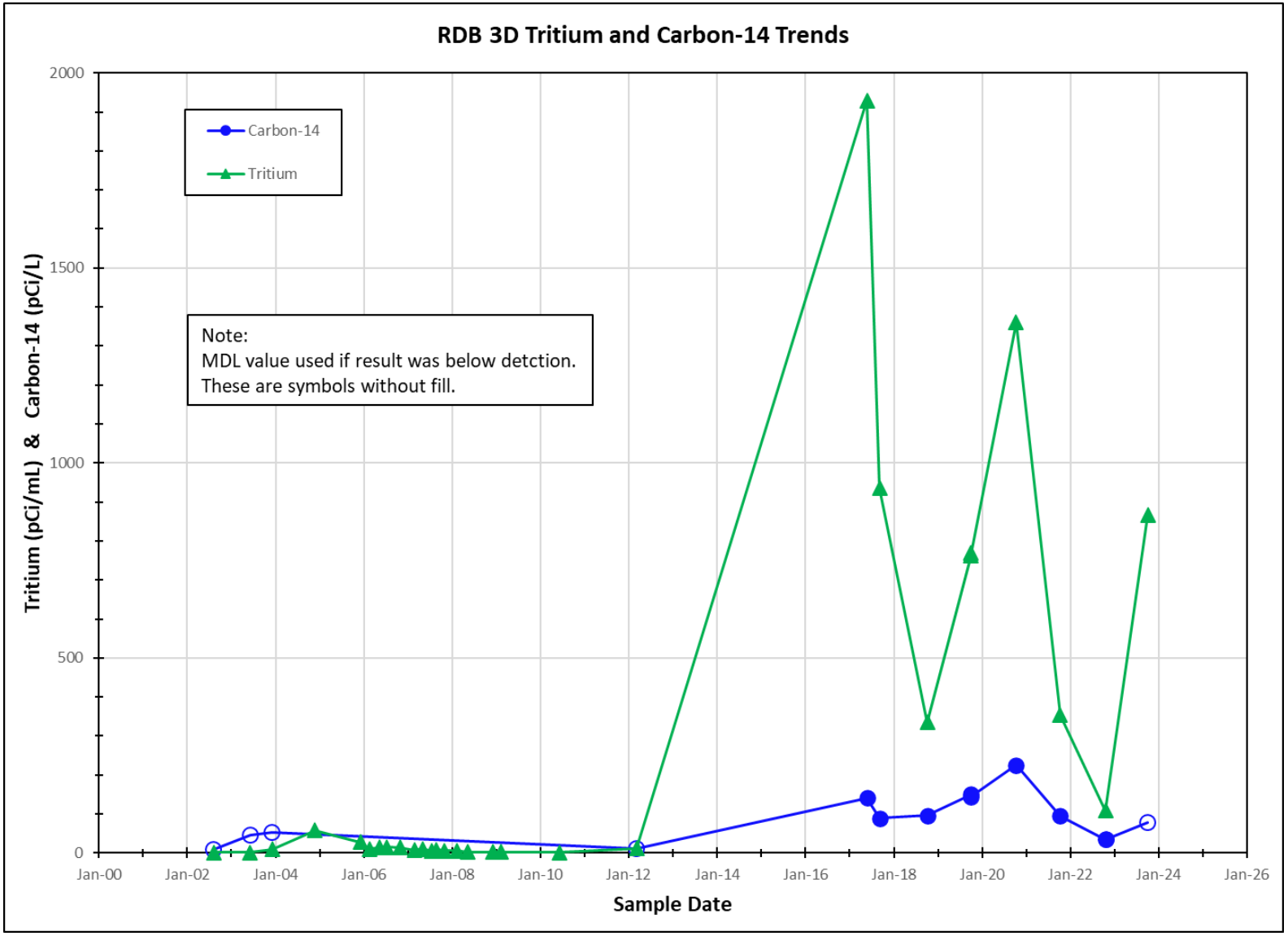

Figure G-9. Tritium and Carbon-14 Trend Data in well RDB 3D at RAOU

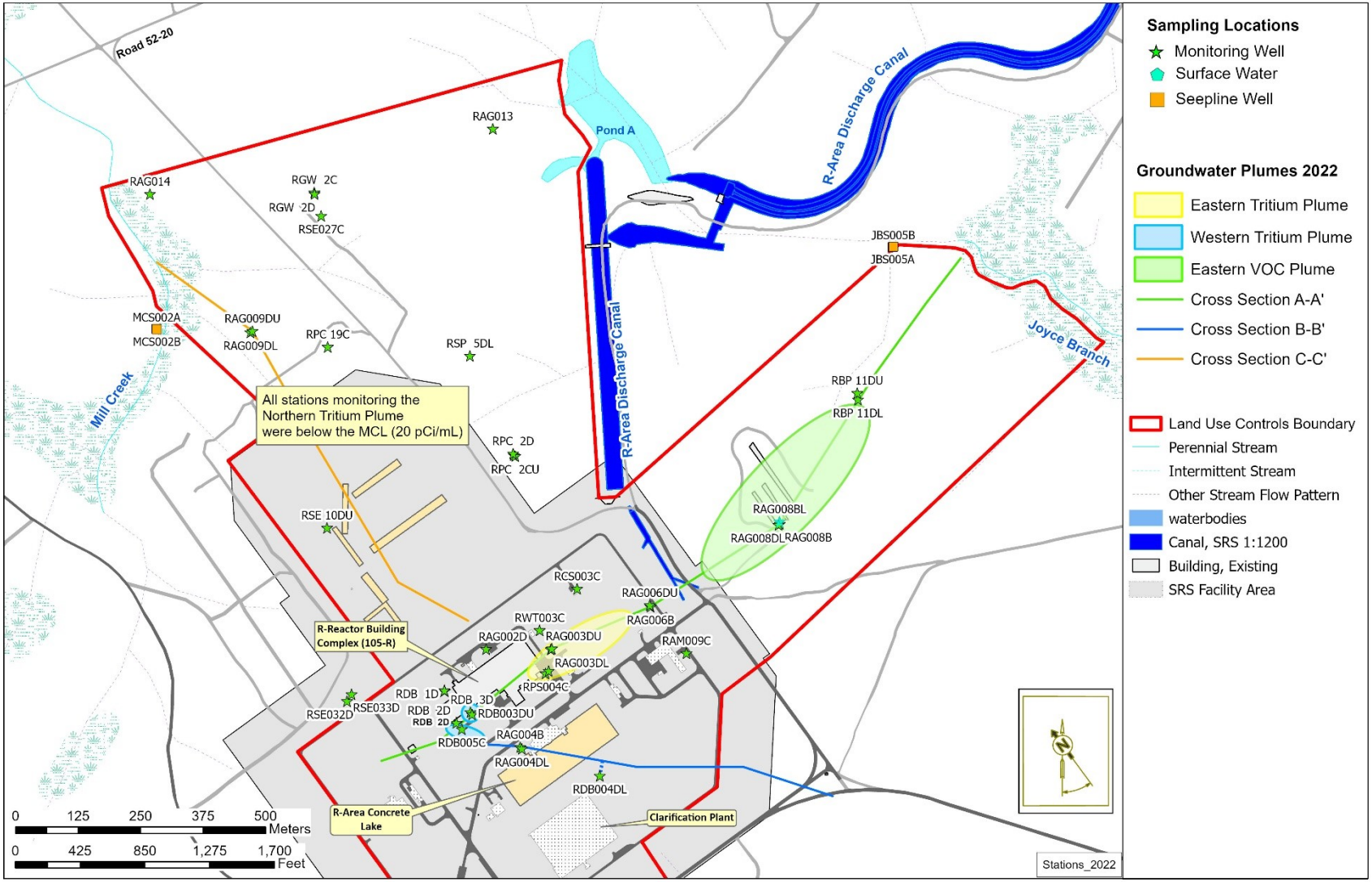

Figure G-10. MNA Monitoring Stations for RAGW Plumes (2022)

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 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

Per the approved 2019 Groundwater Mixing Zone Report (SRNS 2020), groundwater is monitored for strontium-90, and water elevation. Concentrations of strontium-90 in all wells have been below their mixing zone concentration limits since the mixing zone was established in 2007, except for one result at well RSE 10 (Figure H-6). However, that elevated result is attributed to excessive turbidity in the well.

The boundary well data was reviewed and no confirmed MCL exceedances for strontium-90 have been evaluated since the previous five-year remedy review. 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 over time, be relatively stationary, and not move significantly in any direction (WSRC 2004). The selected remedy of monitored natural attenuation (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).

Summary of Inspections and Interviews

Interviews were conducted with Eric Barron, O&M staff member, and Brian Hanshew, O&M Site Manager, on October 22, 2024 at the O&M organization offices. No issues were identified for the RRSB OU during these interviews. The RRSB OU was inspected by Savannah River Nuclear Solutions, LLC (SRNS) Environmental Compliance and Area Completion Projects (EC&ACP) on July 31, 2024. No issues were identified during these inspections.

The RRSB OU was inspected by SRNS EC&ACP and USDOE personnel on December 3, 2019. No issues were identified for the RRSB OU during this inspection that would affect the protectiveness of the remedy. However, SRS was greatly impacted by Hurricane Helene and closed in response during the period of September 27, 2024 through October 6, 2024 with the exception of emergency and essential personnel. The site resumed normal operations on October 7, 2024. EC&ACP O&M personnel are evaluating the impacts of Hurricane Helene and post-hurricane damage assessments and cleanup activities are ongoing. No storm damages have been identified at the RRSB OU that would affect the protectiveness of the remedy.

A regulatory field inspection meeting with USDOE, USEPA, and SCDES ~~will be scheduled after submittal of the revision 0 of this document~~was held February 27, 2025. SRNS personnel ~~will~~ were also ~~be~~ present in the meeting. During the meeting, the participants ~~will~~ viewed drone footage of RRSB and ~~will be~~were provided an opportunity to walk down the OU. The USEPA and SCDES elected not to perform a walk down because the drone video provided them better views of the OU. No significant problems regarding the protection of this remedy for this OU as implemented ~~are anticipated to be~~ were identified during the inspection.