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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SAVANNAH RIVER SITE • AIKEN, SOUTH CAROLINA

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EXECUTIVE SUMMARY

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

Due to the large number of SRS remedial decisions, USDOE, USEPA and SCDES agreed to conduct the remedy reviews in five phases, approximately one year apart, with OUs grouped by the following remedy types: (1) native soil covers and/or land use controls (LUCs); (2) groundwater; (3) engineered cover systems; (4) geosynthetic or stabilization/solidification cover systems; and (5) operating equipment. This is the second phase of the Seventh Five-Year Remedy Review Report, with this report evaluating SRS OUs that have groundwater remediation as a final remedy.

According to the data reviewed and the site inspections, the remedies evaluated in this report are effective and functioning as intended. The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection are still valid. No new information has come to light that calls into question the protectiveness of any of the remedies evaluated. The remedies have been determined to be protective of human health and the environment. No issues or recommendations resulted from this remedy review.

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BEHP	Bis(2-ethylhexyl)phthalate
bgs	below ground surface
BHC	benzene hexachloride
BRA	Baseline Risk Assessment
CAGW	C-Area Groundwater
CBRP	C-Area Burning/Rubble Pit (131-C)
CCl_4	carbon tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
Ci	curies
cDCE	cis-1,2-dichloroethylene
cm	centimeter or centimeters
CM	contaminant migration
cm/sec and cm/s	centimeter per second
CMCOC	contaminant migration constituent of concern
CMP Pits	Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G)
CMS/FS	Corrective Measures Study/Feasibility Study
CO_2	carbon dioxide
COC	constituent of concern
CPT	cone penetrometer technology
CRSB	C-Area Reactor Seepage Basins
CSSLP	Central Shops Scrap Lumber Pile (631-2G)
+D	plus daughter
DCE	dichloroethene
DCM	dichloromethane
DDD	p,p'-dichlorodiphenyldichloroethane
DDE	p,p'-dichlorodiphenyldichloroethylene
DDT	p,p'-dichlorodiphenyltrichloroethane
DNT	2,4-dinitrotolene
DO	dissolved oxygen
DOSB	D-Area Oil Seepage Basin (631-G)
DNAPL	dense non-aqueous phase liquid
EAROD	Early Action Record of Decision
EC&ACP	Environmental Compliance and Area Completion Projects
ECO	ecological
ECODS	Early Construction and Operational Disposal Site
EE/CA	Engineering Evaluation/Cost Analysis
EMP	Effectiveness Monitoring Plan
EMR	Effectiveness Monitoring Report

LIST OF ACRONYMS AND ABBREVIATIONS *(continued)*

ERH	electrical resistance heating
ESD	Explanation of Significant Differences
FFA	Federal Facility Agreement
FY	fiscal year
ft	feet
ft^3	cubic feet
ft^3/min	cubic feet per minute
FYR	Five-year remedy
GA	Gordon Aquifer
gal	gallon
GAU	Gordon Aquifer Unit
GWMZ	Groundwater Mixing Zone
HH	human health
HWMF	hazardous waste management facility
ICA	Isolated Contamination Area
in	inches
IRA	interim remedial action
IROD	Interim Record of Decision
ISD	in situ decommissioning
IOU	integrator operable unit
KBRP	K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G)
kg	kilogram
km	kilometers
km^2	square kilometers
L	liters
LADB	L-Area Disassembly Basin
LAERB	L-Area Emergency Retention Basin
LAHS	L-Area Hot Shop
LAOCB	L-Area Oil and Chemical Basin
LASG	L-Area Southern Groundwater
LAZ	Lower Aquifer Zone
lbs	pounds
LBRP	L-Area Burning/Rubble Pit (131-L)
LLC	Limited Liability Company
LRSB	L-Area Reactor Seepage Basin
LUCAP	Land Use Controls Assurance Plan
LUCIP	Land Use Controls Implementation Plan
LUC	land use control
m	meters
m3	meters
MCL	maximum contaminant level
mi	miles

LIST OF ACRONYMS AND ABBREVIATIONS *(continued)*

mi^2	square mile or square miles
MAZ	Middle Aquifer Zone
µg	micrograms
mg	milligrams
mL	microliters
mV	milliVolt
MNA	monitored natural attenuation
MZ	mixing zone
MZCL	mixing zone concentration limit
NA or N/A	not applicable
NBN	no building number
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
NDMA	N-nitroso-dimethylamine
NFA	No Further Action
NPL	National Priorities List
NRDC	National Resource Defense Council
NTCR	non-time critical removal
O&M	operation and maintenance
ORP	oxidation reduction potential
OU	operable unit
PAR	P and R
PBDE	polybrominated biphenyls, polybrominated diphenyl ethers
PBRP	P-Area Burning/Rubble Pit (131-P)
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
ρCi	picoCuries
PCR	Post Construction Report
PFAS	per- and polyfluoroalkyl substances
PFOS	perfluorooctane sulfonic acid
PRG	Preliminary Remediation Goal
PSA	Potential Source Area
PSL	process sewer line
PTSM	principal threat source material
RAGW	R-Area Groundwater
RAO	remedial action objective
RAOU	R Area Operable Unit
RCOC	refined constituent of concern
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-tri-nitro-1,3,5-triazine
RFI	RCRA Facility Investigation

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

RSL	regional screening levels
S/S	solidification/stabilization
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHEC	South Carolina Department of Health and Environmental Control
SCDES[1]	South Carolina Department of Environmental Services
SE	secular equilibrium
sec or s	second(s)
SEMS	Superfund Enterprise Management System
SPRG	surface preliminary remediation goal
SRS	Savannah River Site
SRNS	Savannah River Nuclear Solutions, LLC
SSHASP	Site-Specific Health and Safety Plan
SVE	soil vapor extraction
TBD	to be determined
TCE	trichloroethylene
TCCZ	Tan Clay Confining Zone
TCP	trichloropropane
TNT	2,4,6-trinitrotoluene
TZ	Transmissive Zone
UE	unrestricted exposure
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
UST	underground storage tanks
UTRA	Upper Three Runs Aquifer
UU	unlimited use
VC	vinyl chloride
VOC	volatile organic compound
WADB	Wetland Area at Dunbarton Bay
WSRC	Washington Savannah River Company
WSRC	Westinghouse Savannah River Company
yd	yards
yd3	cubic yards
ZOI	zone of influence

[1] South Carolina Department of Environmental Services (SCDES) was known as South Carolina Department of Health and Environmental Control prior to July 1, 2024.

SAVANNAH RIVER SITE SUMMARY

I. INTRODUCTION

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

The U.S. Department of Energy (USDOE) prepared this seventh five-year remedy review for Savannah River Site (SRS) OUs that selected groundwater remediation as a remedial action pursuant to CERCLA Section 121 and as amended by SARA and the NCP. During implementation of the five-year remedy review process at the SRS, the U.S. Environmental Protection Agency (USEPA), the South Carolina Department of Environmental Services (SCDES), and the USDOE recognized that remedial action decision document(s) would be issued for multiple OUs. Rather than generate individual five-year remedy review reports for each OU, the USDOE and regulatory agencies determined that it would be more cost effective to conduct a remedy review for all applicable OUs on the same five-year cycle. The First Five-Year Remedy Review was issued in August 1997 (WSRC 1997); the Second

Five-Year Remedy Review was issued in February 2004 (WSRC 2003); the Third Five-Year Remedy Review was issued in January 2009 (SRNS 2008); the Fourth Five-Year Remedy Review was issued in February 2014 (SRNS 2013); the Fifth Five-Year Remedy Review was issued in December 2018 (SRNS 2015, SRNS 2017a, SRNS 2018a, SRNS 2018b, and SRNS 2018c) , the Sixth Five-Remedy Review was issued in December 2023 (SRNS 2019, SRNS 2020, SRNS 2021, SRNS 2022b, SRNS 2023b).

The size of each report has grown considerably since 1997 due to the growing number of OU remedies evaluated, and the level of detail required for data reviews, site inspection reporting, and document formatting based on USEPA guidance. To allow for a more even distribution of resources, a recommendation was made by SRS in the Fourth Five-Year Remedy Review Report (SRNS 2013) that future reviews should be conducted in phases based on OU groupings with similar remedies. In addition to a reduction in the total volume for future remedy review reports, evaluating similar remedies in the same review period supports easier identification and resolution of similar issues and allows for more efficient implementation of similar initiatives. Beginning with the Fifth Five-Year Remedy Review Report, the USDOE, USEPA, and SCDES agreed to segregate the five-year remedy review reports into five OU groupings (grouped by remedy similarity) with a different group submitted annually on a five-year cycle. The SRS OUs are grouped by the following remedy types:

(1) Native Soil Covers and/or Land Use Controls (LUCs);
(2) Groundwater Remedies;
(3) Engineered Cover Systems;
(4) Geosynthetic or Stabilization/Solidification Cover Systems; and
(5) Operating Equipment.

The trigger date for submittal of the next five-year remedy review report to the regulatory agencies is based on the USEPA signature date of the previous report. Therefore, the final signature for the last grouping of Seventh Five-Year Remedy Review Report is due no later than December 31, 2028. A more detailed discussion of the phased reviews and transition schedule are provided in Appendix A.

This report documents the Seventh Five-Year Remedy Review for the 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 summary status of SRS is provided in the Five-Year Summary Review Form in Table 1. A chronology of site events including the effective dates for the Consent Decree, the FFA, and the NPL Listing is provided in Appendix A. Chronologies of significant activities and regulatory milestones for individual OUs are included in the site-specific remedy review reports (Appendix C through Appendix 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, and in some cases, disposed of at SRS. Past disposal practices (e.g., seepage basins, pits and piles, landfills, etc.) have resulted in soil and groundwater contamination.

Hazardous waste handled at SRS are managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities require SCDES operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from the SCDES, which was most recently renewed on February 11, 2014. Module VIII of the Hazardous and Solid Waste Amendments portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

Physical Characteristics

SRS occupies approximately 802.9 km^2 (310 mi^2) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 40 km (25 mi) southeast of Augusta, Georgia, and 32 km (20 mi) south of Aiken, South Carolina. Approximately 90 percent of SRS land consists of natural and managed forests. The locations at SRS where nuclear materials were produced, stored, and disposed are clustered into distinct industrial areas that are separated by large areas of forest. OUs are generally contained within or adjacent to these industrial areas.

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

Land and Resource Use

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

The future land use for all of the OUs at SRS is anticipated to be industrial with the USDOE maintaining control of the land. According to the *Savannah River Site Future Use Project*

Report (USDOE 1996), residential uses of SRS land should be prohibited. LUCs selected as part of the remedial action will prohibit residential use of the area.

SRS manages its own drinking and process water supply from groundwater located beneath the SRS. SRS domestic and process water systems are supplied from a network of approximately 40 wells in widely scattered locations across the site, of which eight wells supply the primary drinking water system. Wells serving site process and drinking water in the larger site areas are typically 180 to 270 m (600 to 900 ft) in depth and pump water from the deeper Crouch Branch and McQueen Branch aquifers. Wells serving the smaller site facilities, such as barricades, pumphouses, and field laboratories, are shallower in depth (30 to 90 m [100 to 300 ft]) and are similar to large household-type wells. The SRS domestic water systems meet state and federal drinking water standards.

History of Contamination

During the early 1950s, SRS began to produce materials used in nuclear weapons, primarily tritium, plutonium-239, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases disposed of at SRS. Hazardous substances, as defined by the CERCLA, are currently present in the environment at SRS, with past disposal practices (e.g., seepage basins, pits and piles, landfills, etc.) resulting in soil and groundwater contamination.

II. RESPONSE ACTION SUMMARY

Initial Response

After SRS was placed on the NPL in 1989, the SRS Site Evaluation program was initiated to identify potential release sites present at SRS that would require investigation and potential remediation under CERCLA. Five hundred fifteen (515) potential release sites have been identified. The FFA includes a schedule for the investigation and remedial action (if needed) for each potential release site not already completed.

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

The collaborative efforts of the USDOE, USEPA, and SCDES support a consistent approach to site characterization, human health and ecological risk analyses, remedy selection, establishment of cleanup levels and remedy implementation for individual OUs at SRS. Technical and administrative protocols have been established to promote the consistent implementation of USEPA guidance at OUs across SRS. An environmental database is used to track sampling, analysis, and results of environmental characterization and monitoring. The environmental database is not available to the public directly. However, the information retained in the database is provided in regulatory documents that are submitted to USEPA and SCDES for review and approval and are available to the public in the SRS Administrative Record File. An SRS Area Completion Strategy (WSRC 2006) was developed which allowed for the simultaneous characterization and cleanup of multiple OUs and potential sources of contamination in congested industrial areas.

Basis for Taking Action

Groundwater contaminant plumes associated with SRS OUs cover approximately 2,023 hectares (5,000 acres) of the SRS. The lateral extent of these plumes is indicated on Figure 2. The primary contaminants in groundwater are volatile organic compounds (VOCs) and tritium. Strontium-90, iodine-129, and metals are present in groundwater above drinking water standards to a lesser extent. VOCs are present in the vadose zone between the source unit and the groundwater at a number of OUs and act as a secondary source of contamination to the groundwater.

Based on remedial investigations and technical evaluations, the OUs addressed in this remedy review have hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. They are reviewed

every five years to ensure protection of human health and the environment. The specific contaminants and remedial actions for each OU are described in greater detail in the OU-specific appendices (Appendix C through Appendix H).

Remedial Actions

Remedial actions may target source areas, soil, vadose zone, and/or groundwater. Cleanup levels, formerly referred to as remedial goals in SRS decision documents, are defined for individual OUs, and are included as part of the remedial action objectives (RAOs). RAOs specify the exposure pathway to be mitigated and the receptor to be protected. In general, RAOs at SRS are:

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

Additionally, LUCs are part of all remedial actions where hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unlimited use and unrestricted exposure. The type of LUCs and implementation and reference to the OU-specific land use control implementation plan (LUCIP) are described in Section VII of the OU-specific appendices. LUCs are defined for individual OUs, but in general, LUC objectives at SRS:

- 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). 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) 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.

The Revision 0 report was submitted on December 19, 2024. USEPA and SCDES performed site inspections 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 2020), USDOE recommended including the CAGW OU in the list of LUC OUs in the FFA Annual Progress Reports. Since November 2020, USDOE has included the CAGW OU in the FFA Annual Progress Reports, which demonstrate long-term protectiveness by recognizing SRS facility security and administrative controls that restrict unauthorized access. The FFA Annual Progress Report is required by the FFA and includes an annual certification by the USDOE Savannah River Operations Manager that the listed OUs 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 Groundwater Monitoring Report*, SRNS-RP-2017-00356, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2017c. *Groundwater Flow and Solute Transport Model of the CMP Pits OU (U) Tetra Tech, Inc. Alpharetta, GA*, SRNS-TR-2017-00312, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2018a. *Fifth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Engineered Cover Systems (U)* Aiken, South Carolina, SRNS-RP-2016-00609, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

SRNS, 2018c. *Fifth Five-Year Remedy Review Report for Savannah River Site Operable Units with Operating Equipment (U)* Aiken, South Carolina, SRNS-RP-2017-00567, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

SRNS, 2019. *Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Native Soil Covers and/or Land Use Controls (U)*, Aiken, South Carolina, SRNS-RP-2018-00811, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Groundwater Remedies (U)* Aiken, South Carolina, SRNS-RP-2019-00511, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2021. *Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Engineered Cover System (U)* Aiken, South Carolina, SRNS-RP-2020-00420, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2022a. *Land Use Control Implementation Plan for the Lower Three Runs Integrator Operable Unit (Upper Subunit) (U)*, SRNS-RP-2022-00017, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2022b. *Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Geosynthetic or Stabilization/Solidification Cover Systems (U), Aiken, South Carolina*, SRNS-RP-2021-04229, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2023a. *Federal Facility Agreement Annual Progress Report for Fiscal Year 2023*, SRNS-RP-2023-01323, November 2023, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2023b. *Sixth Five-Year Remedy Review Report for Savannah River Site Operable Units with Operating Equipment (U)*, Aiken, South Carolina, SRNS-RP-2022-00468, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540-R-01-007, OSWER No. 9355.7-03B-P, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

USEPA, 2011. *Recommended Evaluation of Institutional Controls: Supplement to the "Comprehensive Five-Year Review Guidance"*, OSWER 2011 Directive 9355.7-18, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

USEPA, 2012. *Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews*, OSWER 2012 Directive 9200.2-111, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

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

WSRC, 1999. *Corrective Measures Implementation/Remedial Design/Remedial Design Report/Remedial Action Workplan for the D-Area Oil Seepage Basin (631-G) (U)*, WSRC-

RP-99-4006, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2002. *Record of Decision Remedial Alternative Selection for the L-Area Burning/Rubble Pit (131-L), Gas Cylinder Disposal Facility (131-2L), and L-Area Rubble Pile (131-3L) (U)*, WSRC-RP-98-4195, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003. *Second Five-Year Review Report for the Savannah River Site (U),* WSRC-RP-2001-4163, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2004. *Land Use Control Implementation Plan (LUCIP) for the R-Area Reactor Seepage Basins Operable Unit (U)*, WSRC-RP-2004-4032, Revision 1, Westinghouse Savanah River Company, Savannah River Site, Aiken, SC

WSRC, 2006. *Area Completion Strategy for the Savannah River Site (U)*, ERD-EN-2005-0084, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007. *Land Use Control Implementation Plan (LUCIP) for the Chemicals, Metals, and Pesticides Pits Operable Unit (080-170G, 080-171G, 080-180G, 080-182G, 080-183G, and 080-190G) (U)*, WSRC-RP-2004-4078, Revision 1.2, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Land Use Control Implementation Plan for the L-Area Southern Groundwater Operable Unit (NBN) (U)*, WSRC-RP-2007-4049, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

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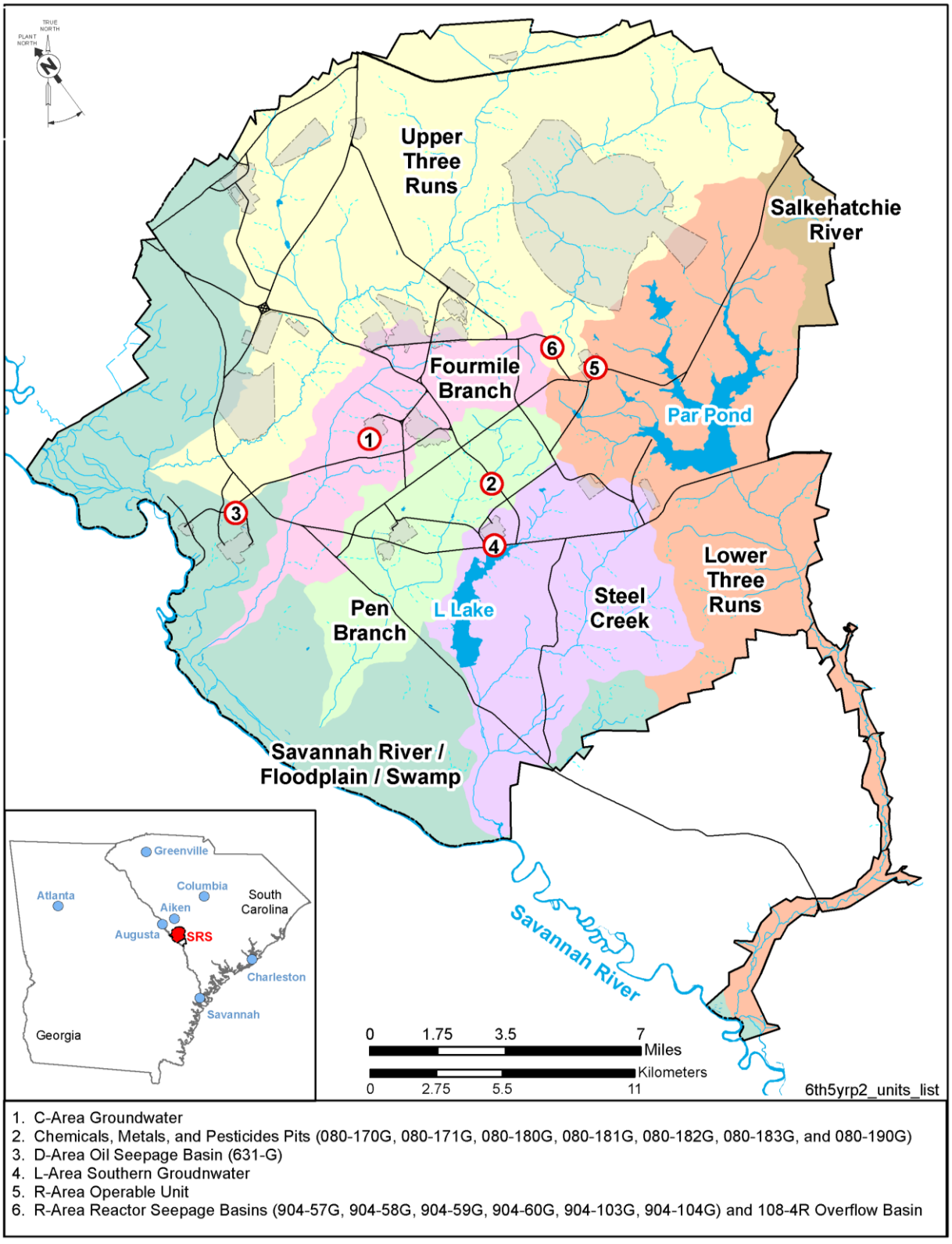


Figure 1. Location Map for SRS OUs with Groundwater Remedies

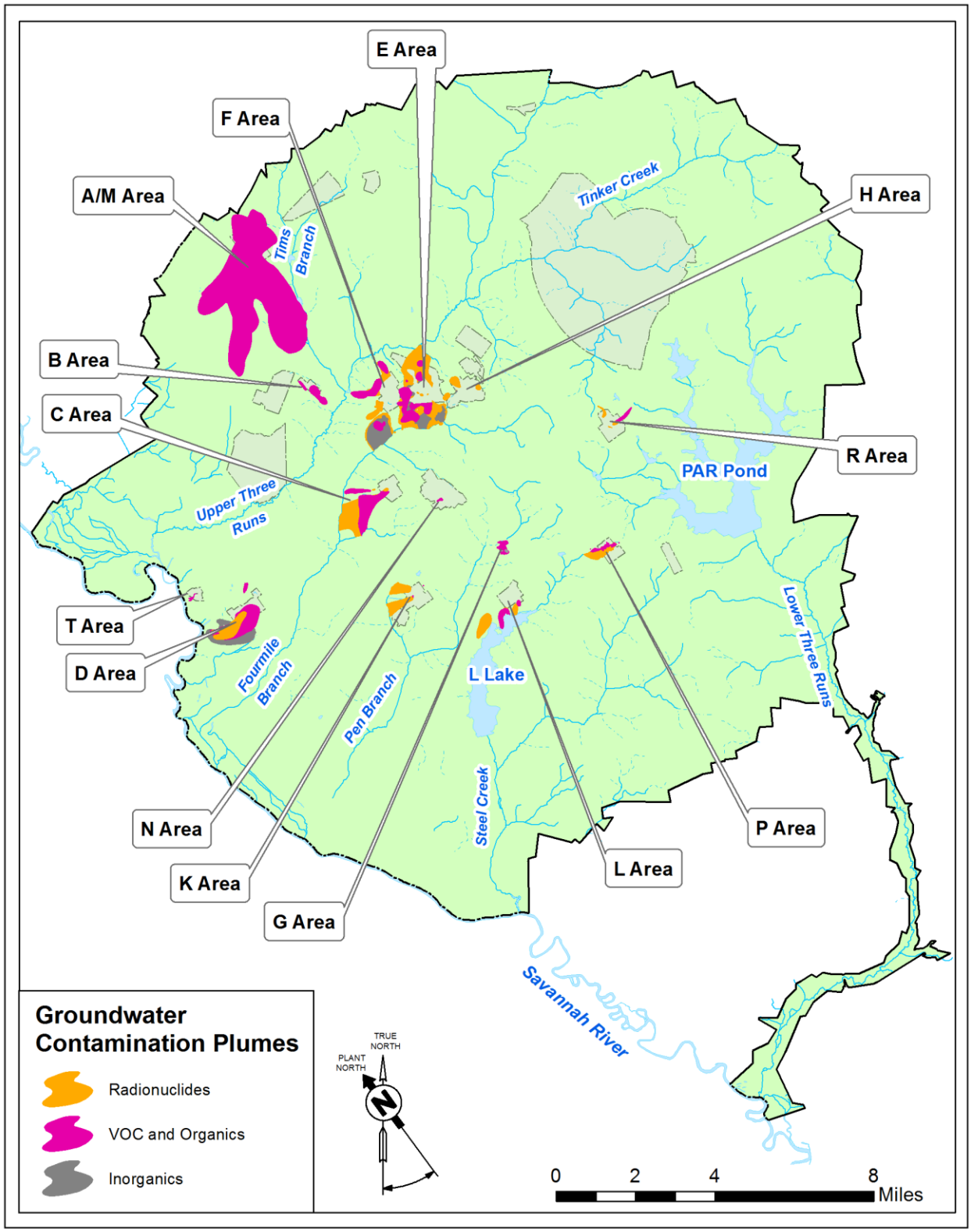


Figure 2. Groundwater Contamination at the Savannah River Site

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION			
Site Name: Savannah River Site			
EPA ID: SC1890008989			
Region: 4	**State:** SC	**City/County:** Aiken/Aiken	
SITE STATUS			
NPL Status: Final			
Multiple OUs?: Yes	**Has the Site achieved Construction Completion?** No		
REVIEW STATUS			
Lead Agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency Name:** U.S. Department of Energy			
Author Name (Federal or State Project Manager: N/A			
Author Affiliation: Savannah River Nuclear Solutions, LLC			
Review Period: June 15, 2024 – December 31, 2025 (SRS OUs with Groundwater Remedies)			
Date of Site Inspections: June 2024 – December 2024 (SRS OUs with Groundwater Remedies)			
Type of Review: Statutory			
Review Number: 7			
Triggering Action Date: December 31, 2023 (includes all five phases)			
Due Date *(five years after triggering action date)*: December 31, 2028 (includes all five phases)			

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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	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 3. LUC Summary Table

Operable Units	Media, Engineered Controls, and Areas that do not support UU/UE based on current conditions	LUCs Needed	LUCs Called for in the Decision Documents	Impacted Parcel(s)[a]	LUC Objectives[b]	Title of LUC Instrument Implemented and Date (or Planned)
C-Area Groundwater[c]	Groundwater, Surface Water, Vadose Zone Soil	TBD	No	82	• TBD	TBD
Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G)	Soil, Groundwater	Yes	Yes	24	• Prevent contact, removal, or excavation of Ballast Area and Vadose Zone contaminated soil • Maintain the integrity of the existing cover • Maintain the use of the site for industrial activities only in order to prevent residential exposure • Prevent unauthorized access to the closed waste unit as long as waste remains a threat to human health or the environment in order to protect the industrial worker • Prevent unauthorized residential or agricultural access to groundwater in the area	WSRC 2007
D-Area Oil Seepage Basin (631-G)	Groundwater	Yes	Yes	27	• Prevent unauthorized exposure to the contaminated groundwater	WSRC 1999

Table 3. LUC Summary Table *(continued)*

Operable Units	Media, Engineered Controls, and Areas that do not support UU/UE based on current conditions	LUCs Needed	LUCs Called for in the Decision Documents	Impacted Parcel(s)[a]	LUC Objectives[b]	Title of LUC Instrument Implemented and Date (or Planned)
L-Area Southern Groundwater	Groundwater	Yes	Yes	77	• Preclude future residential development or potable water use of local contaminated groundwater • Maintain the integrity of any current or future remedial or monitoring system or component such as monitoring wells until remedial goals are achieved and restrictions are no longer warranted • Prevent access to contaminated groundwater in the area as long as contaminant concentrations exceed MCLs for purposes other than implementing the selected remedy	WSRC 2008
R-Area Operable Unit	Concrete, Metal Components, Rail Bed Materials, Soil, Sediment, Groundwater	Yes	Yes	95	• Restrict unauthorized worker access and prevent contact, removal, or excavation of contaminated waste, pipelines, equipment, and buildings • Prohibit development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds • Prohibit industrial use of the R-Area Isolated Contamination Area Potential Source Area • Maintain the integrity of any current or future remedial or monitoring system, such as soil covers, or groundwater monitoring wells • Prevent access or use of contaminated groundwater until cleanup levels are met • Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion	SRNS 2011

Table 3. LUC Summary Table *(continued/end)*

Operable Units	Media, Engineered Controls, and Areas that do not support UU/UE based on current conditions	LUCs Needed	LUCs Called for in the Decision Documents	Impacted Parcel(s)[a]	LUC Objectives[b]	Title of LUC Instrument Implemented and Date (or Planned)
R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin	Soil, Groundwater	Yes	Yes	25	• Prevent contact, removal, or excavation of contaminated soil and pipelines • Preclude residential use of the area • Prevent unauthorized access to contaminated groundwater in the area	WSRC 2004

a The Impacted Parcel(s) identification is represented by the SEMS number.
b The LUC objectives statements were obtained directly from the referenced LUC document. LUC objective statements vary in complexity due to the age of the document and guidance in place at the time the remedial decision was selected.
c 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.

TBD – to be determined
UU – unlimited use
UE – unrestricted exposure

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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)	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.

Table 6. OUs without Issues and Recommendations in the Seventh Five-Year Remedy Review Report for SRS OUs with Groundwater Remedies

OU(s) without Issues/Recommendations Identified in the Five-Year Review	
SEMS #:	**24, 25, 27, 77, 82, 95**

Table 7. Issues and Recommendations Identified in the Seventh Five-Year Remedy Review Report for SRS OUs with Groundwater Remedies

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

N/A – not applicable

* Only issues and recommendations that affect the protectiveness of the remedy will be listed in the above table. All other issues and recommendations will be discussed in the Other Findings section, if warranted.

Table 8. Protectiveness Statements for the Seventh Five-Year Review Report for SRS OUs with Groundwater Remedies

PROTECTIVENESS STATEMENT(S)		
Operable Unit: C-Area Groundwater (CAGW) SEMS # 82	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The interim remedy at the CAGW OU is protective of human health and the environment.		
Operable Unit: Chemical, Metals, and Pesticides (CMP) Pits (080-17G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G), SEMS # 24	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the CMP Pits OU is protective of human health and the environment.		
Operable Unit: D-Area Oil Seepage Basin (DOSB) (631-G), SEMS #27	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the DOSB OU is protective of human health and the environment.		
Operable Unit: L-Area Southern Groundwater (LASG), SEMS #77	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the LASG OU is protective of human health and the environment.		
Operable Unit: R-Area Operable Unit (RAOU), SEMS #95	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the RAOU is protective of human health and the environment.		
Operable Unit: R-Reactor Area Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin (RRSB), SEMS #25	***Protectiveness Determination:*** Protective	***Addendum Due Date (if applicable):*** N/A
Protectiveness Statement: The remedy at the RRSB OU is protective of human health and the environment.		

APPENDIX A. SEVENTH FIVE-YEAR REMEDY REVIEW REPORT PHASED REVIEWS

I. FIVE-YEAR REMEDY REVIEW PHASES

The size of the Savannah River Site (SRS) five-year remedy review reports has grown considerably since the first report was issued in 1997 with respect to the number of operable unit (OU) remedies evaluated and the level of detail required. Beginning with the Fifth Five-Year Remedy Review Report, the U.S. Department of Energy, U.S. Environmental Protection Agency (USEPA), and South Carolina Department of Environmental Services (SCDES) agreed to segregate the OUs into five groupings based on remedy similarity with a different group submitted annually on a five-year cycle. This phased approach not only reduces the volume of future remedy reports but is also more effective in identifying and resolving issues for similar remedies.

The SRS OUs are grouped by the following remedy types:

1. Native Soil Covers and/or Land Use Controls (LUCs);
2. Groundwater Remedies;
3. Engineered Cover Systems;
4. Geosynthetic or Stabilization/Solidification Cover Systems; and
5. Operating Equipment.

The trigger date for submittal of the next five-year remedy review report to the regulatory agencies is based on the USEPA signature date of the previous report. The final signature for the last grouping of Seventh Five-Year Remedy Review Report is due no later than December 31, 2028. The remedy reviews for the five OU remedy groups are issued in compliance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan to ensure the five-year limit between decision documents is not exceeded.

A list of the SRS OUs with remedy decision documents grouped into one of the five phased reviews is provided in Table A-1. Table A-1 will be updated in future remedy review

reports as additional remedy decision documents are approved. A general description of the five remedy types is provided below.

Phase 1: Native Soil Covers and/or LUCs

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

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

LUCs are maintained for all OUs where residual hazardous substances, pollutants, or contaminants remain on-site or have been left in place above levels that are acceptable for unlimited use and unrestricted exposure. LUCs may be implemented as a stand-alone remedy when active measures are determined not to be practicable or combined with other remedial actions. LUCs involve institutional controls (i.e., administrative controls) and engineering controls and can include monitoring, maintenance, reporting, access restrictions, signage, fencing, and land use restrictions. In older SRS remedy documents, the term “institutional controls” was often used in place of the broader LUC term.

Phase 2: Groundwater Remedies

For purposes of the seventh five-year phased remedy review, SRS OUs that have monitoring activities associated with Monitored Natural Attenuation (MNA) or a Mixing Zone (MZ) permit as well as interim remedial actions are grouped in the Groundwater

Remedies category. Groundwater remedies that include operating equipment are discussed in the remedy review report for operating equipment.

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

Low-energy-consumption, low-carbon-emission systems are used at SRS to remediate vadose zone soils for the purpose of preventing groundwater contamination. These "green" technologies leverage natural systems to protect and remediate groundwater. Many existing soil vapor extraction (SVE) systems have been converted from active vacuum extraction to low-energy MicroBlower™ and/or passive BaroBall™ systems. BaroBall™ and MicroBlower™ systems are two types of SVE systems currently in operation at SRS. BaroBalls™ rely on natural fluctuations in barometric pressure to pump volatile organic compounds (VOCs) from the subsurface to the atmosphere at individual SVE wells. SVE wells with MicroBlowers™ are designed to use solar power to generate a vacuum that exhausts VOC vapors from individual wells. Both MicroBlowers™ and BaroBalls™ are low-energy-consumption, low-carbon-emission devices that remove VOC contaminants from the subsurface.

MNA is a passive groundwater remedial action where the fringe and dilute areas of a plume degrade by natural biogeochemical or physical processes such as biodegradation, radioactive decay, dilution, and simple dispersion. MNA remedies must be accompanied

by source control, such as those discussed above, and a technical justification that conditions are favorable for natural attenuation. The groundwater plume should not be expanding significantly, and surface water standards cannot be exceeded at the groundwater discharge point. MNA remedy justifications are supported by groundwater modeling and a commitment to continued monitoring and reporting. When only the uppermost aquifer is impacted, SCDES may issue a MZ permit that is essentially a permit for an MNA remedy. SRS has a mixture of CERCLA Record of Decisions (RODs) that require MNA as the final action for groundwater under CERCLA, and RODs that require SCDES MZ permits to implement the MNA remedy.

Phase 3: Engineered Cover Systems

For purposes of the seventh five-year phased remedy review, SRS OUs that selected an engineered cover system or similar cover system as the remedy are grouped in the Engineered Cover Systems category.

The function of an engineered cover system is similar to that of a native soil covers, to protect against human and/or ecosystem exposure to waste or contaminated material left in place. Although engineered covers do not completely prevent infiltration, they can achieve very low permeabilities if well compacted. Compaction is important to reduce damage from differential settlement and is often used at SRS to remediate OUs that contain diverse waste material such as rubble pits/piles. Another objective of using engineered cover systems is to promote more effective surface drainage and to minimize infiltration.

SRS OUs were placed in this grouping if the selected cover features/performance requirements exceeded those of a basic native soil cover. For example, an OU with a remedy that selected cover and/or fill material with a higher clay content to minimize infiltration or for drainage and slope contouring was included in this category even if the clay material did not have engineering compaction requirements.

Phase 4: Geosynthetic or Stabilization/Solidification Cover Systems

For purposes of the seventh five -year phased remedy review, SRS OUs that installed a geosynthetic or solidification/stabilization (S/S) cover system are grouped in the Geosynthetic or S/S Cover Systems category.

Many cover systems are designed to protect groundwater by minimizing the infiltration of rainwater through the contaminated material left in place. Geosynthetic cover systems are constructed at SRS OUs when there is a concern that contamination left in place may leach to groundwater above acceptable levels. A typical cross section of a geosynthetic cover system consists of a vegetative/soil protective layer, a geosynthetic drainage layer, an impermeable geosynthetic liner, and compacted common fill placed over the contaminated material. A specific hydraulic conductivity to reduce storm water infiltration, usually 1E-07 cm/s or less, is specified in the design. Low permeability covers are often paired with SVE units that remove VOCs from the subsurface soil to prevent migration of contaminants to groundwater.

In some cases, radioactively contaminated soils have been stabilized with in-situ grouting followed by installation of a low permeability cover (i.e., compacted clay, concrete, etc.) to deter migration of contaminants to the groundwater. Not only does a S/S technology stabilize waste left in place; the in-situ containment also provides another layer of protection to prevent intrusion and exposure to contaminated material.

Phase 5: Operating Equipment

For purposes of the seventh five-year phased remedy review, SRS OUs that have ongoing active remediation systems are grouped under the Operating Equipment category.

A range of active remediation systems are used at SRS. SVE systems are used to remove VOCs from vadose zone source areas before the contaminants can migrate to the water table. Pump and treat systems (e.g., air strippers and associated recovery wells) are used to remove contaminant mass and exert hydraulic control over contaminated groundwater plumes. Thermal technologies have been employed in several areas to mobilize dense non-aqueous phase liquid (DNAPL) VOCs in the vadose zone and groundwater. Dynamic

Underground Stripping is a technology employed at SRS that utilizes steam injection to enhance removal from large DNAPL source zones. Electrical Resistance Heating has been used in smaller DNAPL source zones.

II. SRS OUS WITH REMEDIAL DECISIONS

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

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

Table A-1. Seventh Five-Year Remedy Review Report Phases for SRS OUs

Native Soil Covers and/or LUCs		Groundwater		Engineered Cover Systems		Geosynthetic or Stabilization/Solidification Cover Systems		Operating Equipment	
Submittal Date[a]	*Issuance Year*	*Submittal Date*[a]	*Issuance Year*	*Submittal Date*[a]	*Issuance Year*	*Submittal Date*[a]	*Issuance Year*	*Submittal Date*[a]	*Issuance Year*
2023	2024	2024	2025	2025	2026	2026	2027	2027	2028
C-Area Operable Unit		C-Area Groundwater		Central Shops Burning/Rubble Pits (631-1G and 631-3G)		B-Area Operable Unit		A-Area Burning/Rubble Pits (731-A/731-1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A)	
C-, K-, and L-Reactor Complexes		Chemicals, Metals, and Pesticides Pit (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G)		D-Area Burning/Rubble Pits (431-D and 431-1D)		C-Area Reactor Seepage Basins (904-66G, 904-67G, and 904-68G)		A-Area Miscellaneous Rubble Pile (731-6A)	
Early Construction and Operational Disposal Site (ECODS) L-1, N-2, P-2, and R-1A, R -1B, R -1C		D-Area Oil Seepage Basin (631-G)		F-Area Hazardous Waste Management Facility (HWMF) (904-41G, 904-42G, 904-43G)		D-Area Expanded Operable Unit (Consisting of D-Area Ash Basin [488-D] and D-Area Rubble Pit [431-2D])		A/M Area Groundwater	
ECODS N-1, Central Shops Scrap Lumber Pile (631-2G), Building 690-N (Ford Building)		L-Area Southern Groundwater		Ford Building Seepage Basin (904-91G)		E-Area Low-Level Waste Facility (643-26E)		C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN)	
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)		R-Area Operable Unit[c]		H-Area HWMF (904-44G, 904-45G, 904-46G, 904-56G)		F-Area Tank Farm		D-Area Operable Unit	
Gunsite 012		R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, and 904-104G) and 108-4R Overflow Basin		K-Area Burning/Rubble Pit and Rubble Pile (131-K and 631-20G)		F-Area Retention Basin (281-3F)		F-Area Groundwater Operable Unit	
Heavy Equipment Wash Basin (NBN)				M-Area HWMF (904-51G and 904-112G)		General Separations Area Consolidation Unit		H-Area Groundwater Operable Unit	
K-Area Bingham Pump Outage Pit (643-1G)				Metallurgical Laboratory HWMF (904-110G)		H-Area Tank Farm		M-Area Settling Basin Inactive Process Sewer Lines (081-M)	

Table A-1. Seventh Five-Year Remedy Review Report Phases for SRS OUs (*continued/end*)

Native Soil Covers and/or LUCs		Groundwater		Engineered Cover Systems		Geosynthetic or Stabilization/Solidification Cover Systems		Operating Equipment	
Submittal Date[a]	*Issuance Year*	*Submittal Date*[a]	*Issuance Year*	*Submittal Date*[a]	*Issuance Year*	*Submittal Date*[a]	*Issuance Year*	*Submittal Date*[a]	*Issuance Year*
2023	2024	2024	2025	2025	2026	2026	2027	2027	2028
L-Area and P-Area Bingham Pump Outage Pits (643-2G, 643-3G, and 643-4G)				Mixed Waste Management Facility (643-28E)		K-Area Reactor Seepage Basin (904-65G)		M-Area Operable Unit	
PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals) and Lower Three Runs Integrator Operable Unit (IOU) Tail Portion (Middle and Lower Subunits)				SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)		L-Area Oil and Chemical Basin (904-83G)		P-Area Burning/Rubble Pit (131-P)	
R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3						L-Area Reactor Seepage Basin (904-64G)		TNX Area Operable Unit	
Silverton Road Waste Unit (731-3A)						Old F-Area Seepage Basin (904-49G)			
Wetland Area at Dunbarton Bay in Support of Steel Creek IOU[b]						P-Area Operable Unit			
						P-Area Reactor Seepage Basin (904-61G, 904-62G, and 904-63G)			
						R-Area Burning/Rubble Pits (131-R and 131-1R) and R-Area Rubble Pile (631-25G)			
						T-Area Operable Unit			

a Represents December submittal date of the Revision 0 document for each five-year remedy review report.
b ROD was issued on October 12, 2023. This OU was not included in the first phase of the sixth five-year remedy review (i.e., native soil covers and/or LUCs) because the remedy had not been implemented.
c R-Reactor Complex will be discussed as part of R-Area Operable Unit.

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

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
Compacted Native Soil								
Central Shops Burning/Rubble Pit (631-5G)	1	CSBRP 5G	0.15	0	0	0	0	0
Early Construction and Operational Disposal Site (ECODS) C-1	1	CAOU	0.16	0	0	0	0	1.27
ECODs L-1	1	ECODS L-1	0.40	0	0	0	0	0.94
ECODs N-2	1	ECODS N-2	0.47	0	0	0	0	1.31
ECODs P-2	1	ECODS P-2	0.18	0	0	0	0	2.42
ECODs R-1A, R-1B, R-1C	1	ECODS R-1A, R-1B, R-1C	0.3	0	0	0	0	1.76
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)	1	FBRP	1.18	0	0	0	0	3.8
K-Area Bingham Pump Outage Pit (BPOP) (643-1G)	1	KBPOP	0.55	0	0	0	0	0.59
L-Area BPOP (643-2G and 642-3G)	1	L/P-BPOP	0.31	0	0	0	0	0.73
P-Area BPOP (643-4G)	1	L/P-BPOP	0.28	0	0	0	0	0.41
R-Area BPOP (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3	1	RBPOP	0.88	0	0	0	0	3.1
Silverton Road Waste Unit (731-3A)	1	SRWU	1.36	0	0	0	0	5.3
Central Shops Burning/Rubble Pits (631-1G and 631-3G)	3	CSBRP	0.43	0	0	0	0	2.81
D-Area Burning/Rubble Pits (431-D and 431-1D)	3	DBRP	0.54	0	0	0	0	0.73
A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A), Metals Burning Pit (731-5A)	5	ABRP/RP MCB/MBP	9.95	0	0	0	10,200	10.1
M-Area Operable Unit	5	MAOU	0.84	3,600	0	4,350	0	70.9
Land Use Controls Only								
C-Area Operable Unit	1	CAOU	0	0	0	0	0	56.5
C-Reactor Complex	1	CKL Rx	0	0	0	0	0	3.4
K-Reactor Complex	1	CKL Rx	0	0	0	0	0	3.8
L-Reactor Complex	1	CKL Rx	0	0	0	0	0	3.5
D-Area Operable Unit (488-2D and west of the 488-1D)	5	DAOU	0	0	0	0	315,821	245
Gunsite 012	1	Gunsite 012	0	0	0	0	0	8.9
Heavy Equipment Wash Basin (NBN)	1	HEWB	0	0	0	0	0	0.3
Lower Three Runs IOU	1	PAR Pond	5535.2	0	0	0	0	5535.2
Wetland Area at Dunbarton Bay	1	WADB	0	0	0	0	22,000	39

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

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
Water Cover								
PAR Pond (685-G) (Including the Pre-Cooler Ponds and Canals)	1	PAR Pond	1,340	0	0	0	0	2556.1
Geosynthetic Clay (hydraulic conductivity 1E-07 cm/sec, 1E-08 cm/sec)								
General Separations Area Consolidation Unit	4	GSACU	77.3	0	0	50,950	0	86
D-Area Expanded Operable Unit consisting of D-Area Ash Basin (488-D) and D-Area Rubble Pit (431-2D)	4	DEXOU	25	0	0	110,110	74	43.27
E-Area Low-Level Waste Facility (643-26E)	4	E-Area LLWF	13.6	123,072	0	0	0	0
T-Area Operable Unit	4	TAOU	9.4	0	0	1,531	0	47.58
P-Area Reactor Seepage Basin (904-61G, 904-62G, and 904-63G)	4	PRSB	2.3	0	7,400	1,928	0	3.13
R-Area Burning/Rubble Pits (131-R and 131-1R) and Rubble Pile (631-25G)	4	RBRP/RP	0.32	0	0	0	250	0.44
Compacted Clay (hydraulic conductivity 1E-07 cm/sec)								
F-Area Hazardous Waste Management Facilities (HWMFs) (904-41G, 904-42G, and 904-43G)	3	F-HWMF	6.8	0	0	0	0	10
H-Area HWMF (904-44G, 904-45G, 904-46G, 904-56G)	3	H-HWMF	22.1	0	0	0	0	25
M-Area HWMF (904-51G and 904-112G)	3	M-HWMF	2.4	0	37,800	39,700	0	4.5
Metallurgical Laboratory HWMF (904-110G)	3	Met Lab HWMF	0.2	0	0	0	0	3.5
Mixed Waste Management Facility (943-28E)	3	MWMF	58	0	0	0	0	85
P-Area Burning/Rubble Pit (131-P)	5	PBRP	0.6	0	0	0	0	0.89
Compacted Clay w/Waste Solidification (hydraulic conductivity 1E-05 cm/sec)								
C-Area Reactor Seepage Basins (904-66G, 904-67G, and 904-68G)	4	CRSB	3.1	0	2,667	0	0	3.1
F-Area Retention Basin (281-3F)	4	FRB	0.59	0	1,150	42	0	1.07
Old F-Area Seepage Basin (904-49G)	4	OFASB	1.8	0	10,154	0	0	1.8
L-Area Reactor Seepage Basin (904-64G)	4	LRSB	1.73	0	0	0	0	1.73
L-Area Oil and Chemical Basin (904-83G)	4	LAOCB	0.45	0	2,170	200	0	1.32
K-Area Reactor Seepage Basin (904-65G)	4	KRSB	0.2	0	583	0	0	0.74
Asphalt/Concrete								
R-Area Operable Unit	2	RAOU	1.55	0	123,091	0	13,404	450
R-Area Reactor Seepage Basin (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, and 904-104G) and 108-4R Overflow Basin	2	RRSB	18.1	0	0	370	0	37.8

Table A-2. Summary of Remedial Actions without Operating Equipment at SRS *(continued/end)*

Unit Name	FYR Phase	OU	Area Covered (acres)	Volume Covered (yd^3)	Volume Stabilized (yd^3)	Volume Consolidated (yd^3)	Volume Removed (yd^3)	LUC (acres)
Asphalt/Concrete (continued)								
Heavy Water Components Test Reactor	4	BAOU	1.55	0	123,091	0	0	0.15
P-Area Operable Unit	4	PAOU	0.86	0	117,981	0	10,905	85.32
F-Area Tank Farm	4	FTF	0.72	0	0	0	0	NA*
H-Area Tank Farm	4	HTF	0.23	0	0	0	0	NA*
Compacted Common Fill (no hydraulic conductivity requirement)								
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G)	2	CMP Pits	0.3	0	0	0	0	7.1
R-Area Ash Basin (188-R)	2	RAOU	15	0	0	0	0	15
Ford Building Seepage Basin (904-91G)	3	FBSB	0.22	0	0	0	0	0.28
K-Area Burning/Rubble Pit (131-K) and Rubble Pile (631-20G)	3	KBRP	0.8	0	0	10,000	0	1.15
SRL Seepage Basins (904-53G1, 904-53G2, 904-54G, and 904-55G)	3	SRL SB	2.1	0	0	0	6,200	2.56
P-007 Outfall	4	PAOU	4.5	0	0	0	8,000	4.5
P-Area Ash Basin (188-P)	4	PAOU	13.7	0	0	0	0	13.7
A-Area Miscellaneous Rubble Pile (731-6A)	5	AMRP	1.2	0	0	0	23.7	3.08
D-Area Operable Unit (Bubble Tower and Moderator Processing)	5	DAOU	0.7	0	0	16,500	116.7	165
C-Area Burning/Rubble Pit (131-C)	5	CBRP	0.6	0	0	0	0	141.2
D-Area Coal Pile Runoff Basin (489-D) (25% northern portion)	5	DAOU	4.8	0	0	5,720	0	4.96
New TNX Seepage Basin (904-102G)	5	NTSB	0.51	0	0	0	0	2.24

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

cm/sec = centimeter per second
FYR = Five-Year Remedy
yd3 = cubic yards

*NA = Not applicable. The Land Use Control Implementation Plan will be deferred until final closure of the entire OU. Therefore, the LUC area has not been established.

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

Unit Name	FYR Phase	OU	Start	Finish	ZOI Area (acres)	Volume Treated	Volume Removed (as of 2023)	COCs
Pump-and-Treat								
Water Treatment Units								
F-Area Groundwater OU	5	FAGW	1997	2003	250	345,718,674 gal	--	--
H-Area Groundwater OU	5	HAGW	1997	2003	250	347,165,473 gal	--	--
Air Stripper								
A-Area Groundwater OU	5	A/M GW	1992	2022	1,600	1,914,506,457 gal	17,341 lbs	PCE, TCE
M-Area Groundwater OU	5	A/M GW	1983	Ongoing	--	5,267,510,897 gal	578,102 lbs	PCE, TCE
TNX-Area Groundwater OU	5	TNX GW	1996	2007	80	275,070,482 gal	125	VOC, CCl_4
Airlift Recirculation Pumps								
A/M-Area Groundwater OU	5	A/M GW	1997	2020	0.08	1,900,000,000 gal	542	PCE, TCE
Miscellaneous Chemical Basin (731-4A)	5	A/M GW	2002	2011			46	VOC
Thermal Treatments								
Dynamic Underground Stripping								
A/M-Area Groundwater OU (321-M SSTA)	5	A/M GW	2000	2001	1.1	1,600,000 gal	70,000 lbs	VOC
A/M-Area Groundwater OU (Western Sector)	5	A/M GW	2005	2010	3+	12,000,000 gal	450,000 lbs	VOC
Electrical Resistance Heating with Soil Vapor Extraction								
C-Area Groundwater OU	5	CMP Pits	2006	2006	0.02	1,800 gal	730 lbs	TCE
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G)	2	CMP Pits	2008	2009	0.05	5,300 gal	2,300 lbs	VOC
Detritiation								
D-Area Operable Unit	5	DAOU	2009	2011	--	1,650 gal	472 Ci	Tritium
Soil Vapor Extraction								
Mechanical								
A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A), Metals Burning Pit (731-5A)	5	ABRP/RP MCB/MBP	2008	2017	0.34	55,000 yd^3	144 lbs	TCE
Miscellaneous Chemical Basin (731-4A)	5	A/M GW	2001	2002	--	582 yd^3	170 lbs	TCE
A-Area Miscellaneous Rubble Pile (731-6A)	5	AMRP	2004	2017	--	6,000 yd^3	146 lbs	VOC
A/M-Area Groundwater OU (WSTS)	5	A/M GW	2012	2019	--	--	2,582 lbs	VOC

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

Unit Name	FYR Phase	OU	Start	Finish	ZOI Area (acres)	Volume Treated	Volume Removed	COCs
Soil Vapor Extraction (continued)								
Mechanical (continued)								
A/M-Area Groundwater OU (A014 - 782-3M)	5	A/M GW	1995	Ongoing	--	--	9,514 lbs	VOC
A/M-Area Groundwater OU (A-014 - Mobile #3)	5	A/M GW	2008	Ongoing	--	--	11,443 lbs	VOCs
C-Area Burning/Rubble Pit (131-C)	5	CBRP	2000	2004	0.28	4,500 yd^3	2,100 lbs	VOCs
M-Area Settling Basin Inactive Process Sewer Lines (081-M)	5	MIPSL	2007	2021	0.05	1,200 yd^3	5,446 lbs	PCE, TCE
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) Field A	2	CMP Pits	2002	2005	0.56	9,000 yd^3	9,300 lbs	VOCs
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) Field B	2	CMP Pits	2001	2002	0.21	3,400 yd^3	230 lbs	VOCs
MicroBlowers™								
A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A)	5	ABRP/RP MCB/MBP	2003	Ongoing	0.07	1,200 yd^3	78 lbs	VOC
Miscellaneous Chemical Basin (731-4A), Metals Burning Pit (731-5A)	5	ABRP/RP MCB/MBP	2001	Ongoing	0.04	580 yd^3	18 lbs	VOC
A/M-Area Groundwater OU (DUS)	5	A/M GW	2006	Ongoing	--	--	4,401 lbs	VOC
A/M-Area Groundwater OU (WSTS)	5	A/M GW	2015	Ongoing	--	--	2,272 lbs	VOC
A/M-Area Groundwater OU (SRNL)	5	A/M GW	2015	Ongoing	--	--	159 lbs	VOC
A/M-Area Groundwater OU (MAPSL)	5	A/M GW	2016	Ongoing	--	--	1,066 lbs	VOC
A/M-Area Groundwater OU (MRS-34)	5	A/M GW	2016	Ongoing	--	--	83 lbs	VOC
C-Area Burning/Rubble Pit (131-C)	5	CBRP	2004	Ongoing	0.03	465	422 lbs	VOC
D-Area Operable Unit (Bubble Tower)	5	DAOU	2010	Ongoing	0.25	4,033 yd^3	42 lbs	VOC
M-Area Settling Basin Inactive Process Sewer Lines (081-M)	5	MIPSL	2008	2020	--	4,033 yd^3	236 lbs	VOC
A-Area Miscellaneous Rubble Pile (731-6A)	5	AMRP	2017	2020	--	--	20 lbs	VOC
P-Area Operable Unit PSAs 3A and 3B	4	PAOU	2010	2012	--	94,622 yd^3	45 lbs	VOC
TNX-Area Groundwater OU	5	TNX GW	2007	Ongoing	--	1,500 yd^3	12 lbs	VOC

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

Unit Name	FYR Phase	OU	Start	Finish	ZOI Area (acres)	Volume Treated	Volume Removed	COCs
Soil Vapor Extraction (continued)								
BaroBalls™								
A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A)	5	ABRP/RP MCB/MBP	2003	Ongoing	0.22	3,500 yd^3	34 lbs	--
Miscellaneous Chemical Basin (731-4A)	5	ABRP/RP MCB/MBP	2001	Ongoing	0.19	3,200 yd^3	30 lbs	--
A/M-Area Groundwater OU	5	A/M GW	1998	Ongoing	--	--	--	--
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) Field B	2	CMP Pits	2001	2010	0.21	3,374 yd^3	--	--
M-Area Operable Unit	5	MAOU	2010	Ongoing	0.59	4,350 yd^3	--	--
P-Area Burning/Rubble Pit (131-P)	5	PBRP	2004	Ongoing	0.03	1,400 yd^3	--	--
Metallurgical Laboratory (Met Lab)	3	Met Lab	1998	Ongoing	-	-	-	TCE, PCE
TNX	5	TNX	1996	2006	-	-	-	VOC
Injection								
Base Injection with Vertical Barrier Walls								
F-Area Groundwater OU	5	FAGW	2005	Ongoing	--	--	--	--
H-Area Groundwater OU	5	HAGW	2010	Ongoing	--	--	--	--
Edible Oil								
TNX-Area Groundwater OU	5	TNX GW	2008	2010	--	--	--	--

A/M GW = A/M-Area Groundwater
ABRP/RP = A-Area Burning/Rubble Pits and Rubble Pit
AMRP = A-Area Miscellaneous Rubble Pile
CBRP = C-Area Burning/Rubble Pit
CMP Pits = Chemical, Metals, and Pesticides Pits
COC = contaminant of concern
DAOU = D-Area Operable Unit
DUS = Dynamic Underground Stripping
FAGW = F-Area Groundwater
HAGW = H-Area Groundwater
MAOU = M=Area Operable Unit
MCB/MBP = Miscellaneous Chemical Basin / Metals Burning Pit
MIPSL = M-Area Settling Basin Inactive Process Sewer Lines
PAOU = P-Area Operable Unit
PBRP = P-Area Burning/Rubble Pit
PSA = Potential Source Area
TNX GW = TNX Groundwater
WSTS = Western Sector Treatment System
Ci = curies
FYR = Five-Year Remedy
gal = gallon
lbs = pounds
OU = operable unit
PCE = tetrachloroethylene
TCE = trichloroethylene
VOC = volatile organic compound
yd^3 = cubic yards
ZOI = zone of influence

-- No data

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Table A-4. Chronological Listing of SRS Issued Decision Documents

Document Title[a]	Document Number	Rev.	Issuance Date[b]
Consent Decree Signed			***May 26, 1988***
NPL Listing Effective Date			***December 21, 1989***
A/M Area Groundwater IROD (RCRA)	WSRC-RP-92-744	0	September 16, 1992
M-Area Hazardous Waste Management Facility (904-51G, 904-112G) IROD (RCRA)	WSRC-RP-92-743	0	September 16, 1992
Metallurgical Laboratory Hazardous Waste Management Facility (904-110G) IROD (RCRA)	WSRC-RP-92-745	0	September 16, 1992
Federal Facility Agreement Declared Effective			***August 16, 1993***
F-Area Hazardous Waste Management Facility (904-41G, 904-42G, 904-43G) ROD (RCRA)	WSRC-RP-93-1042	1	October 1, 1993
H-Area Hazardous Waste Management Facility (904-44G, 904-45G, 904-46G, 904-56G) ROD (RCRA)	WSRC-RP-93-1043	1	October 1, 1993
Mixed Waste Management Facility (643-28E) ROD (RCRA)[c]	WSRC-RP-93-1511	1	September 23, 1994
Tank 105-C Hazardous Waste Management Facility ROD (RCRA)[c]	WSRC-RP-94-106	1	September 23, 1994
TNX Groundwater Operable Unit IROD[c]	WSRC-TR-94-0375	1	November 16, 1994
PAR Pond (685-G) IROD[c]	WSRC-RP-93-1549	0	February 16, 1995
D-Area Oil Seepage Basin (631-G) IROD[c]	**WSRC-RP-93-1550**	**1**	**March 6, 1995**
F-Area Groundwater Operable Unit (904-41G, 904-42G, 904-43G) IROD (RCRA)[c]	WSRC-RP-94-1162	1	April 13, 1995
H-Area Groundwater Operable Unit (904-44G, 904-45G, 904-45G, 904-56G) IROD (RCRA)[c]	WSRC-RP-94-1163	1	April 13, 1995
M-Area West Unit (631-21G) ROD[c]	WSRC-RP-95-626	0	September 29, 1995
Old Radioactive Waste Burial Ground (643-E) IROD	WRSC-RP-96-102	0	July 25, 1996
Burma Road Rubble Pit (231-4F) ROD	WSRC-RP-96-101	1	July 25, 1996
D-Area Burning/Rubble Pits (431-D, 431-1D) ROD	WSRC-RP-96-867	1	July 3, 1997
F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) ROD	WSRC-RP-96-868	1	July 3, 1997
Grace Road Site (631-22G) ROD	WSRC-RP-96-160	1	July 3, 1997
Gunsite 113 Access Road Unit (631-24G) ROD	WSRC-RP-96-833	1	July 3, 1997
Gunsite 720 Rubble Pit Unit (631-16G) ROD	WSRC-RP-96-832	1	July 3, 1997
Silverton Road Waste Unit (713-3A) ROD	WSRC-RP-96-171	1	July 3, 1997
Central Shops Burning/Rubble Pit (631-6G) ROD	WSRC-RP-96-873	1	July 3, 1997

Table A-4. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
First Five-Year Remedy Review	***WSRC-RP-97-403***	***0***	***August 27, 1997***
Old F-Area Seepage Basin (904-49G) ROD	WRSC-RP-96-872	1.1	July 3, 1997
TNX Groundwater Operable Unit ESD	WSRC-RP-97-169	1	October 10, 1997
K-Area Bingham Pump Outage Pit (643-1G) ROD	WSRC-RP-97-178	1	June 11, 1998
C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, 189-P) RODc	WSRC-RP-97-850	1	November 10, 1998
L-Area Oil and Chemical Basin and L-Area Acid/Caustic Basin (904-83G, -79G) ROD	WSRC-RP-97-143	1	November 10, 1998
716-A Motor Shops Seepage Basin (904-101G) ROD	WSRC-RP-97-840	0	November 16, 1998
Fire Department Hose Training Facility (904-113G) ROD	WSRC-RP-97-171	1	November 16, 1998
Old F-Area Seepage Basin (904-49G) ESD	WSRC-RP-98-4123	1	December 16, 1998
D-Area Oil Seepage Basin (631-G) ROD	**WSRC-RP-97-402**	**1**	**May 7, 1999**
C-Area Burning/Rubble Pit (131-C) IROD	WSRC-RP-98-4039	0	May 7, 1999
F-Area Retention Basin (281-3F) ROD	WSRC-RP-97-145	1.1	May 19, 1999
Ford Building Waste Site (643-11G) ROD	WSRC-RP-98-4066	1	October 13, 1999
Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G) IROD	**WSRC-RP-98-4192**	**1.1**	**January 19, 2000**
SRL Seepage Basins (904-51G1, 904-52G2, 904-52G, 904-55G) ROD	WSRC-RP-97-848	1.1	April 26, 2000
C-Reactor Seepage Basins (904-66G, 904-67G, 904-68G) Plug-In ROD ESD	WSRC-RP-2000-4032	0	October 18, 2000
L & P Bingham Pump Outage Pits (643-2G, 643-3G, 643-4G) ROD	WSRC-RP-98-4015	1	October 18, 2000
Burma Road Rubble Pit, 231-4F ESD[c]	WSRC-RP-98-4170	1	February 6, 2001
A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) IROD	WSRC-RP-2000-4001	1	February 9, 2001
Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/5A) IROD	WSRC-RP-98-4031	1.1	February 9, 2001
West of SRL “Georgia Fields” Site (631-19G) ROD	WSRC-RP-99-4164	0	February 22, 2001
F-Area Retention Basin (281-3F) ESD[c]	WSRC-RP-2000-4079	1	June 7, 2001
K-Area Burning/Rubble Pit (131-K & 631-20G) ROD[c]	WSRC-RP-97-862	1	August 8, 2001
ORWBG Old Solvent Tanks (650-01E through 650-22E) IROD	WSRC-RP-2000-4193	1	September 27, 2001
Ford Building Seepage Basin ROD	WSRC-RP-2000-4156	1	April 5, 2002

Table A-4. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G) IROD Amendment	**WSRC-RP-2000-4158**	**1.2**	**April 8, 2002**
K-Area Reactor Seepage Basin ESD[c]	WSRC-RP-99-4200	1.1	September 16, 2002
General Separations Area Consolidation Unit ROD	WSRC-RP-2002-4002	0	October 25, 2002
Central Shops Sludge Lagoon (080-24G) ROD	WSRC-RP-2000-4189	1	November 15, 2002
C-Area & L-Area Reactor Seepage Basin ROD Amendment	WSRC-RP-2002-4063	1	December 5, 2002
R-Area Acid/Caustic Basin (904-77G) ROD	WSRC-RP-2002-4015	1	February 10, 2003
L-Area Burning/Rubble Pit (131-L) & Rubble Pile (131-3L) & Gas Cylinder Disposal Facility (131-2L) ROD	WSRC-RP-98-4195	1.1	February 17, 2003
A-Area Burning/Rubble Pits (731-A/731-1A) and Rubble Pit (731-2A) ESD	WSRC-RP-2001-4281	1	March 10, 2003
R-Area Bingham Pump Outage Pits (643-8G, 643-9G and 643-10G) and R-Area Unknown Pits #1, #2, and #3 ROD	WSRC-RP-2001-4129	1.1	April 28, 2003
TNX Area Groundwater Operable Unit ESD[c]	WSRC-RP-2001-00764	0	May 19, 2003
Central Shops Burning/Rubble Pits (631-1G and 631-3G) ROD	WSRC-RP-2001-4265	1.1	June 30, 2003
P-Area Burning/Rubble Pit (131-P) ROD	WSRC-RP-2000-4197	1	August 8, 2003
A-Area Miscellaneous Rubble Pile (731-6A) ROD	WSRC-RP-2001-4197	1.3	August 11, 2003
P-Area Reactor Seepage Basin (904-61G, 904-62G, 904-63G) Plug-In ROD ESD	WSRC-RP-2002-4105	1.1	October 2, 2003
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G) Second IROD Amendment	**WSRC-RP-2001-4232**	**1.1**	**October 21, 2003**
L-Area Hot Shop (717-G) ROD	WSRC-RP-2002-4025	1.1	November 3, 2003
Road A Chemical Basin (904-111G) ROD	WSRC-RP-2002-4153	0	November 3, 2003
Second Five-Year Remedy Review[c]	***WSRC-RP-2001-4163***	***1.1***	***February 12, 2004***
R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G and 108-4R Overflow Basin) ROD	**WSRC-RP-2003-4093**	**1**	**March 18, 2004**
TNX Burying Ground (643-G), New TNX Seepage Basin, Old TNX Seepage Basin and TNX Groundwater (082-G) ROD	WSRC-RP-2003-4017	1	April 7, 2004
SRL Oil Test Site (808-16G) ROD	WSRC-RP-2003-4164	1	September 20, 2004

Table A-4. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
R-Area Burning/Rubble Pits (131-R and 131-1R) and Rubble Pile (631-25G) ROD	WSRC-RP-2004-4004	1	September 28, 2004
C-Area Reactor Groundwater IROD	**WSRC-RP-2004-4022**	**1**	**October 15, 2004**
D-Area Expanded Operable Unit (Consisting of D-Area Ash Basin, 488-D and D-Area Rubble Pit, 431-2D) ROD	WSRC-RP-2004-4007	1	December 17, 2004
Old F-Area Seepage Basin (904-49G) ROD Amendment	WSRC-RP-2003-4136	1	December 17, 2004
Heavy Equipment Wash Basin and Central Shops Burning/Rubble Pit (631-5G) ROD	WSRC-RP-2003-4185	1.1	January 28, 2005
Chemical, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G) ROD	WSRC-RP-2004-4090	1	May 10, 2005
Silverton Road Waste Unit ESD	WSRC-RP-2004-4092	1.1	June 16, 2005
TNX Area OU ESD	WSRC-RP-2005-4030	1	November 7, 2005
Hydrofluoric Acid Spill (631-4G) ROD	WSRC-RP-2005-4000	0	December 28, 2005
T-Area OU ROD	WSRC-RP-2004-4070	1	January 4, 2006
K-Area Sludge Land Application Site (761-4G) and PAR Pond Sludge Land Application Site (761-5G) ROD	WSRC-RP-2005-4064	1	June 30, 2006
211-FB Pu-239 Release (081-F) ROD	WSRC-RP-2005-4090	1	September 18, 2006
M-Area Inactive Process Sewer Lines (081-M) ROD	WSRC-RP-2006-4001	1	April 26, 2007
L-Area Southern Groundwater ROD	**WSRC-RP-2006-4052**	**1.1**	**May 9, 2007**
A-Area Burning/Rubble Pits and Rubble Pit (731-A, 731-1A, 731-2A) and the Miscellaneous Chemical Basin/Metals Burning Pit (731-4A, 731-5A) ROD	WSRC-RP-2005-4095	1.1	August 2, 2007
C-Area Burning/Rubble Pit (131-C) and Old C-Area Burning/Rubble Pit (NBN) ROD	WSRC-RP-2007-4082	1	July 9, 2008
Third Five-Year Remedy Review	***WSRC-RP-2007-4063***	***1.1***	***January 28, 2009***
P-Area Operable Unit Early Action ROD	WSRC-RP-2008-4037	1.1	January 29, 2009
M-Area Operable Unit ROD	WSRC-RP-2008-4030	1	February 5, 2009
M-Area Operable Unit ESD	SRNS-RP-2009-00406	1	July 9, 2009
P-Area Operable Unit Early Action ROD ESD	SRNS-RP-2009-00704	1	October 27, 2009
C-, K-, L- and R-Reactor Complexes Early Action ROD	**SRNS-RP-2009-00707**	**1**	**December 8, 2009**
E-Area Low Level Waster Facility (Slit Trench Disposal Units 1 and 2) IROD	SRNS-RP-2009-00538	1	January 22, 2010

Table A-4. Chronological Listing of SRS Issued Decision Documents *(continued)*

Document Title[a]	Document Number	Rev.	Issuance Date[b]
Early Construction and Operational Disposal Site L-1, N-2, P-2, R-1A, R-1B, R-1C ROD	SRNS-RP-2009-00072	1	March 30, 2010
E-Area Low Level Waste Facility (Slit Trench Disposal Units 1 and 2) ESD	SRNS-RP-2009-01128	1	April 22, 2010
P-Area Operable Unit ROD	SRNS-RP-2009-01368	1	July 22, 2010
Gunsite 218 Rubble Pile ROD	SRNS-RP-2010-00051	1	October 22, 2010
R-Area Operable Unit ROD	**SRNS-RP-2010-01062**	**1**	**April 20, 2011**
L-Area Northern Groundwater ROD	SRNS-RP-2011-00134	1	June 20, 2011
Gunsite 012 (including ECODS G-3) ROD	SRNS-RP-2010-01232	1	June 27, 2011
D-Area Operable Unit Early Action ROD	SRNS-RP-2010-00162	1.2	September 26, 2011
PAR Pond Unit: Lower Three Runs IOU Tail Portion (Middle and Lower Subunits) ESD	SRNS-RP-2012-00121	1	September 13, 2012
B-Area Operable Unit ROD	SRNS-RP-2012-00354	1	April 16, 2013
F-Area Tank Farm, Waste Tanks 17 and 20 IROD	SRR-CWDA-2013-00111	1	April 30, 2013
TNX Area Operable Unit (Second ESD to the ROD)	SRNS-RP-2012-00205	1	June 12, 2013
F-Area Tank Farm (Tanks 18 and 19 ESD to the IROD)	SRR-CWDA-2013-00007	1.1	September 23, 2013
Fourth Five-Year Remedy Review	***SRNS-RP-2012-00011***	***1.1***	***February 4, 2014***
L-Area Southern Groundwater Operable Unit (ESD to the ROD)	**SRNS-RP-2012-00736**	**1**	**September 10, 2014**
F-Area Tank Farm (Tanks 5 and 6 ESD to the IROD)	SRR-CWDA-2014-00008	1	September 11, 2014
C-Area Operable Unit Early Action ROD	SRNS-RP-2014-00836	1	September 2, 2015
Fifth Five-Year Remedy Review for SRS OUs with Native Soil Covers and/or LUCs	***SRNS-RP-2014-00902***	***1***	***November 30, 2015***
H-Area Tank Farm (Waste Tank 16) IROD	SRR-CWDA-2015-00157	1	August 16, 2016
Fifth Five-Year Remedy Review for SRS OUs with Groundwater Remedies	***SRNS-RP-2015-00419***	***1***	***February 2, 2017***
H-Area Tank Farm (Waste Tank 12) ESD to the IROD	SRR-CWDA-2016-00107	0	April 20, 2017
Fifth Five-Year Remedy Review for SRS OUs with Engineered Covers	***SRNS-RP-2016-00609***	***1***	***February 21, 2018***
Fifth Five-Year Remedy Review for SRS OUs with Geosynthetic or S/S Cover Systems	***SRNS-RP-2016-00610***	***1***	***March 27, 2018***
Wetland Area at Dunbarton Bay in Support of Steel Creek Integrator Operable Unit ROD[d]	SRNS-RP-2013-00730	1	June 20, 2018
Fifth Five-Year Remedy Review Report for SRS OUs with Operating Equipment	***SRNS-RP-2017-00567***	***1***	***December 5, 2018***
G-Area Oil Seepage Basin (761-13G) Operable Unit ROD	***SRNS-RP-2018-01050***	***1***	***June 26, 2019***

Table A-4. Chronological Listing of SRS Issued Decision Documents *(continued/end)*

Document Title[a]	*Document Number*	*Rev.*	*Issuance Date*[b]
Sixth Five-Year Remedy Review Report for SRS OUs with Native Soil Covers and/or LUCs	***SRNS-RP-2018-00811***	***1***	***November 5, 2019***
Sixth Five-Year Remedy Review Report for SRS OUs with Groundwater Remedies	***SRNS-RP-2019-00511***	***1***	***December 9, 2020***
Stormwater Outfall A-013 (NBN) ROD	SRNS-RP-2020-00904	1	September 30, 2021
Sixth Five-Year Remedy Review Report for SRS OUs with Engineered Cover Systems	***SRNS-RP-2020-00420***	***1***	***December 21, 2021***
Lower Three Runs Integrator Operable Unit ROD	SRNS-RP-2020-00542	1	December 21, 2021
Sixth Five-Year Remedy Review Report for SRS OUs with Geosynthetic or Solidification/Stabilization Cover Systems	***SRNS-RP-2021-04229***	***1***	***December 28, 2022***
Wetland Area at Dunbarton Bay in Support of Steel Creek IOU ESD to the ROD	SRNS-RP-2022-00982	1	August 10, 2023
Early Construction and Operational Disposal Site N-1 (South of N Area) (NBN), Central Shops Scrap Lumber Pile (631-2G), and Building 690-N, Process Heat Exchanger Repair Facility (AKA Ford Building) Operable Unit ROD[d]	SRNS-RP-2022-01284	1	October 12, 2023
F-Area Tank Farm (F-Area Diversion Boxes 5 and 6) ESD to the IROD	SRMC-CWDA-2023-00006	1	October 12, 2023
Sixth Five-Year Remedy Review Report for SRS OUs with Operating Equipment	***SRNS-RP-2022-00468***	***1***	***December 22, 2023***
Seventh Five-Year Remedy Review Report for SRS OUs with Native Soil Covers and/or LUCs	***SRNS-RP-2023-00715***	***1***	***TBD***

a Shaded text identifies the SRS OUs evaluated in this report for the second phase of the seventh five-year remedy review (i.e., groundwater remedies).

b Unless otherwise noted, the Issuance Date represents the date that the public was notified that the Three-Party signed document was available.

c This is the last signature date instead of the Issuance Date.

d Early Construction and Operational Disposal Site N-1 (NBN) (ECODS N-1), Central Shops Scrap Lumber Pile (631-2G) (CSSLP), and Building 690-N, Process Heat Exchanger Repair Facility (also known as Ford Building) Operable Unit is included in the native soil covers and/or LUCs phase. However, since the seventh five-year remedy review document development will occur before completion of the remedy implementation, ECODS N-1, CSSLP, and Ford Building OU will not be discussed in this review cycle.

Table A-5. Summary of No Remedial Actions at SRS OUs

Operable Unit	Remedial Action
No Action/No Further Action	
211-FB Pu-239 Release (081-F)	No Action
716-A Motor Shops Seepage Basin (904-101G)	No Action
Burma Road Rubble Pit (231-4F)	No Action
Central Shops Burning/Rubble Pit (631-6G)	No Action
Central Shops Sludge Lagoon (080-24G)	No Action
C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, 189-P)	No Further Action
Fire Department Hose Training Facility (904-113G)	No Action
Ford Building Waste Site (643-11G)	No Further Action (Removal)
G-Area Oil Seepage Basin (761-13G)	No Action
Gas Cylinder Disposal Facility (131-2L)	No Action
Grace Road Site (631-22G)	No Action
Gunsite 113 Access Road Unit (631-24G)	No Action
Gunsite 218 Rubble Pile (621-23G)	No Action
Gunsite 720 Rubble Pit Unit (631-16G)	No Action
Hydrofluoric Acid Spill (631-4G)	No Action
K-Area and PAR Pond Sludge Land Application Site (761-4G and 761-5G)	No Action
L-Area Burning/Rubble Pit (131-L)	No Action
L-Area Hot Shop (717-G)	No Further Action
L-Area Northern Groundwater (NBN)	No Action
L-Area Rubble Pile (131-3L)	No Action
M-Area West Unit (631-21G)	No Action
R-Area Acid/Caustic Basin (904-77G)	No Action
Road A Chemical Basin (904-111G)	No Action
SRL Oil Test Site (080-16G)	No Action
Stormwater Outfall A-013 (NBN)	No Action
West of SRL “Georgia Fields” Site (631-19G)	No Action
No Action/No Further Action OUs Associated with OUs Requiring Remedial Action	
108-4R Overflow Basin (108-4R)[1]	No Further Action
489-D Coal Pile Runoff Basin – Southern 75% Subunit[2]	No Further Action
A-Area Burning/Rubble Pit (731-1A)[3]	No Action
A-Area Burning/Rubble Pit (731-A)[3]	No Action
Central Shops Burning/Rubble Pit (631-5G)[4]	No Action
ECODS B-3 and B-5 (NBN)[5]	No Further Action
ECODS G-3 (Adjacent to Gunsite 012) (NBN)[6]	No Action
L-Area Acid/Caustic Basin (904-79G)[7]	No Action
Metals Burning Pit (731-5A)[3]	No Action
Rubble Pile Across from Gunsite 012 (NBN)[4]	No Action
R-Area Rubble Pile (631-25G)[8]	No Action

Table A-5. Summary of No Remedial Actions at SRS OUs (*continued/end)*

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

1 – Included with R-Reactor Seepage Basins (904-103G, 904-104G, 904-57G, 904-58G, 904-59G, and 904-60G)
2 – Included with D-Area Operable Unit
3 – Included with A-Area Burning/Rubble Pits (731-A and731-1A) and Rubble Pit (731-2A), Miscellaneous Chemical Basin (731-4A) and Metals Burning Pit (731-5A)
4 – Included with Heavy Equipment Wash Basin (NBN)
5 – Included with B-Area Operable Unit
6 – Included with Gunsite 012
7 – Included with L-Area Oil and Chemical Basin (904-83G)
8 – Included with R-Area Burning/Rubble Pits (131-R and 131-1R)

Table A-6. List of OU Subunits with Remedial Actions

#	OU Subunits[a,b]	SEMS #
1	A-Area Burning/Rubble Pit, 731-1A	28
	A-Area Burning/Rubble Pit, 731-A	
	A-Area Rubble Pit, 731-2A	
	Miscellaneous Chemical Basin, 731-4A	
	Metals Burning Pit, 731-5A	
2	A-Area Miscellaneous Rubble Pile, 731-6A	30
3	A/M Area Groundwater	36
4	B-Area Operable Unit	48
5	C-Area Burning/Rubble Pit, 131-C	31
	Old C-Area Burning/Rubble Pit, NBN	
6	C-Area Groundwater	82
7	C-Area Process Sewer Line as Abandoned, NBN	79
	C-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN	
	C-Reactor Discharge Canal, NBN	
	ECODS C-1 (Near C-Area Reactor Discharge Canal), NBN	
	Potential Release from C-Area Disassembly Basin, NBN	
	Potential Release from C-Area Reactor Cooling Water System, 186/190-C	
8	C-Area Reactor Seepage Basin, 904-66G	60
	C-Area Reactor Seepage Basin, 904-67G	
	C-Area Reactor Seepage Basin, 904-68G	
9	Central Shops Burning/Rubble Pit, 631-1G	50
	Central Shops Burning/Rubble Pit, 631-3G	
10	CMP Pit, 080-170G	24
	CMP Pit, 080-171G	
	CMP Pit, 080-180G	
	CMP Pit, 080-181G	
	CMP Pit, 080-182G	
	CMP Pit, 080-183G	
	CMP Pit, 080-190G	
11	C-, K-, L-Reactor Complexes	79, 90, 91
12	D-Area Burning/Rubble Pit, 431-D	15
	D-Area Burning/Rubble Pit, 431-1D	
13	D-Area Ash Basin, 488-D	67
	D-Area Rubble Pit, 431-2D	
14	D-Area Oil Seepage Basin, 631-G	27
15	D-Area Coal Pile Runoff Basin, 489-D	63
	D-Area Waste Oil Facility, 484-10D	
	D-Area Asbestos Pit, 080-20G	
	Combined Spills from 483-D and Associated Areas, NBN	
	D-Area Process Sewer Lines as Abandoned, NBN	
16	E-Area Low Level Waste Facility, 643-26E	86
17	ECODS L-1, NBN	22
	ECODS P-2, NBN	
	ECODS R-1A, R-1B, R-1C, NBN	
	ECODS N-2, NBN	

Table A-6. List of OU Subunits with Remedial Actions *(continued)*

#	OU Subunits[a,b]	SEMS #
18	ECODS N-1 (South of N Area), NBN[c]	93
	Central Shops Scrap Lumber Pile, 631-2G[c]	
	Building 690-N, Process Heat Exchanger Repair Facility (Ford Building)[c]	
19	F-Area Burning/Rubble Pit, 231-1F	14
	F-Area Burning/Rubble Pit, 231-2F	
	F-Area Burning/Rubble Pit, 231-F	
20	F-Area Groundwater Operable Unit (904-41G, 904-42G, 904-43G)	8
21	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-41G)	6
	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-42G)	
	F-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-43G)	
22	F-Area Retention Basin, 281-3F	23
23	F-Area Tank Farm, Waste Tanks 17 and 20	23
	F-Area Tank Farm, Waste Tanks 18 and 19	
	F-Area Tank Farm, Waste Tanks 5 and 6	
24	Ford Building Seepage Basin, 904-91G	58
25	General Separations Area Consolidation Unit including Old Radioactive Waste Burial Ground(643-E) and Old Solvent Tanks (650-01E through 650-22E)	32
	Warner's Pond, 685-23G and Spill of 3/08/1978 of Unknown Seepage Basin Pipe Leak in H-Area Seepage Basin and Spill on 02/08/1978 of Unknown H-Area Process Sewer Line Cave-In, NBN	
	H-Area Retention Basin, 281-3H and Spill of 5/01/1956 of Unknown Retention Basin Pipe Leak, NBN	
	HP-52 Ponds, NBN	
26	Gunsite 012 Rubble Pile, NBN	78
27	H-Area Groundwater OU	9
28	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-44G)	7
	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-46G)	
	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-45G)	
	H-Area Hazardous Waste Management Facility (F-Area Seepage Basin, 904-56G)	
29	H-Area Tank Farm, Waste Tank 12	89
	H-Area Tank Farm, Waste Tank 16	
30	Heavy Equipment Wash Basin, NBN	53
31	K-Area Bingham Pump Outage Pit, 643-1G	20
32	K-Area Burning/Rubble Pit, 131-K	40
	K-Area Rubble Pile, 631-20G	
33	K-Area Reactor Seepage Basin, 904-65G	55
34	L-Area Bingham Pump Outage Pit, 643-2G	26
	L-Area Bingham Pump Outage Pit, 643-3G	
	P-Area Bingham Pump Outage Pit, 643-4G	39
35	L-Area Oil Chemical Basin, 904-83G	17
36	L-Area Reactor Seepage Basin, 904-64G	65
37	L-Area Southern Groundwater, NBN	77
38	Lower Three Runs IOU, NBN	35
	PAR Pond (including the Pre-Cooler Ponds and Canals), 685-G	
	Old R-Area Discharge Canal, NBN	

Table A-6. List of OU Subunits with Remedial Actions *(continued)*

#	OU Subunits[a,b]	SEMS #
39	M-Area Hazardous Waste Management Facility: Lost Lake, 904-112G	1
	M-Area Hazardous Waste Management Facility: M-Area Settling Basin, 904-51G	
40	M-Area Settling Basin Inactive Process Sewers to Manhole 1, 081-M	19
41	Inactive Clay Process Sewer Lines (Including Potential Release of TCT, TET, TCE, HNO_3, U, Heavy Metals from 321-M Abandoned Sewer Line), NBN	92
	Salvage Yard, 741-A	
	M-Area Underground Sump 321-M #001	
	M-Area Underground Sump 321-M #002	
	M-Area Test Pile Facility, 305-A	
42	Metallurgical Laboratory Hazardous Waste Management Facility, 904-110G	2
43	Mixed Waste Management Facility, 643-28E	33
44	Old F-Area Seepage Basin, 904-49G	16
45	P-Area Burning/Rubble Pit, 131-P	59
46	P-Area Ash Basin (including Outfall P-007), 188-P	94
	Potential Release from P-Area Disassembly Basin, NBN	
	Potential Release from P-Area Reactor Cooling Water System, 186/190-P	
	P-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN	
	P-Area Process Sewer Lines as Abandoned, NBN and Spill on 3/15/79 of 5500 Gallons of Contaminated Water, NBN	
47	P-Area Reactor Seepage Basin, 904-61G	66
	P-Area Reactor Seepage Basin, 904-62G	
	P-Area Reactor Seepage Basin, 904-63G	
48	R-Area Bingham Pump Outage Pit, 643-10G	38
	R-Area Bingham Pump Outage Pit, 643-8G	
	R-Area Bingham Pump Outage Pit, 643-9G	
	R-Area Unknown Pit #1 (Runk-1), NBN	
	R-Area Unknown Pit #2 (Runk-2), NBN	
	R-Area Unknown Pit #3 (Runk-3), NBN	
49	R-Area Burning/Rubble Pit, 131-1R	43
	R-Area Burning/Rubble Pit, 131-R	
	R-Area Rubble Pit, 631-25G	
50	Area on the North Side of Building 105-R	95
	Laydown Area North of 105-R	
	R-Area Cooling Water Effluent Sump, 107-R	
	Potential Release of $NaOH/H_2SO_4$ from 183-2R, NBN	
	R-Area Ash Basin, 188-R	
	Potential Release from R-Area Disassembly Basin, NBN	
	R-Area Reactor Area Cask Car Railroad Tracks as Abandoned, NBN	
	Release from the Decontamination of R-Reactor Disassembly Basin, NBN	
	Combined Spills North of Building 105-R, NBN	
	R-Area Process Sewer Lines as Abandoned, NBN	
	R-Area Reactor Building, 105-R	
	R-Area Groundwater Operable Unit, NBN	

Table A-6. List of OU Subunits with Remedial Actions *(continued/end)*

#	OU Subunits[a,b]	SEMS #
51	R-Area Reactor Seepage Basin, 904-103G	25
	R-Area Reactor Seepage Basin, 904-104G	
	R-Area Reactor Seepage Basin, 904-57G	
	R-Area Reactor Seepage Basin, 904-58G	
	R-Area Reactor Seepage Basin, 904-59G	
	R-Area Reactor Seepage Basin, 904-60G	
52	Silverton Road Waste Unit, 731-3A	13
53	SRL Seepage Basin, 904-53G1	47
	SRL Seepage Basin, 904-53G2	
	SRL Seepage Basin, 904-54G	
	SRL Seepage Basin, 904-55G	
54	Neutralization Sump, 678-T	96
	X-001 Outfall Drainage Ditch, NBN	
	TNX Outfall Delta, Lower Discharge Gully and Swamp, NBN	
	TNX-Area Process Sewer Lines and Tile Fields as Abandoned, NBN	
55	TNX Groundwater, 082G	21
	New TNX Seepage Basin, 901-102G	29
	Old TNX Seepage Basin, 904-76G	
	TNX Burying Ground, 643-5G (Including Spill on 1/12/53 of ½ Ton of Uranyl Nitrate, NBN)	
56	Wetland Area at Dunbarton Bay	71

a OU subunits include RCRA/CERCLA units and RCRA regulated units. Deactivation & Decommissioning facilities are not represented.
b Shaded text identifies the SRS OUs evaluated in this report for the second phase of the sixth five-year remedy review (i.e., groundwater remedies).
c ECODS N-1, CSSLP, and Ford Building OU is included in the native soil covers and/or LUCs phase. However, since the seventh five-year remedy review document development will occur before the remedy implantation, this OU will not be included in this review cycle.

APPENDIX B. EVALUATION OF CHANGES IN STANDARDS AND TOXICITY

This appendix provides an evaluation of changes in standards and toxicity for chemical and radiological constituents since the last five-year remedy review was initiated in 2019 for the Savannah River Site (SRS) operable units (OUs) evaluated in this report. The purpose of the evaluation is to determine if there are any changes in standards or toxicity values that would call into question the protectiveness of the remedy. No protectiveness issues with respect to changes in standards and toxicity were identified in the previous five-year remedy review report (SRNS 2020).

An evaluation was performed for analytes that were identified as constituents of concern (COCs) for the SRS OUs discussed in Appendix C through Appendix H. As discussed in Appendix A, the OUs evaluated in this report were grouped in the Groundwater Remedies category because they have monitoring activities associated with Monitored Natural Attenuation or a Mixing Zone permit. However, these OUs may also have subunits with COCs in soil or building material (concrete and metal) media in addition to groundwater as documented in the respective remedy selection documents. For this reason, an evaluation of changes in standards and toxicity values for chemical and radiological COCs identified in soil, concrete, and groundwater media is shown in Tables B-1 through B-6.

The United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for Nonradiological Constituents (May 2024), USEPA Preliminary Remediation Goals (PRGs) for Radionuclides (February 2024), USEPA Surface Preliminary Remediation Goals (SPRGs) for Radionuclides (March 2020), and USEPA Maximum Contaminant Levels (MCLs) for radiological and chemical constituents were evaluated in this review. These values were compared to the values available in 2019 when the last five-year remedy review for SRS OUs in the Groundwater Remedies category was initiated (SRNS 2020). Standards and toxicity values for both the industrial worker and hypothetical residential receptor are provided for comparative purposes for most media.

The comparison tables do not make any distinction between COCs that were the primary drivers for the selected remedial action and other analytes that were simply addressed

through the same remedy. Most importantly, the values presented in Tables B-1 through B-6 are not cleanup levels and should not be considered remedial goals unless otherwise noted in the OU-specific remedy reviews. For these reasons, the information in Appendix B is not stand-alone, but must be considered in context with the information and selected remedy presented in the OU-specific reviews located in Appendix C through Appendix H.

Change to a standard or toxicity factor is unique to each analyte and is often related to revisions in exposure assumptions, reference doses, cancer potency factors, and exposure pathways used to calculate the screening value. For the reasons explained in the previous paragraph, the impact that more stringent RSLs or PRGs have on protectiveness must be considered with respect to the OU-specific remedy. In most cases, a change in a standard or toxicity value is irrelevant because the analyte(s) may no longer be present or significantly reduced if the selected remedy also included excavation and offsite disposal. In addition, exposure to contaminants may be controlled by a cover system.

In November 2016, a major revision to the approach for calculating PRGs for radiological constituents was announced by USEPA. The primary change was that the plus daughters (+D) isotopes designation was removed and the secular equilibrium (SE) PRG calculation was identified as the preferred (i.e., default) value. The PRGs for each daughter are combined with the parent on a fractional basis to produce a single PRG for the parent, and the resulting PRG is based on secular equilibrium of the full chain regardless of half-life. Decay is not included in this PRG option, as the assumption of SE is that the parent is continually being renewed. This was the default PRG calculation option used in the previous five-year remedy review prior to release of the Peak PRG option described in the following paragraph.

In October 2020, a new PRG option, called the Peak PRG, was added to the USEPA website; it calculates the activity of the parent radionuclide to be protective of the peak excess lifetime cancer risk for the entire decay chain over time. The underlying assumption of the Peak PRG option is that the pure isotope was released, and progeny begin ingrowth and decay. The Peak PRG is calculated for the time period when the parent and progeny

activities present the most risk. The Peak PRG is now the preferred default PRG option for use at Superfund sites.

SE only occurs when the half-life of the progeny is much shorter than the half-life of the parent. When the progeny has a longer half-life that the parent, equilibrium does not exist. The assumption of SE in these cases significantly overestimates the activity of the progeny, resulting in a much lower PRG. The SE PRG also assumes that the parent is continually being renewed, which is not valid for inactive waste units. Therefore, the Peak PRGs in most cases are less conservative (i.e., higher) than the SE PRGs. For comparison, the SE PRGs used in the previous five-year remedy review are shown with the now preferred Peak PRGs in Tables B-2, B-3, and B-6.

The evaluation for each remedy to determine if exposure assumptions, toxicity data, cleanup levels, and remedial action objectives are still valid is discussed in each OU-specific review located in Appendix C through Appendix H. The evaluations shown in Tables B-1 through B-6 confirm that there have been no significant changes in standards or toxicity factors that would affect the protectiveness of the remedies evaluated in this report.

Documents Reviewed

SRNS, 2020. *Sixth Five-Year Remedy Review Report for the Savannah River Site Operable Units with Groundwater Remedies (U)* Aiken, South Carolina, SRNS-RP-2019-00511, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

Analyte[a]	2019 RSLs[b]		2024 RSLs[c]		SEMS Number(s)[d]
	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	Residential Soil (mg/kg)	Industrial Worker Soil (mg/kg)	
Arsenic	6.8E-01	3.0E+00	6.8E-01	3.0E+00	95
p,p'-dichorodiphenyl dichloroethane (DDD)	1.9E+00	9.6E+00	2.3E+00	9.6E+00	24
p,p'-dichlorodiphenyl dichloroethylene (DDE)	2.0E+00	9.3E+00	2.0E+00	9.3E+00	24
p,p'-dichlorodiphenyl trichloroethylene (DDT)	1.9E+00	8.5E+00	1.9E+00	8.5E+00	24
Dieldrin	3.4E-02	1.4E-01	3.4E-02	1.4E-01	24
Endrin	1.9E+01	2.5E+02	1.9E+01	2.5E+02	24
Heptachlor epoxide	7.0E-02	3.3E-01	7.0E-02	3.3E-01	24
PCBs (Aroclor 1254)	2.4E-01	9.7-01	2.4E-01	9.7E-01	24

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix H.
b USEPA Nonradiological RSLs for soil, May 2019.
c USEPA Nonradiological RSLs for soil, May 2024.
d OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-6.

mg/kg = milligrams per kilogram
PCBs = polychlorinated biphenyls
SEMS = Superfund Enterprise Management System

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

Analyte[a]	2019 PRGs[b]		2024 PRGs[c]		SEMS Number(s)[d]
	Residential Soil (ρCi/g)	Industrial Worker Soil (ρCi/g)	Residential Soil (ρCi/g)	Industrial Worker Soil (ρCi/g)	
Americium-241	5.2E-02	8.4E-02	4.8E-01	4.67E+00	25
Cesium-137(+D)	4.6E-02	6.9E-02	4.01E-02	9.07E-02	25, 95
Cobalt-60	9.4E-03	1.4E-02	2.85E-02	4.83E-02	25, 95
Europium-154	2.0E-02	3.0E-02	4.67E-02	6.97E-02	95
Plutonium-238	1.3E-02	2.0E-02	5.50E-01	1.41E+01	25
Plutonium-239	4.5E-02	7.3E-02	4.45E-01	1.22E+01	25
Plutonium-240	9.8E-03	1.5E-02	4.45E-01	1.23E+01	25
Potassium-40	1.4E-01	2.2E-01	5.81E-03	2.19E-01	95
Radium-226(+D)	1.3E-02	2.0E-02	1.92E-03	2.08E-02	95
Strontium-90(+D)	3.1E+00	6.8E+00	4.77E-03	9.00E+00	25, 95
Tritium	1.3E-01	1.6E-01	1.16E-01	2.99E-01	95
Uranium-235(+D)	4.6E-02	7.3E-02	6.13E-03	7.31E-02	95
Uranium-238(+D)	1.2E-02	2.0E-02	1.75E-03	2.0E-02	95

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix H.
b USEPA Radiological PRGs for soil (January 2019). Default SE PRG that includes daughter products from the entire decay chain.
c USEPA Radiological PRGs for soil (February 2024). Default Peak PRG that includes daughter products from the entire decay chain, as appropriate.
d OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-6.

mg/kg = milligrams per kilogram
ρCi/g = picoCuries per gram
SEMS = Superfund Enterprise Management System

Table B-3. Comparison of Radiological Standards in Concrete Media

Analyte[a]	2019 SPRGs[b] Industrial Worker Concrete (ρCi/g)	2024 SPRGs[c] Industrial Worker Concrete (ρCi/g)	SEMS Number(s)[d]
Americium-241(+D)	8.7E-02	8.07E-02	95
Americium-243(+D)	5.8E-02	5.25E-02	95
Barium-133	1.2E-01	1.17E-01	95
Cesium-137(+D)	6.9E-02	7.24E-02	95
Cobalt-60	1.4E-02	1.62E-02	95
Europium-152	3.2E-02	3.56E-02	95
Nickel-63	--[e]	--[e]	95
Silver-108m	2.5E-02	2.52E-02	95
Strontium-90(+D)	9.0E+00	7.50E+00	95

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix H.
b USEPA Radiological SPRGs for concrete, May 2019. Default SE PRG that includes daughter products from the entire decay chain.
c USEPA Radiological SPRGs for concrete (March 2020), calculated August 2024 for the outdoor worker for 3-D direct external exposure. Default SE PRG that includes daughter products from the entire decay chain.
d OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-6.
e PRG for nickel-63 was not published in the May 2019 or March 2020 update.

ρCi/g = picoCuries per gram
SEMS = Superfund Enterprise Management System

Table B-4. Comparison of Nonradiological Standards in Groundwater Media (RSLs)

Analyte[a]	2019 RSL[b] (µg/L)	2024 RSL[c] (µg/L)	SEMS Number(s)[d]
alpha-Benzene hexachloride (α-BHC)	7.2E-03	7.2E-03	24
beta-Benzene hexachloride (β-BHC)	2.5E-02	2.5E-02	24
delta-Benzene hexachloride (δ-BHC)	2.5E-02	2.5E-02	24
Dieldrin	1.8E-03	1.8E-03	24

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix H.
b USEPA Nonradiological RSLs for tap water, May 2019.
c USEPA Nonradiological RSLs for tap water, May 2024.
d OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-6.

µg/L = micrograms per liter
SEMS = Superfund Enterprise Management System

Table B-5. Nonradiological Standards in Groundwater Media (MCLs)

Analyte[a]	MCL (µg/L)[b]	SEMS Number(s)[c]
PCBs (Aroclor-1254)	5.0E-01[c]	95
Benzene	5.0E+00	27
Bis(2-ethylhexl) phthalate (BEHP)	6.0E+00	24
Carbon tetrachloride	5.0E+00	24, 95
1,1-Dichloroethene (1,1-DCE)	7.0E+00	27
Chloroform	8.0E+01	95
cis-1,2-Dichloroethene (cis-1,2-DCE)	7.0E+01	27, 95
Dichloromethane (Methylene chloride)	5.0E+00	24, 27
Lead	1.5E+01[d]	95
Lindane	2.0E-01	24
Tetrachloroethylene (PCE)	5.0E+00	24, 27, 77
Trichloroethylene (TCE)	5.0E+00	24, 27, 77, 82, 95
Trihalomethanes (Total)	8.0E+01	24
Vinyl chloride (VC)	2.0E+00	27, 95

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix H.
b Current MCL table is provided for reference only. Comparative analysis is not shown because MCLs have not changed since the previous five-year remedy review.
c OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-6.
d MCL used for contaminant migration analysis. Constituent is not a groundwater COC.

µg/L = micrograms per liter
PCBs = polychlorinated biphenyls
SEMS = Superfund Enterprise Management System

Table B-6. Radiological Standards in Groundwater Media (PRGs/MCLs)

Analyte[a]	2019 PRG (ρCi/L)[b]	2024 PRG (ρCi/L)[c]	MCL (ρCi/L)[d]	SEMS Number(s)[e]
Americium-241	--	--	1.5E+01[f]	25
Carbon-14	--	--	2.0E+03[g,h]	25, 95
Chlorine-36	--	--	7.0E+02[g,h]	95
Iodine-129	--	--	1.0E00[g,h]	95
Molybdenum-93	1.4E+01[g]	1.4E+01[g]	--	95
Nickel-59	--	--	3.0E+02[g,h]	95
Niobium-94	6.7E+00[g]	6.7E+00[g]	--	95
Plutonium-239/240	--	--	1.5E+01[f,g]	25
Potassum-40	2.1E+00[g]	2.1E+00[g]	--	95
Silver-108m	6.5E+00[g]	6.5E+00[g]	--	95
Strontium-90	--	--	8.0E00[h]	25
Tritium	--	--	2.0E+04[h]	77, 95

a Analytes listed were identified as COCs for the OUs discussed in Appendix C through Appendix H.
b USEPA Radiological PRGs for tap water, January 2019. Value is the default SE PRG that includes daughter products from the entire decay chain.
c USEPA Radiological PRGs for residential tap water, February 2024. Default Peak PRG that includes daughter products from the decay chain as appropriate.
d USEPA Radioactivity in Drinking Water, Appendix III (January 1981). Comparative analysis is not shown for MCLs because standards have not changed since the previous five-year remedy review.
e OUs and corresponding SEMS number(s) are identified in Appendix A, Table A-6.
f Gross alpha particle activity = 15 ρCi/L
g PRG/MCL used for contaminant migration analysis. Constituent is not a groundwater COC.
h Man-made beta/gamma emitters = 4 mrem/year dose

mrem = millirem
ρCi/L = picoCuries per liter
SEMS = Superfund Enterprise Management System

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APPENDIX C. C-AREA GROUNDWATER OPERABLE UNIT

I. INTRODUCTION

This is the fifth five-year remedy review for the C-Area Groundwater (CAGW) Operable Unit (OU). The review was conducted from June 2024 through December 2024. Contaminants have been left in place at the CAGW OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the interim action remedy in place at the CAGW OU is protective of human health and the environment. This report documents the results of the review.

II. OU CHRONOLOGY

Table C-1 lists the chronology of site events for the CAGW OU.

III. BACKGROUND

The CAGW OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media associated with the CAGW OU are the vadose zone soil (source area), surface water, and groundwater.

Physical Characteristics

CAGW OU is located in the west-central portion of the SRS, entirely within the Fourmile Branch watershed (Figure C-1). CAGW OU encompasses groundwater below C Area, north to unnamed tributaries of Fourmile Branch, west to Fourmile Branch, and south to Castor Creek (Figure C-2), which comprises approximately 3.29 km^2 (1.27 mi^2).

The hydrogeologic conceptual site model for the interim action for the CAGW OU depicts contamination from volatile organic compounds (VOCs), primarily trichloroethylene (TCE), and tritium above their respective maximum contaminant levels (MCLs). The contamination originated in C Area from reactor operations and migrated through the vadose zone (the unsaturated zone above the water table) to the Transmissive Zone (TZ)

of the Upper Three Runs Aquifer (UTRA). Contaminants in the TZ are readily transported west toward Fourmile Branch and to the south towards Castor Creek. Below the TZ is the Tan Clay Confining Zone (TCCZ), which is composed of the Upper Tan Clay Layer, the Middle Aquifer Zone (MAZ), and a Lower Tan Clay Layer. The TCCZ inhibits downward migration of contaminants into the Lower Aquifer Zone (LAZ) of the UTRA. However, the Upper Tan Clay Layer is discontinuous in places and downward contaminant migration does occur, primarily contaminating the MAZ and to a lesser extent the LAZ. The contaminated groundwater in the MAZ and LAZ discharges into Fourmile Branch or Castor Creek (SRNS 2014).

CAGW OU is currently monitored by the following:

- Fifty-nine groundwater monitoring wells;
- Eight seepline monitoring stations; and
- Sixteen surface water sampling stations.

Periodic groundwater monitoring in CAGW OU began in 1983 and continues to the present. The VOC contamination in C-Area groundwater that originated from the C-Area Burning/Rubble Pit (131-C) (CBRP) OU, mainly TCE and tetrachloroethylene (PCE), is being addressed by the CBRP OU.

Land and Resource Use

The CAGW OU sources are located within an industrial use area, but the distal portion of the groundwater plume extends beyond the industrial use boundary. However, shallow groundwater and surface water at SRS are not used for drinking water, hygiene, recreation, or process water. According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for the CAGW OU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

In 1955, C-Reactor began operations with a mission of producing nuclear materials for the defense program. C-Reactor was placed in cold standby in 1987, followed by shutdown due to reduced requirements for the defense-related products. Known sources associated with reactor operations resulted in tritium and VOC contamination in groundwater.

During reactor operations, TCE was released to the soil at a manhole along a storm sewer line south of the C-Reactor Building (105-C). A TCE groundwater plume extending from the C-Reactor Building (105-C) to Castor Creek, where the TCE plume discharges south of C Area. Figure C-3 shows the location of the TCE vadose zone source relative to the reactor building, the location of soil borings, and monitoring well data in 2002. An Interim Record of Decision (IROD) for the TCE vadose zone source area was issued on October 15, 2004 (WSRC 2004a). The interim remedial action selected in the IROD was Electrical Resistance Heating (ERH) with Soil Vapor Extraction (SVE). The purpose of the interim remedial action was to reduce vadose zone TCE concentrations to levels that would not exceed the MCL (5 μg/L), if the contaminant leached into the groundwater. Groundwater monitoring conducted from fiscal year (FY) 2012 through FY2023 found that TCE concentrations are still above its MCL (5 μg/L) but declining (Figure C-4). PCE has been below its MCL (5 μg/L) since FY2006.

Tritium gas and tritiated water were produced during the operation of the reactor and was released from numerous sources. No tritium has been produced since C-Reactor was shut down in June 1985. Other than atmospheric releases, the two primary discharge areas for tritiated water were the C-Area Discharge Canal and the C-Area Reactor Seepage Basins (CRSBs). Characterization data indicated contaminants released to the C-Area Discharge Canal from C-Reactor operations were carried by high discharge flows to Fourmile Branch. The CRSBs, a known historical source of tritium and other radionuclides, were remediated using low-permeability grout stabilization of basin soils as documented in the *Post-Construction Report/Final Remediation Report for the C-Area Reactor Seepage Basins (904-66G, -67G, and -68G) Operable Unit* (WSRC 2003). Although tritium concentrations in groundwater are still above the MCL (20 pCi/mL), groundwater and surface water data

collected from FY2014 through FY2019 indicate the size and concentration of the CAGW OU tritium plume has significantly decreased relative to the original 1998 to 2002 characterization (Figure C-5) (SRNS 2014). The IROD did not address tritium in the groundwater; therefore, tritium is not part of this remedy review. However, tritium groundwater concentrations will continue to be monitored to document the decreasing trend and will be addressed in the final CAGW OU ROD that is proposed to be issued in April 2030.

Initial Response

The nature and extent of groundwater contamination within the CAGW OU was comprehensively investigated between 1998 and 2002. The results were presented in the RCRA Facility Investigation (RFI) / Remedial Investigation (RI) Report (WSRC 2004b).

Basis for Taking Action

The RFI/RI characterization data indicated that groundwater concentrations of TCE in the vicinity of the manhole along a storm sewer line south of the C-Reactor Building (105-C) exceeded its MCL (5 µg/L) by 2,600 times, at 13,000 µg/L. The FY2023 TCE plume (Figure C-4) extends from south of the C-Reactor Building to over 1.6 km (1 mi) downgradient to Castor Creek (SRNS 2023a). In 2002, residual TCE (maximum = 51.846 mg/kg) in the vadose zone soil was present at levels that were still impacting groundwater. Although shallow groundwater aquifers at SRS are not used as drinking water sources, the potential for unacceptable human exposure to contaminated groundwater exists as long as TCE remains above its MCL. Thus, control of the migration of TCE was necessary through a source control action. The geometry of the TCE vadose zone source is a vertical cylinder approximately 18 m (60 ft) in diameter extending 21 m (70 ft) below ground surface.

IV. REMEDIAL ACTIONS

The selected interim action for the CAGW OU, ERH with SVE, is not the final action but has been implemented to minimize the impact of the CAGW on the watershed by removing principal threat waste from the source unit.

Remedy Selection

As stated in the IROD (WSRC 2004a), the interim remedial action objective (RAO) for CAGW OU is as follows:

- Reduce TCE concentrations in the vadose zone source unit so that any leaching of the contaminant will not cause groundwater to exceed the MCL (5µg/L).

The selected interim action remedy was ERH with SVE. The constituents of concern and remedial goals selected for the interim action are provided in Table C-2.

Tritium contamination in groundwater and surface water was not addressed in the IROD (WSRC 2004a). The final remedial action for the tritium and VOC groundwater contamination at the CAGW OU will be documented in the final CAGW OU ROD that is proposed to be issued in April 2030.

Remedy Implementation

Interim Remedial Action – Electrical Resistance Heating

Implementation of the interim remedial action for CAGW OU consisted of the following activities:

- Installed ERH system with a single six-phase heating array consisting of six input electrode/SVE wells equally spaced around the circumference of a 9-m (30-ft) diameter circle. A central neutral electrode/SVE well was centered on the highest contaminant levels in the TCE source. Two SVE wells and two electrodes were installed at different depths in a single large well boring at each of the seven locations. An electrolyte water addition system was installed to maintain electrical conductance during the remedial action.
- Installed an active SVE unit skid consisting of a 300 ft^3/min blower, condensate tank, knockout pot, water/vapor separator, heat exchanger and cooling tower.

ERH used the electrical resistance of soil to heat the soil in-situ using an electrical current. The electrolyte drip tube was used to provide the means to inject an electrolyte solution

into the electrode to increase conductivity between the electrode and the soil interface. The heat vaporized VOCs in the soil. These vapors were withdrawn by the SVE system, via a manifold to a vacuum pumping system, treated and discharged per an air quality control permit. Figure C-6 is a generalized graphic of an ERH with SVE system.

Removal Action

Soil data collected in 2011 determined that the interim remedial action of ERH with SVE at CAGW OU continues to be protective of the groundwater. In 2011, residual TCE (maximum = 1.064 mg/kg) in the vadose zone soil was below levels that would impact groundwater. In 2012, the maximum groundwater TCE concentration downgradient of the former ERH/SVE interim remedial action was 1,770 µg/L; it decreased to 203 µg/L in FY2020 and to 82 µg/L in FY2024 (Figure C-8). The groundwater monitoring network is functioning properly.

Subsequent to the interim action and based on TCE discharge to a tributary of Castor Creek, removal action alternatives were evaluated to address this problem. Per the *Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the C-Area Groundwater Operable Unit* (USDOE 2018), the RAO is to protect human health and the environment by reducing the mass of TCE present in the groundwater. The selected non-time critical removal (NTCR) action remedy is treatment barrier using emulsified edible oil for the distal portion of the CAGW OU TCE groundwater plume. The implementation of the NTCR action for CAGW OU consisted of installing 15 direct push technology injection points to create the treatment barriers.

The groundwater was augmented with the emulsified oil substrate BAC-9, which is an enriched bioaugmentation culture of *Dehalococcoides mccartyi* and enzymes in a water-based medium (SRNS 2019). The emulsified oil mixture (EOS_{100}™ emulsified oil, vitamin B12, dechlorinated dilution water, and $CoBupH_{Mg}$™ buffer) and BAC-9 culture were injected to act as a treatment barrier both by sequestering TCE at the injection points and enhancing the natural ability of the formation to biodegrade TCE between the point of injection and discharge to the unnamed tributary. In addition, TCE preferentially partitions

from the groundwater phase into the oil phase, which should lower the groundwater concentration.

Effectiveness monitoring of the CAGW OU NTCR action began in November 2019 per the *Removal Action Design Plan with Effectiveness Monitoring Plan for C-Area Groundwater Operable Unit* (SRNS 2018). The most recent effectiveness monitoring report was submitted in October 2024 and has proposed reverting back to submitting an annual CAGW OU monitoring report.

Systems Operations/Operation and Maintenance

Currently, there are no remedial systems operating. ERH with SVE operated from June 15, 2006 until the IROD shutdown criterion was met on September 7, 2006. The SVE system continued to operate until September 28, 2006 with 730 lbs of TCE removed during operations (WSRC 2007). The shutdown criterion was met when the temperature in the treatment zone exceeded 189ºF (boiling point of TCE) for at least 30 days cumulatively.

The following actions will be conducted at the CAGW OU until the scheduled FFA final remedial action start date of July 2031:

- Groundwater monitoring as required by the Interim Remedial Action Implementation Plan Effectiveness Monitoring Plan (WSRC 2005). The groundwater wells CRW 20D, CRW 021DR, and CRW-1D (background) monitor groundwater TCE and tritium concentrations, which are performance measures of the completed ERH system operations. Current (2024) photos of wells CRW 021DR and CRW020D are shown in Figure C-7.

Costs associated with the selected interim action remedy for the CAGW OU include operation and maintenance (O&M) costs as reported in the IROD (WSRC 2004a). ERH with SVE activity was completed in 2006 and the remaining O&M cost is associated with groundwater monitoring. The estimated O&M cost since the last remedy review is $0 for FY2020 through FY2024 because costs beyond FY2013 were not included in the original estimate. The actual O&M cost for the same time period is for groundwater monitoring $113,759. The actual O&M costs (Table C-3) 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.

V. PROGRESS SINCE LAST REVIEW

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

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

VI. FIVE-YEAR REVIEW PROCESS

The following tasks were performed as part of the five-year remedy review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed implementation and completion of the interim remedial action;
- Reviewed all process and performance monitoring data provided by the groundwater data reports and provided a technical assessment of whether the ERH with SVE functioned as intended by the IROD and whether the shutdown criteria have been achieved;
- Inspected the OU, interviewed maintenance personnel and documented the results on the Inspection Checklist, provided in Attachment C-1, with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Groundwater and surface water data collected from FY2019 to FY2023 indicate the concentration of the CAGW OU TCE plume has significantly decreased relative to the original 1998 to 2002 characterization. In FY2023, the TCE plume has also decreased in extent relative to the original 1998 to 2002 characterization (SRNS 2023a). Groundwater monitoring wells (CRW020D and CRW 021DR) near the TCE vadose zone source area

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. Storm damages to two wells (CSB020B and CSB020C) have been identified in the distal portion of the CAGW OU 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) was held on February 27, 2025. SRNS personnel were also present in the meeting. During the meeting, the participants viewed drone footage of CAGW OU and 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 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

restrictions via the SRS Site Use/Site Clearance Program. Protectiveness of the interim remedial action will be verified by continued groundwater monitoring.

XI. NEXT REVIEW

The 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, 2014. *Data Report for the C-Area Groundwater (CAGW) Operable Unit (OU) (U)*, SRNS-RP-2014-00835, Revision 0, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2018. *Removal Action Design Plan with Effectiveness Monitoring Plan for the C-Area Groundwater Operable Unit (U)*, SRNS-RP-2018-00807, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2019. *Underground Injection Control Permit Application for the Implementation of the Non-Time Critical Removal Action at the C-Area Groundwater Operable Unit (U)*, SRNS-RP-2019-00030, Revision 0, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2023a. *Effectiveness Monitoring Report (EMR) for the C-Area Groundwater (CAGW) Operable Unit (OU) Removal Action (U)*, SRNS-RP-2023-00913, Revision 0, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC

SRNS, 2023b. *Federal Facility Agreement Annual Progress Report for Fiscal Year 2023*, SRNS-RP-2023-01323, November 2023, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

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WSRC, 2004b. *RCRA Facility Investigation/Remedial Investigation Report for the C-Area Reactor Groundwater (CRGW) Operable Unit,* WSRC-RP-2003-4073, Revision 1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

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WSRC, 2007. *Report on the Effectiveness of the TCE Vadose Source Unit at C Reactor Groundwater (VCRGW) OU Interim Remedial Action*, WSRC-RP-2007-4006, Revision 1, Washington Savannah River Company, Aiken, SC

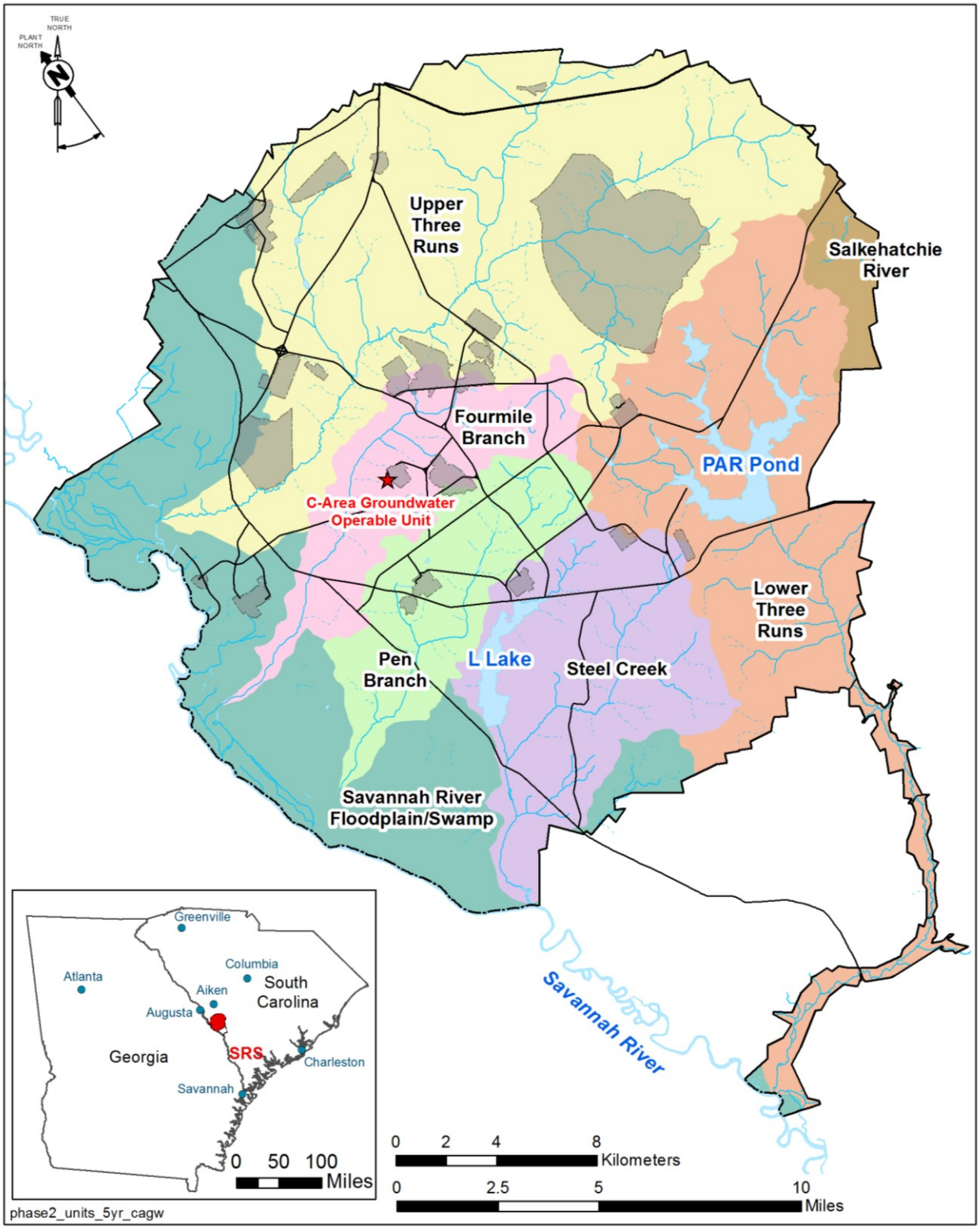


Figure C-1. Location of the CAGW OU within the Savannah River Site

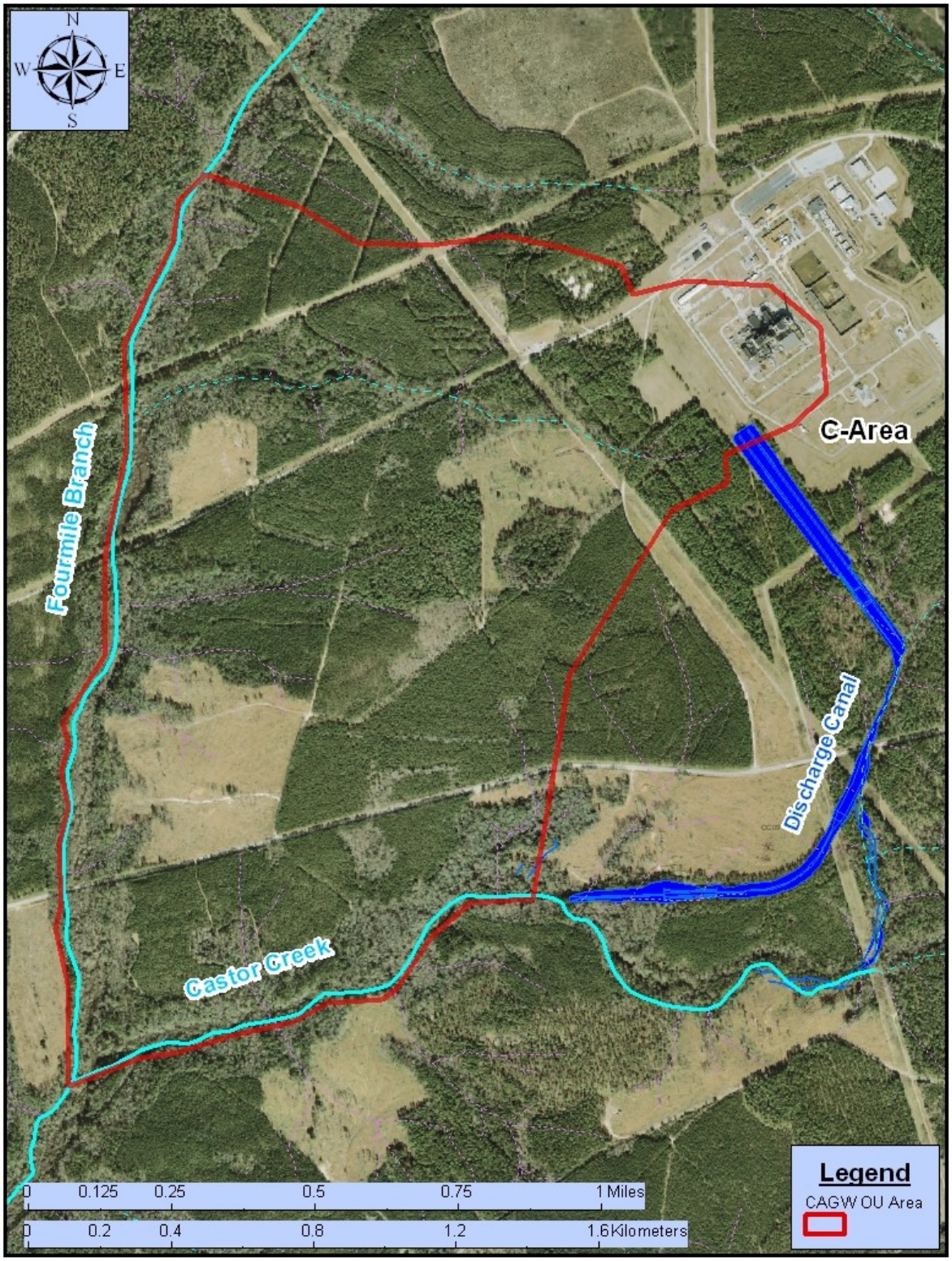


Figure C-2. CAGW OU Boundary Area

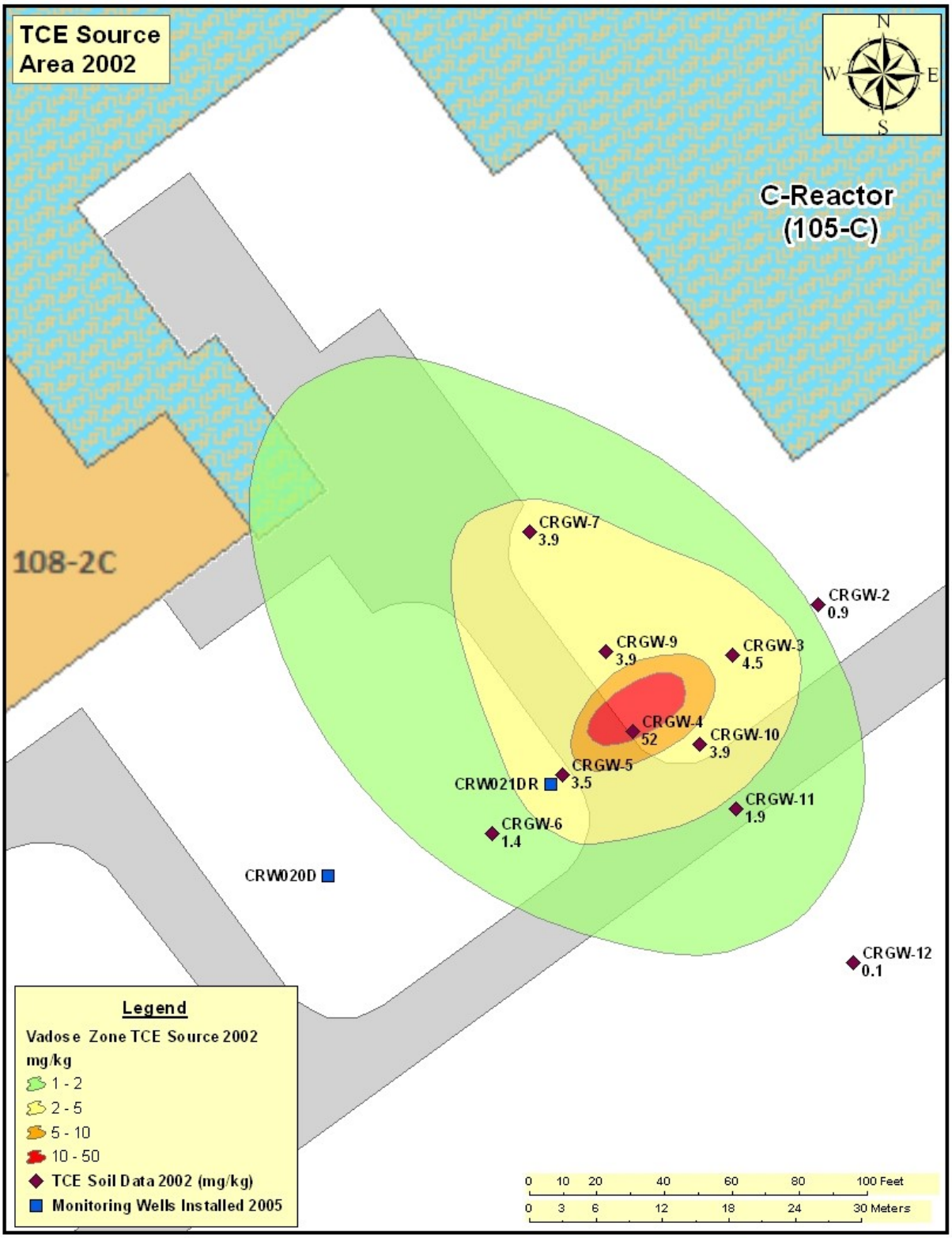


Figure C-3. CAGW OU 2002 TCE Vadose Zone Source Subunit

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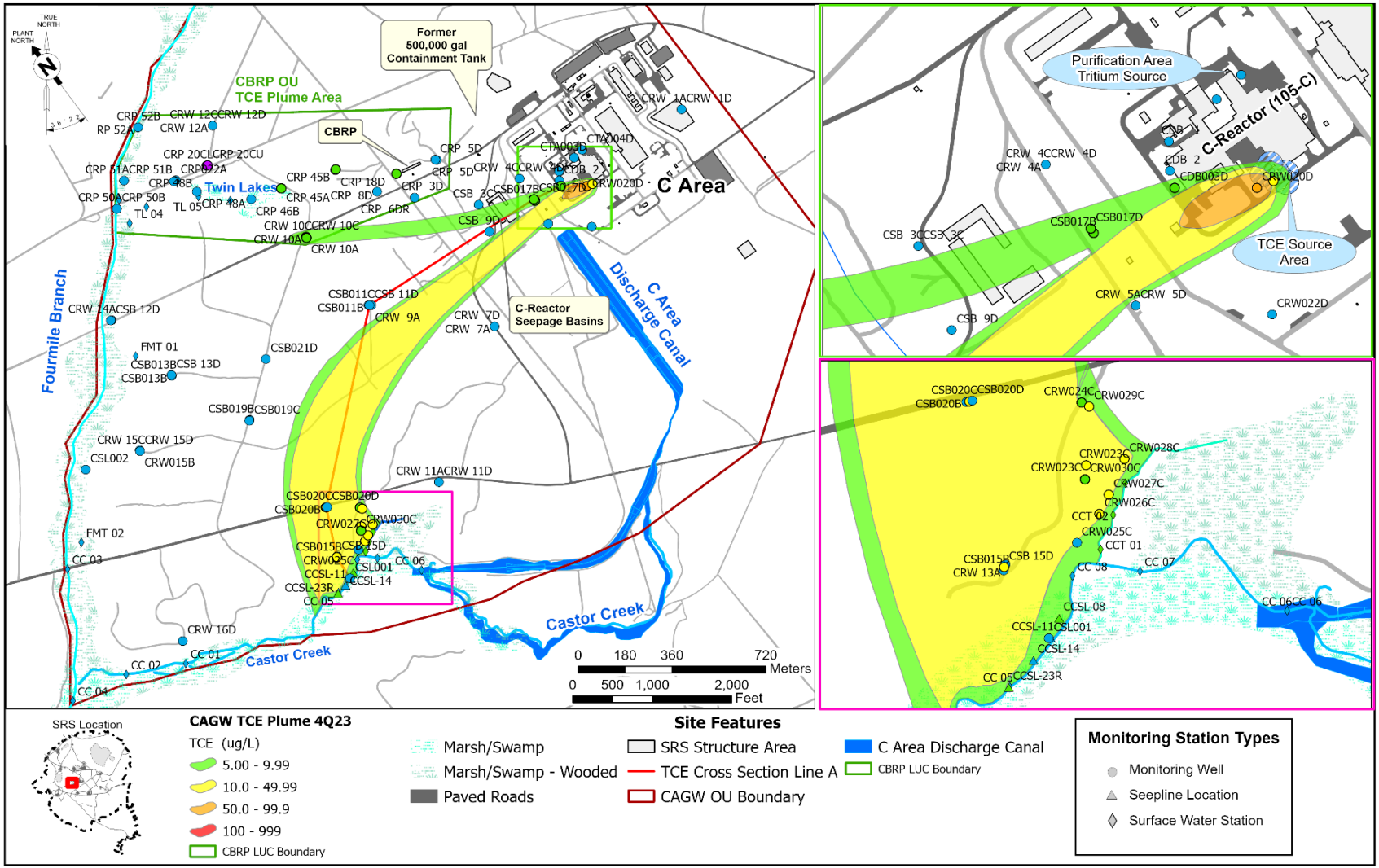


Figure C-4. CAGW OU 2023 TCE Plume Map for Upper Three Runs Aquifer

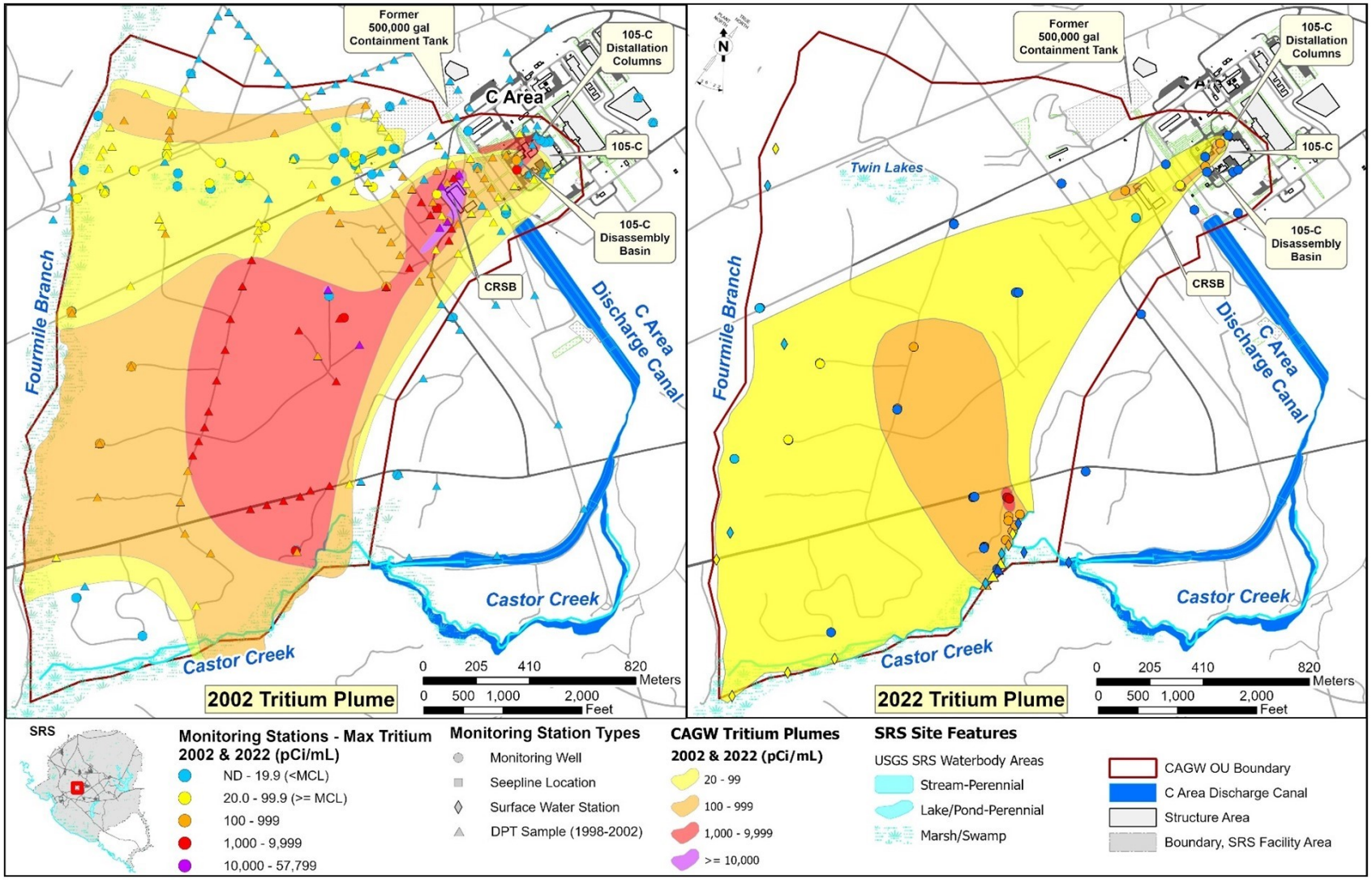


Figure C-5. CAGW OU 2002 and 2023 Tritium Plume Maps

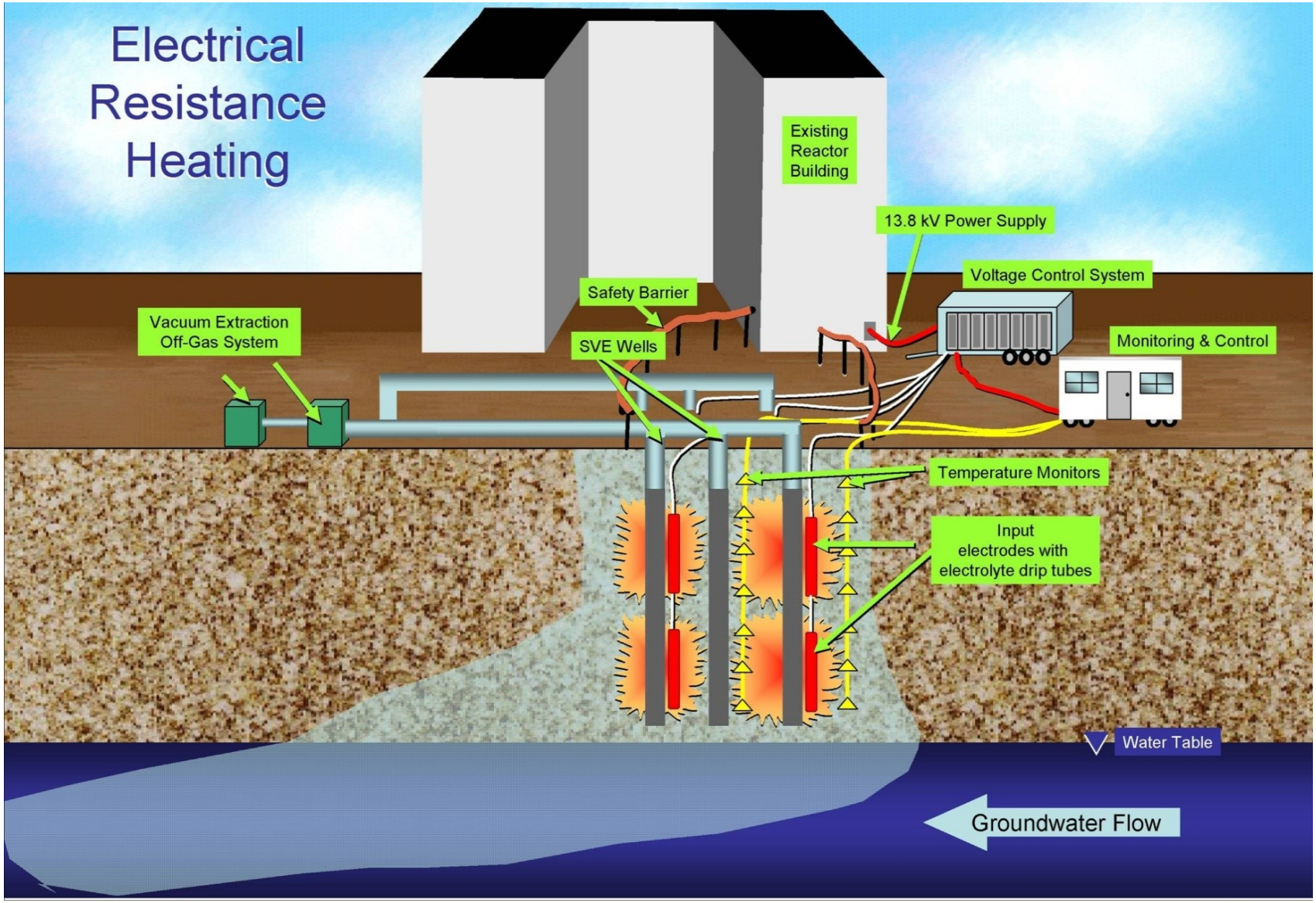


Figure C-6. Generalized Graphic of an ERH with SVE System





Figure C-7. Current Photos of Wells CRW 021DR and CRW 20D (2024)

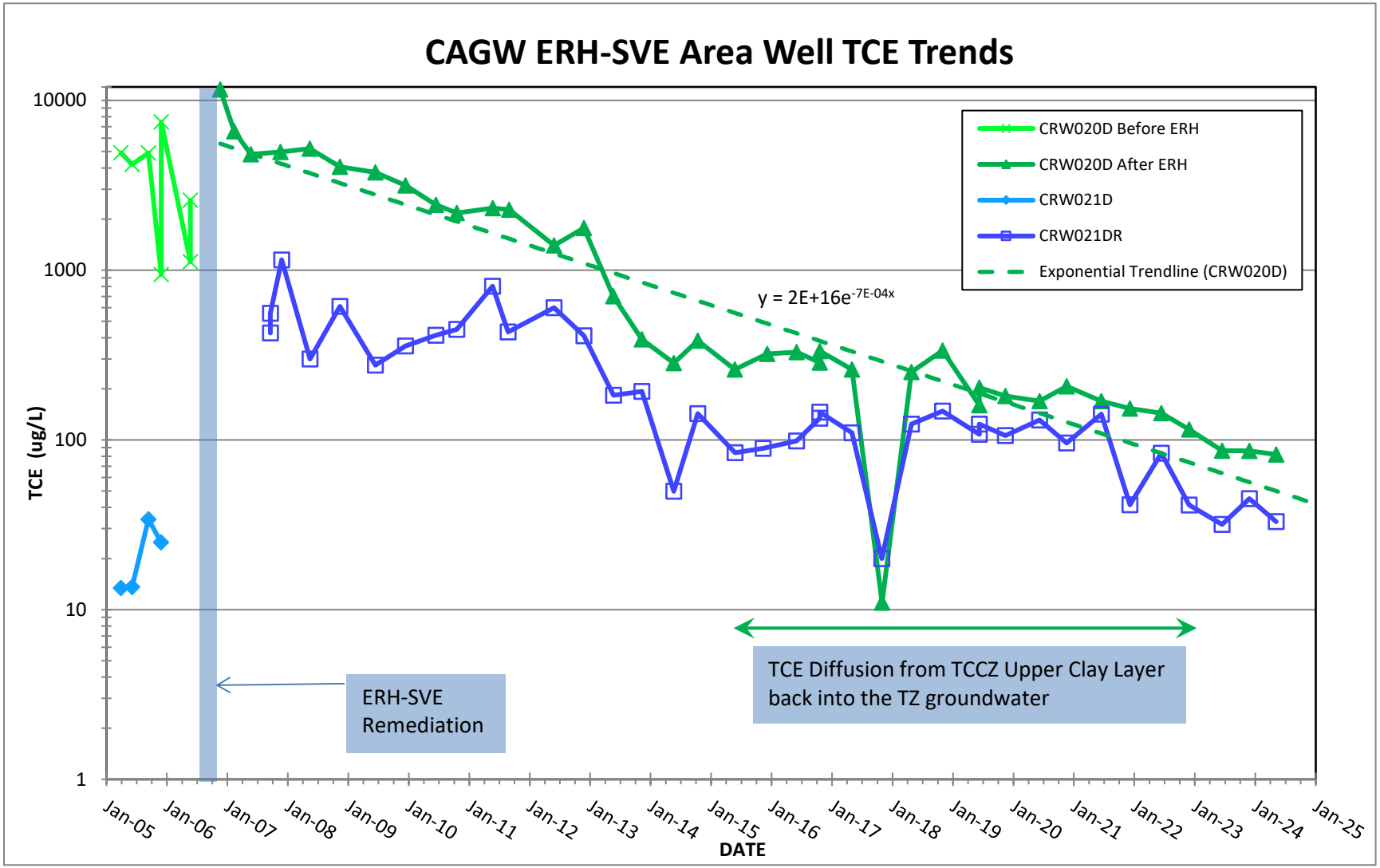


Figure C-8. TCE Groundwater Trends at the ERH with SVE Area Wells (2005 to 2024)

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Table C-1. Chronology of OU Events

Event	Date
RFI/RI Field Start	February 20, 2002
Interim Record of Decision (ROD) Issuance	October 15, 2004
Interim Remedial Action Construction Start / Completion	July 13, 2005 / June 15, 2006
Interim Remedial Action Operations Start / Completion	June 15, 2006 / September 28, 2006
NTCR Action Memorandum Issued	May 30, 2018
Removal Action Operations Field Start / Completion	July 9, 2019 / September 5, 2019
FFA Proposed Final ROD Issue Date	April 2030
Previous Five-Year Remedy Reviews Issuance	January 28, 2009 / February 4, 2014 / February 2, 2017 / December 9, 2020

Table C-2. Summary of Constituents of Concern and Remedial Goals for CAGW OU

Medium of Concern	Constituents of Concern*	Remedial Goal (MCL)
Groundwater	Trichloroethylene	5 µg/L
	Tetrachloroethylene	5 µg/L
	Tritium	20 ρCi/mL
Surface Water in Castor Creek	Tritium	20 ρCi/mL

* The IROD only addressed trichloroethylene.

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

	FY2020	FY2021	FY2022	FY2023	FY2024	Five-Year Total
Total Actual O&M Costs ($)	36,464	17,610	22,637	20,519	16,529	113,759
Total IROD Estimated Direct O&M Costs ($)[1]	0	0	0	0	0	0

1 – The estimated O&M costs since the last remedy review is $0 for FY2020-FY2024 because costs (including those for the five-year remedy review) beyond FY2013 were not include in the original estimate.

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Attachment C-1. Five-Year Review Site Inspection Checklist – C-Area Groundwater Operable Unit

I. SITE INFORMATION			
Site Name:	**C-Area Groundwater Operable Unit**	**Date of Inspection:**	**09/04/2024**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #31**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**75°F and partly sunny**

Remedy Includes: *(Click all that apply)*

- ☐ Landfill Cover/Containment
- ☐ Access Controls
- ☐ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other ERH with SVE for vadose zone remediation of VOCs, periodic groundwater monitoring. Please note that land use controls are not a component of the interim remedy.

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

II. INTERVIEWS (CLICK ALL THAT APPLY)

1. O&M Site Manager: Brian Hanshew (Name) | EC&ACP Post Closure Waste Site O&M Site Manager (Title) | 10/22/2024 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4949

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Eric Barron (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/22/2024 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3395

Problems/Suggestions: ☐ Report Attached

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

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

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

On 10/22/2024, the EC&ACP Post Closure Waste Site Inspector/Maintenance Coordinators, Harold Rodgers (803-953-3363) and Donald Sahm (803-952-4145), were also interviewed.

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(CLICK ALL THAT APPLY)*

1. O&M Documents:

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

Remarks: Monitoring wells are inspected per ER-SOP-011, *Area Completion Projects Monitoring Well Inspection (U)*

2. Health and Safety Plans (HASPs):

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

Remarks: Routine O&M activities do not require a Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response. A SSHASP is prepared if needed.

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

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

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

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

4. Permits and Service Agreements:

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

Remarks:

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

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

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

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

9. Discharge Compliance Records:

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

Remarks:

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

IV. O&M COSTS

1. O&M Organization:

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

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

3. Unanticipated or Unusually High O&M Costs During Review Period
Describe costs and reasons: N/A

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

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

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks: OU-specific fencing is not required by the remedial action.

B. Signs

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

C. Institutional Controls

1. Implementation and Enforcement
Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown
Frequency: Once every five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Khari Bell (Name) OU Manager (Title) 12/03/2024 (Date) 803-952-5085 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A
Violations have been reported: ☐ Yes ☐ No ☒ N/A
Problems/Suggestions: ☐ Report Attached
Access is restricted by physical access controls to SRS (fences, guards, security patrols, etc.) and use controls are managed through the SRS Site Use/Site Clearance Program.

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

D. General

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

2. Land use changes onsite: ☒ N/A
Remarks:

3. Land use changes offsite: ☒ N/A
Remarks:

Attachment C-1. Five-Year Review Site Inspection Checklist – 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

APPENDIX D. CHEMICALS, METALS, AND PESTICIDES (CMP) PITS (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, AND 080-190G) OPERABLE UNIT

I. INTRODUCTION

This report is the sixth five-year remedy review for the Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) Operable Unit (OU). Contaminants have been left in place at the CMP Pits OU 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 CMP Pits OU is protective of human health and the environment. This report documents the results of the review.

II. OU CHRONOLOGY

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

III. BACKGROUND

The CMP Pits OU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) (FFA 1993). The media of concern is surface soil, subsurface soil, groundwater, sediment, and surface water.

Physical Characteristics

The CMP Pits OU is located in the central portion of the SRS in Barnwell County more than 11.2 km (7 mi) from the site boundary and is approximately 1,560 m (5,200 ft) north of the L-Area perimeter fence (Figure D-1). The CMP Pits are located within the Pen Branch watershed approximately 375 m (1,250 ft) southeast of Pen Branch. The OU consists of five subunits: the ballast area soils, CMP Pits and associated vadose zone (Field A), vadose zone (Field B), groundwater, and Pen Branch surface water and sediment (Figure D-2). Characteristics of each subunit are described below:

- The CMP Pits and associated vadose zone (Field A) – An approximately 0.4-hectare (1-acre) area which includes the seven former unlined pits. The seven pits are located in two rows and occupy an area 3 to 4.5 m (10 to 15 ft) wide, 13.5 to 21 m (45 to 70 ft) long, and 3 to 4.5 m (10 to 15 ft) deep. The pits occupy the top of a knoll at an approximate elevation of 94.5 m (310 ft) mean sea level. Field A is the vadose zone area that was contaminated by the CMP Pits operation.
- Vadose zone (Field B) – An area approximately 0.4 hectare (1 acre) that is located 30 m (100 ft) north of Field A. Field B is another vadose zone area that was contaminated by the CMP Pits operation.
- Ballast Area – An area approximately 0.2 hectare (0.5 acre) that is located adjacent to and part of Field A. The Ballast Area was used to stockpile excavated pit soils and fluorescent lighting ballasts during the 1984 excavation.
- Groundwater – Previous wastes dumped at the CMP Pits has contaminated the groundwater at and near the CMP Pits with volatile organic compounds (VOCs) (primarily tetrachloroethylene [PCE] and trichloroethylene [TCE]) and the pesticide, lindane, above maximum contaminant levels (MCLs). The groundwater plume extends from the CMP Pits northward towards Pen Branch.
- Pen Branch Surface Water and Sediment – Groundwater from CMP Pits flows towards and discharges to Pen Branch. However, the stream has only been intermittently and minimally impacted. The sediment at Pen Branch has not been impacted by the CMP Pits operations.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. Although the CMP Pits OU is located in the unrestricted land use zone of SRS, outside of the industrial zone defined by the *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999a), the future land use for the CMP Pits OU is reasonably anticipated to be industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The CMP Pits were designed to receive nonradioactive wastes (chemicals, metals, and pesticides) and operated from August 1971 until February 1979. During that time, chemicals, metals, pesticides, and fluorescent lighting ballasts containing polychlorinated biphenyls (PCBs) were disposed of in the pits. In 1984, the buried wastes and surrounding soil were excavated.

PCBs and pesticides were detected in soil at or near the ground surface to the west of the CMP Pits in an area that is now referred to as the "Ballast Area". The presence of the PCB- and pesticide-contaminated soil is attributed to stockpiling material recovered from the pits during the 1984 excavation.

However, not all contaminated soils were removed during the 1984 action, and the vadose zone remained contaminated with VOCs. Groundwater contamination occurred as a result of the contaminants leaching from soil. Two groundwater plumes, designated as the main plume and the northeast distal plume, now exist at the CMP Pits. These plumes are moving northward towards Pen Branch. Groundwater modeling indicates that the CMP Pits are the source for the main plume (WSRC 2002). Particle tracking towards and from the northeast plume suggests that this plume is from a different source than that of the main plume. A possible source area is a drainage ditch located approximately 110 m (361 ft) north of the CMP Pits (Figure D-2). However, additional characterization efforts concluded that if a source was once present, it is now depleted (WSRC 2003b). It is also possible that the distal plume originated from the main plume but has been separated due to the drop in the water table elevation over time, which has created a dry zone in the upper aquifer zones (Figure D-3).

No contaminants were found at levels that posed a risk to human health or the environment in the Pen Branch surface water or sediment (WSRC 2003b).

Figures D-4 and D-5 presents photographs of the CMP Pits OU before remediation (early 1980s) and currently (2024), respectively.

Initial Response

The following pre-Record of Decision (ROD) activities were performed to support the overall cleanup strategy for the CMP Pits OU:

- Original excavation of the CMP Pits conducted with clean backfill and cover system (1984).
- Soil vapor extraction (SVE) units installed in CMP Pits Field A (Interim Action) (2001) (WSRC 1999b); however, possible dense non-aqueous phase liquid (DNAPL) was found and unexpected conditions forced additional characterization before SVE startup. During operations, 9,300 lbs of VOCs were removed (WSRC 2005).
- Ballast Area Soil Excavation / Off-site Incineration (Interim Action) (2000) (WSRC 1999b); however, soil containing Silvex was found, which could not be treated or disposed of offsite. The amount of contaminated soil was found to be significantly greater than originally estimated. An evaluation of treatment technologies for bioremediation of Silvex contaminated soils was needed.
- SVE implemented in CMP Pits Field B (Interim Action) (2001) (WSRC 2001). During operations, 230 lbs of VOCs were removed (WSRC 2003c).
- Ballast Area Soil Excavation / Bioremediation (Treatability Study – Phase I) (2001)
- SVE implemented in CMP Pits Field A (Interim Action) (2002) (WSRC 2001).
- SVE units converted to passive system (BaroBalls^{TM}) in Field B (Interim Action) (2002) (WSRC 2001).
- Ballast Area Soil Excavation / Bioremediation (Treatability Study – Phase II) (2002) (WSRC 2003d)
- Ballast Area Soil Excavation / Bioremediation (Interim Action) (2004) (WSRC 2003a)

DNAPL VOC contamination was found to be trapped in the clay horizon beneath the CMP Pits in Field A, where SVE units alone could not remediate the contamination. Additional techniques were needed to remediate the contaminant source to groundwater.

Basis for Taking Action

Releases of VOCs (predominantly PCE and TCE) and pesticides to groundwater have occurred from contaminated soil at the CMP Pits. Groundwater is contaminated above MCLs with PCE, TCE, lindane, and carbon tetrachloride. Exposure to these constituents above MCLs through ingestion or prolonged dermal contact increases the risk of cancer. The refined constituents of concern (RCOCs) for the CMP Pits OU are listed in Table D-2.

The CMP Pits OU cleanup levels were developed to be protective in soil based upon future industrial land use and in groundwater to achieve MCLs or residential cleanup levels (Table D-2).

IV. REMEDIAL ACTIONS

Remedy Selection

In 2005, a final ROD (WSRC 2004) was issued to address the source of contamination in the vadose zone and the groundwater plume. The selected remedy for the Ballast Area is land use controls (LUCs) to prevent direct contact to PCB-contaminated soils above concentrations of 1 mg/kg. The selected remedy for the CMP Pits and associated vadose zone is a combination of electrical resistance heating (ERH) to remove DNAPL from the vadose zone and continued operation of the SVE system in Field A. Continued operation of the passive SVE system via BaroBalls^{TM} was selected for Field B. As stated in the ROD, the remedial action objectives (RAOs) are as follows:

Ballast Area

- Prevent ecological receptors from direct contact with PCB-contaminated surface soil at concentrations > 1 mg/kg, and

- Prevent direct contact with pesticide-contaminated surface soils so that constituents of concern (COCs) do not present an unacceptable risk to human and ecological receptors.

CMP Pits Field A and B Vadose Zone

- Prevent COC migration to groundwater, and
- Prevent residential exposure to surface soil above cleanup levels.

Groundwater

- Prevent human exposure to contaminated groundwater above MCLs or cleanup levels,
- Reduce the COC concentrations in the groundwater plume to MCLs, and
- Prevent discharge of contaminated groundwater to surface water at concentrations above MCLs.

Surface Water and Sediment

No RAOs were established for the Pen Branch surface water and sediment because no COCs were identified.

Remedy Implementation

The implementation of the final remedial action included the following activities:

Ballast Area

- Established LUCs (i.e., physical access controls to prevent unauthorized entry to SRS [fences, guards, security patrols, etc.], administrative controls that maintain the CMP Pits OU for industrial use only, warning signs, and use restrictions via the SRS Site Use/Site Clearance Program) after the completion of the interim action. The interim action included a small portion of contaminated soil that was removed for incineration at an offsite facility. The remaining Silvex contaminated soil was treated onsite using enhanced bioremediation.

CMP Pits Field A Vadose Zone

- Operated ERH to remove DNAPL and continued operation of the SVE system throughout the ERH operation.

CMP Pits Field B Vadose Zone

- Continued operation of the interim action passive SVE system via BaroBalls™.

Groundwater

- Established a monitored natural attenuation (MNA) network by installing additional groundwater monitoring wells. MNA will effectively remediate the low-concentration residual groundwater contamination that remains following completion of the source control remedial action. The PCE plumes comprised approximately 17.8 hectares (44 acres); the TCE plumes comprised approximately 16.6 hectares (41 acres) in 2011.
- Submitted an Effectiveness Monitoring Plan (EMP), which provides the sampling and reporting requirements associated with MNA (WSRC 2006a).
- Established LUCs for 2.9 hectares (7.1 acres) at the CMP Pits OU (Figure D-6).

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

- Prevent contact, removal, or excavation of Ballast Area and Vadose Zone contaminated soil;
- Maintain integrity of the existing cover;
- Maintain the use of the site for industrial activities only in order to prevent residential exposure;
- Prevent unauthorized access to the closed waste unit as long as the waste remains a threat to human health or the environment in order to protect the industrial worker;

- Provide public notices for disclosing former waste management and disposal activities and remedial actions taken on the site in order to protect future residents, trespassers, and industrial workers;
- Prevent unauthorized residential or agricultural access to groundwater in the area; and
- Maintain the integrity of any current or future remedial or monitoring system.

System Operations/Operation and Maintenance

Operations at the CMP Pits OU are now complete.

- ERH and SVE have been completed in Field A. The ERH equipment and associated SVE wells were removed or abandoned in accordance with SRS Manual 3Q5 (i.e., currently SRS Manual 3Q1) and R.61-71 South Carolina Well Standards. The results of the ERH/SVE operations were reported in the 2009 Effectiveness Monitoring Report (EMR) (SRNS 2009). Confirmation soil sampling was reported in the 2010 EMR (SRNS 2010).
- At Field B, the passive SVE units were abandoned concurrently with the Field A SVE abandonments.

The following maintenance activities are ongoing:

- Groundwater and surface water monitoring for the MNA network. Sampling will continue until MCLs have been attained. The MNA remedy will be evaluated annually in EMRs based on groundwater monitoring data as defined in the approved EMP (WSRC 2006a). Groundwater monitoring data has been reported in EMRs since June 2009. Based on modeling projections (WSRC 2002), the MNA remedy is expected to reduce groundwater concentrations to below MCLs in as soon as 40 years (approximately 2055).
- Annual site inspections for evidence of damage to the cover system due to erosion or intrusion by burrowing animals. The inspections also address upkeep of the vegetative cover and access control barriers (e.g., the warning signs).

- Necessary repairs (e.g., replacing eroded or disturbed soil, sign repair, etc.) and vegetation management (e.g., mowing, removal of larger vegetation, etc.) are being performed when required.
- LUCs (i.e., physical access controls to prevent unauthorized entry to SRS [fences, guards, security patrols, etc.], administrative controls that maintain the CMP Pits OU for industrial use only and warning signs) are being enforced to preclude access through the SRS Site Use/Site Clearance program and SRS site security.

The operation and maintenance (O&M) costs associated with the selected remedy for CMP Pits OU includes maintenance of the soil cover, groundwater monitoring and LUCs (WSRC 2004). The estimated O&M cost from the ROD since the last remedy review for these activities is $197,793 for Fiscal Year (FY) 2020 through FY2024. The actual O&M cost for FY2020 until FY2024 is $1,066,730. The actual O&M costs (Table D-3) 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 wells) requiring increased maintenance activities. Based on inspections conducted from FY2020 through FY2024, various maintenance activities completed at CMP Pits included vegetation cutting and clearing drainage ditches, vegetation cutting on soil cover, treating active ant mounds, and vegetation removal from around drainage pipe.

V. PROGRESS SINCE LAST REVIEW

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

There were no recommendation 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 implementation of the remedial action,
- Reviewed all process and performance monitoring data provided by the annual EMRs and provided a technical assessment of whether the ERH/SVE and passive SVE functioned as intended by the ROD and whether the shutdown criteria has been achieved,
- Reviewed the groundwater and surface water monitoring data provided in the EMRs (SRNS 2020; SRNS 2021; SRNS 2022; SRNS 2023; SRNS 2024) as summarized in Table D-4,
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment D-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls, and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Five annual EMRs have been submitted since the last five-year remedy review (2019 data [SRNS 2020]; 2020 data [SRNS 2021]; 2021 data [SRNS 2022]; 2022 data [SRNS 2023b]; 2023 data [SRNS 2024]). These reports include all sample results for PCE, TCE, carbon tetrachloride, associated VOC degradation products, 1,4-dioxane, and lindane collected from monitoring wells and surface water stations between 2020 and 2024. These reports include time-series plots at each monitoring station for PCE, TCE, 1,4-dioxane and lindane since 2001, plume maps for the four main constituents (i.e., PCE, TCE, lindane, and 1,4-dioxane), and cross-sections of the stratigraphy with the PCE, 1,4-dioxane, and lindane plumes. Data from the new 2019 and 2021 GA wells and one new LAZ well have provided additional plume coverage.

Due to concerns expressed by the U.S. Environmental Protection Agency (USEPA) and South Carolina Department of Environmental Services (SCDES) during review of the EMRs and Core Team discussion of the lack of Gordon Aquifer (GA) wells at the CMP Pits and increasing trends in source area wells, additional characterization efforts and well

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 was held on February 27, 2025. SRNS personnel were also present in the meeting. During the meeting, the participants viewed drone footage of CMP Pits OU and 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 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, 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

controls that maintain the CMP Pits OU for industrial use only, warning signs, 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 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. *Effectiveness Monitoring Report for the Electrical Resistance Heating (ERH)/ Soil Vapor Extraction (SVE) and Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU)(U) March 2008 through March 2009*, SRNS-RP-2009-00573, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *Effectiveness Monitoring Report for the Electrical Resistance Heating (ERH)/ Soil Vapor Extraction (SVE) and Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU)(U) March 2009 through March 2010*, SRNS-RP-2010-00896, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2017. *Groundwater Flow and Solute Transport Model of the CMP Pits OU (U) Tetra Tech, Inc. Alpharetta, GA*, SRNS-TR-2017-00312, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU)(U) April 2019 through March 2020*, SRNS-RP-2020-00291, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2021. *Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU)(U) April 2020 through March 2021*, SRNS-RP-2021-03832, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2022. *Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU)(U) April 2021 through March 2022*, SRNS-RP-2022-00342, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2023. *Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU)(U) April 2022 through March 2023*, SRNS-RP-2023-00474, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

SRNS, 2024. *Effectiveness Monitoring Report for the Monitored Natural Attenuation (MNA) at the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit (OU)(U) April 2023 through March 2024*, SRNS-RP-2024-00606, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken SC

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

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

WSRC, 1999b. *Interim Record of Decision for the Chemicals, Metals, and Pesticides Pits (080-17G, 080-17.1G, 080-18G, 080-18.1G, 080-18.2G, 080-18.3G, 080-19G) (U)*, WSRC-RP-98-4198, Revision 1.1, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2001. *Interim Record of Decision Amendment for the Chemicals, Metals, and Pesticides Pits (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-*

190G) (U), WSRC-RP-2000-4158, Revision 1.2, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2002. *Groundwater Modeling for the Chemical, Metals, and Pesticides (CMP) Pits (U)*, WSRC-RP-2002-4195, Revision 0, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2003a. *Interim Record of Decision Amendment for the Chemicals, Metals, and Pesticides Pits-Ballast Area (U)*, WSRC-RP-2001-4232, Revision 1.1, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2003b. *RCRA Facility Investigation/Remedial Investigation Addendum with Baseline Risk Assessment for the CMP Pits (U)*, WSRC-RP-2002-4049, Revision 1.1, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2003c. *Report on the Effectiveness of the CMP Pits Interim Remedial Action for 2004*, WSRC-RP-2003-4065, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2003d. *Treatability Study Final Report for the Enhanced Bioremediation of Soils Contaminated with Pesticides and PCBs at the CMP Pits*, WSRC-RP-2003-4067, Revision 0, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2004. *Record of Decision Remedial Alternative Selection for the Chemicals, Metals, and Pesticides Pits Operable Unit (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) (U)*, WSRC-RP-2004-4090, Revision 1, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2005. *Report on the Effectiveness of the CMP Pits Interim Remedial Action for 2004*, WSRC-RP-2005-4050, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006a. *Effectiveness Monitoring Plan for the Electrical Resistance Heating (ERH)/Soil Vapor Extraction (SVE) System and Monitored Natural Attenuation at the*

Chemicals, Metals, and Pesticides Pits Operable Unit (U), WSRC-RP-2005-4077, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2006b. *Interim Post-Construction Report (IPCR) for the Chemicals, Metals, and Pesticides (CMP) Pits Operable Unit – Ballast Area (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, 080-190G) (U)*, WSRC-RP-2005-4065, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007. *Land Use Control Implementation Plan (LUCIP) for the Chemicals, Metals, and Pesticides Pits Operable Unit (080-170G, 080-171G, 080-180G, 080-181G, 080-182G, 080-183G, and 080-190G) (U)*, WSRC-RP-2005-4078, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist Chemical, Metal, and Pesticides Pits (U)*, ER-IDS-019-062, Inspection period 2020 through 2024 (annually)

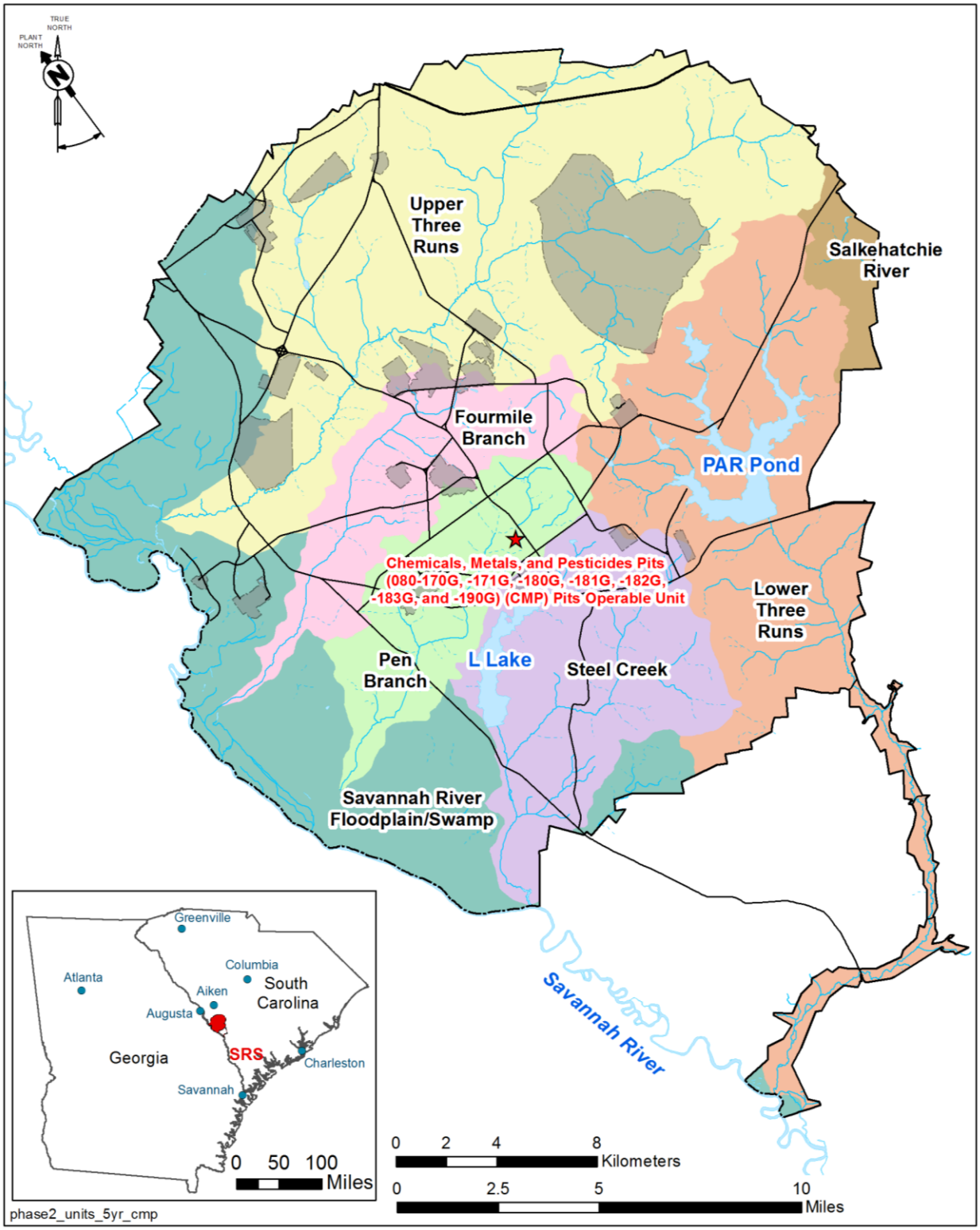


Figure D-1. Location of the CMP Pits OU at SRS

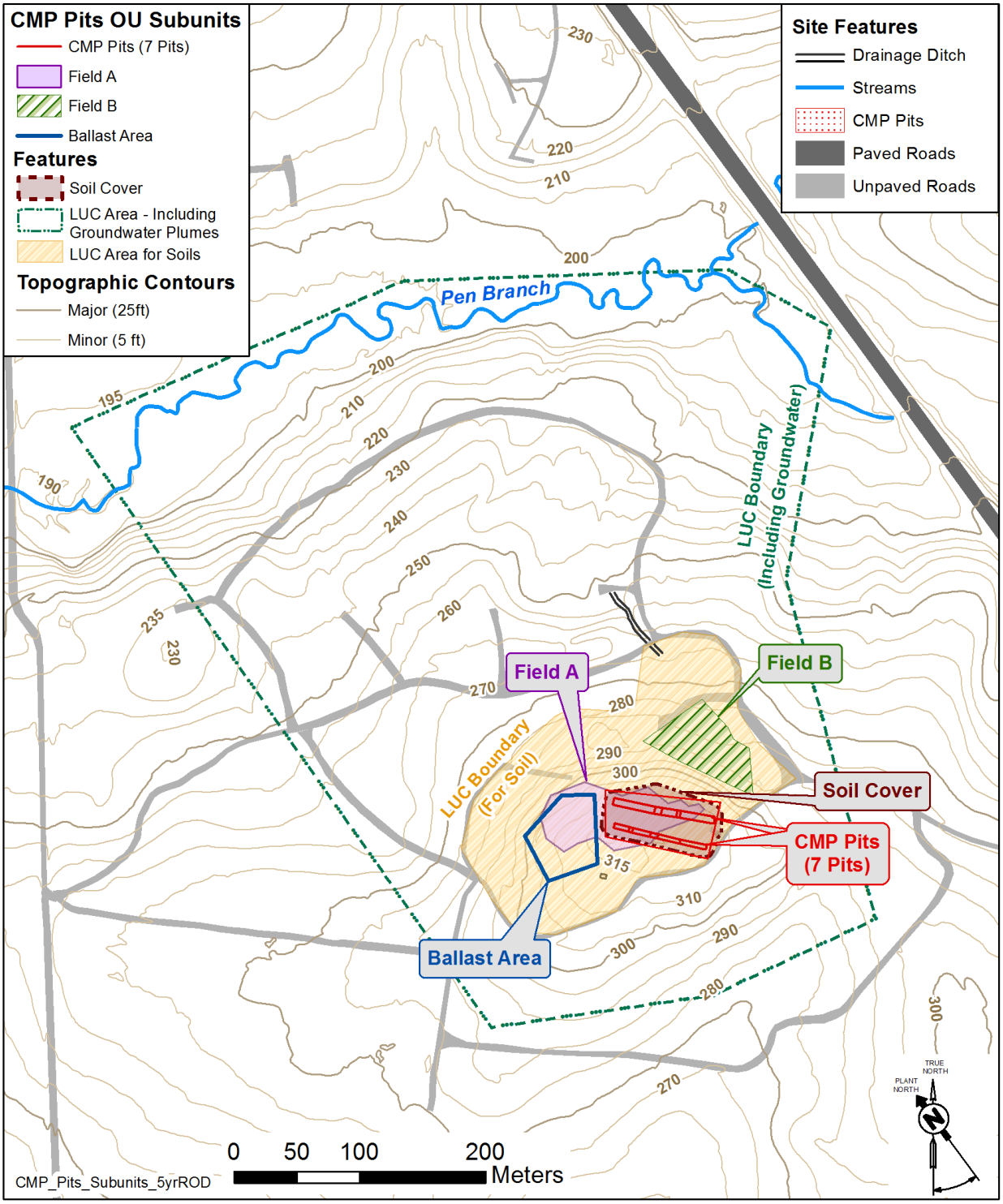


Figure D-2. Layout of the CMP Pits OU

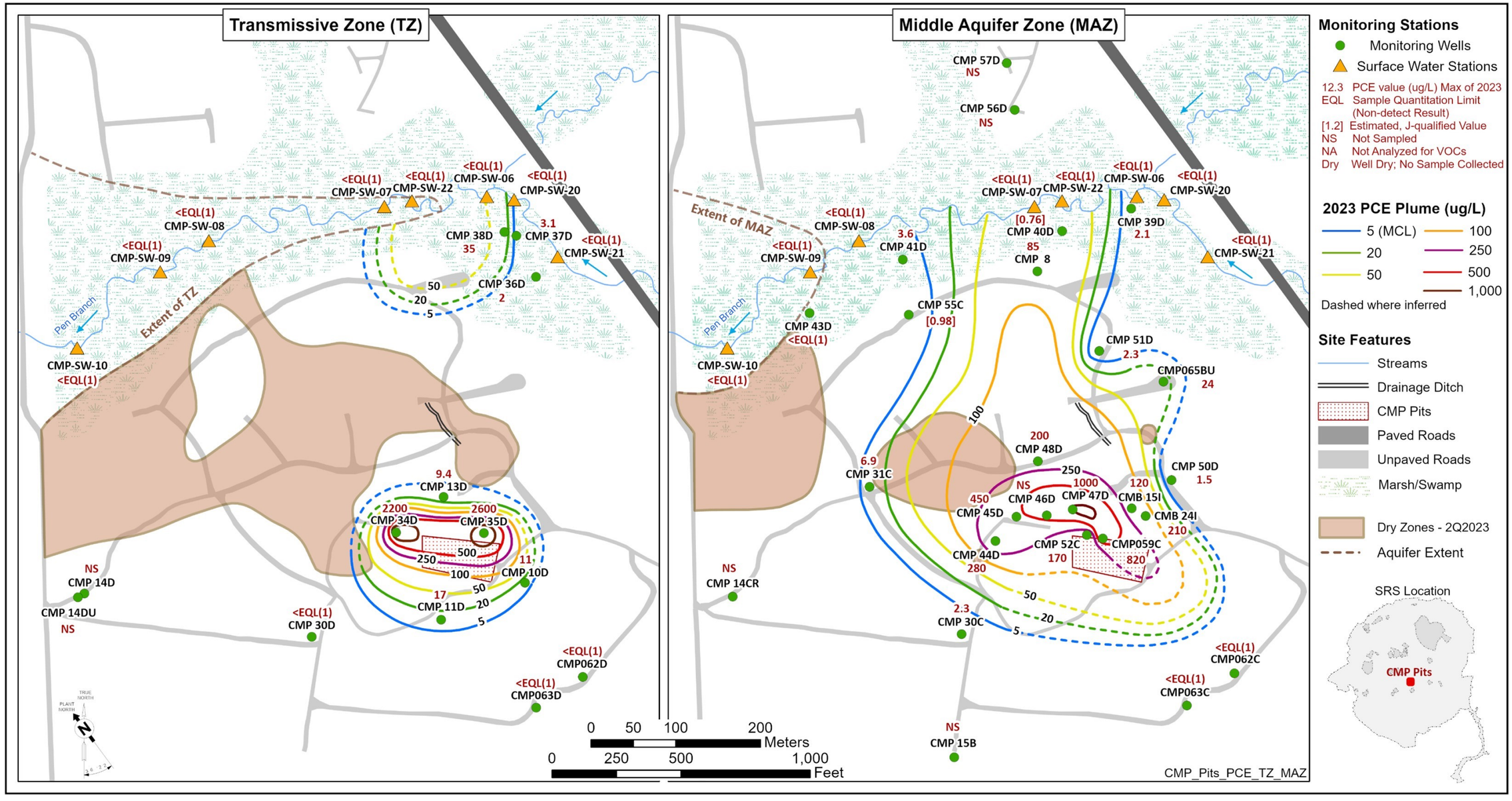


Figure D-3. 2023 PCE Plume in the Transmissive Zone and Middle Aquifer Zone

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Figure D-4. Photo of CMP Pits before Remediation Activities (During Disposal Operation) (early 1980s)



Figure D-5. Photo of CMP Pits (Current) (2024)

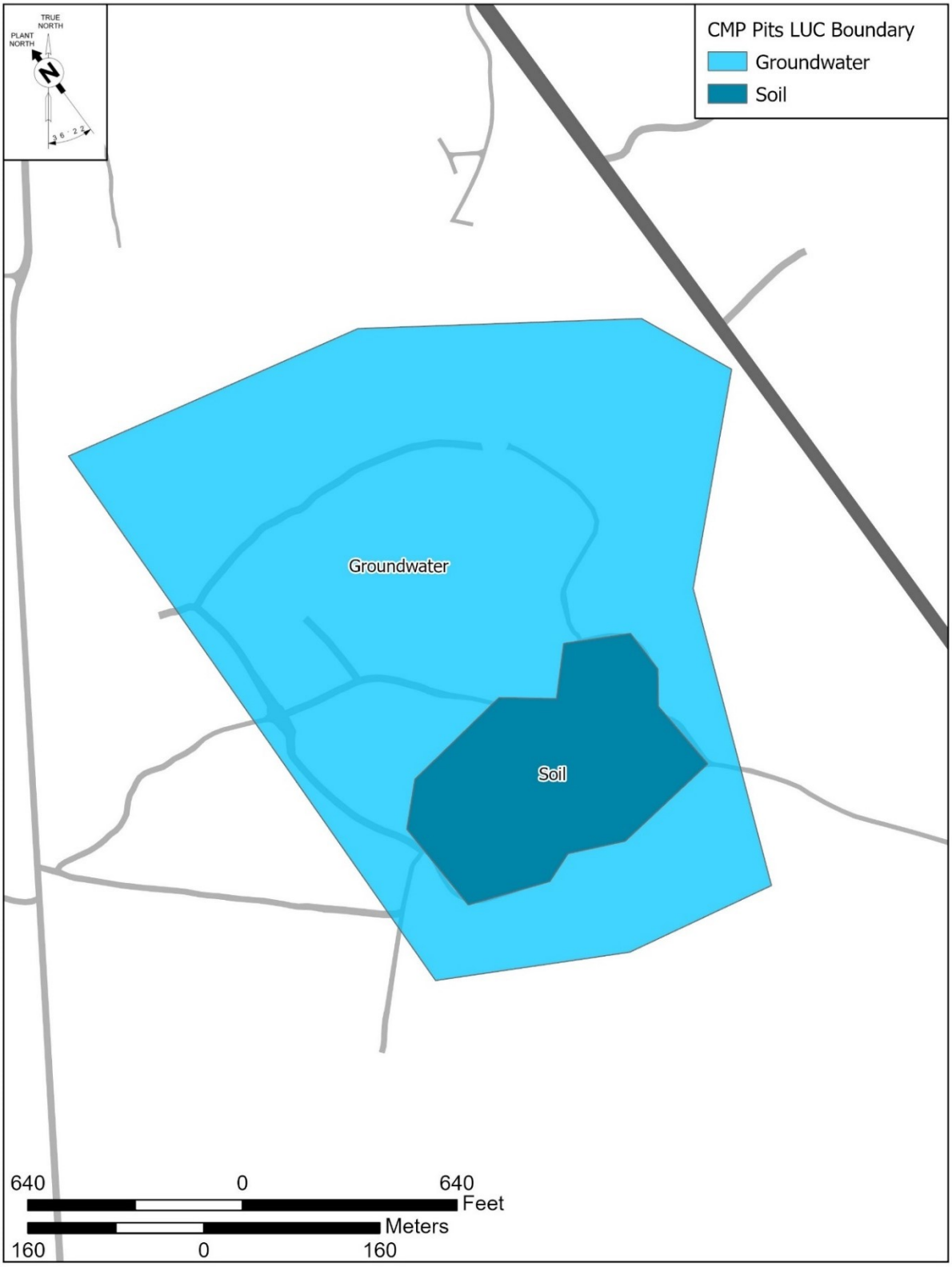


Figure D-6. Land Use Control Boundary for the CMP Pits OU

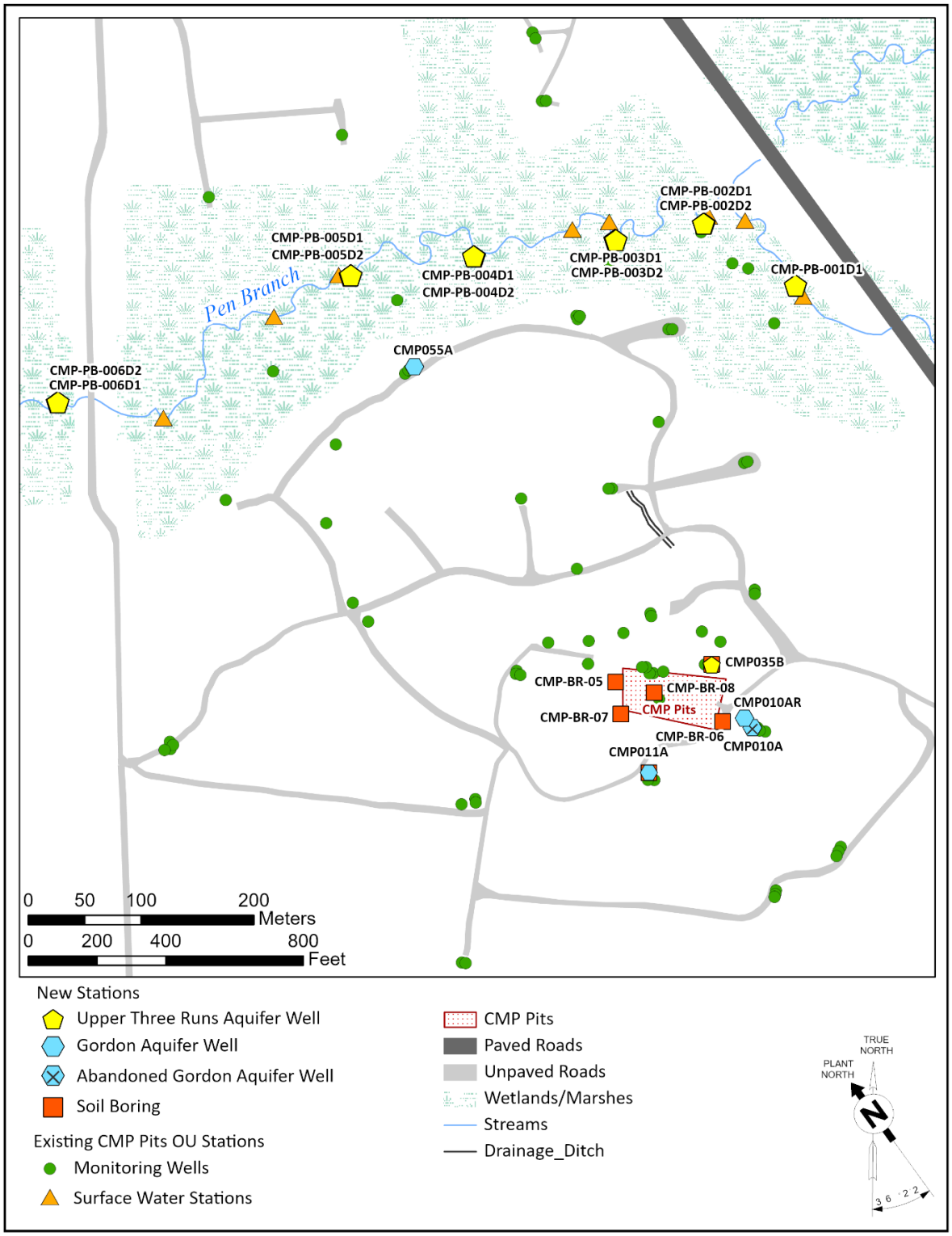
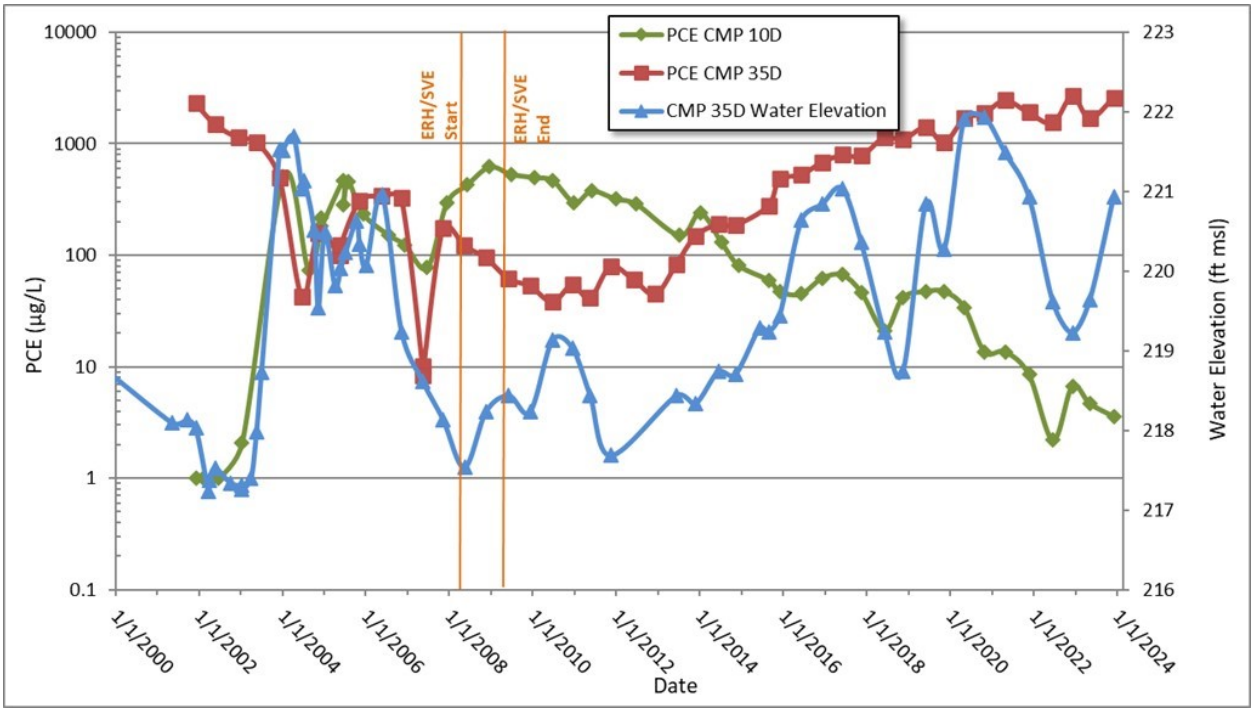


Figure D-7. Locations of Additional Groundwater and Soil Investigations in 2019, 2021, and 2024



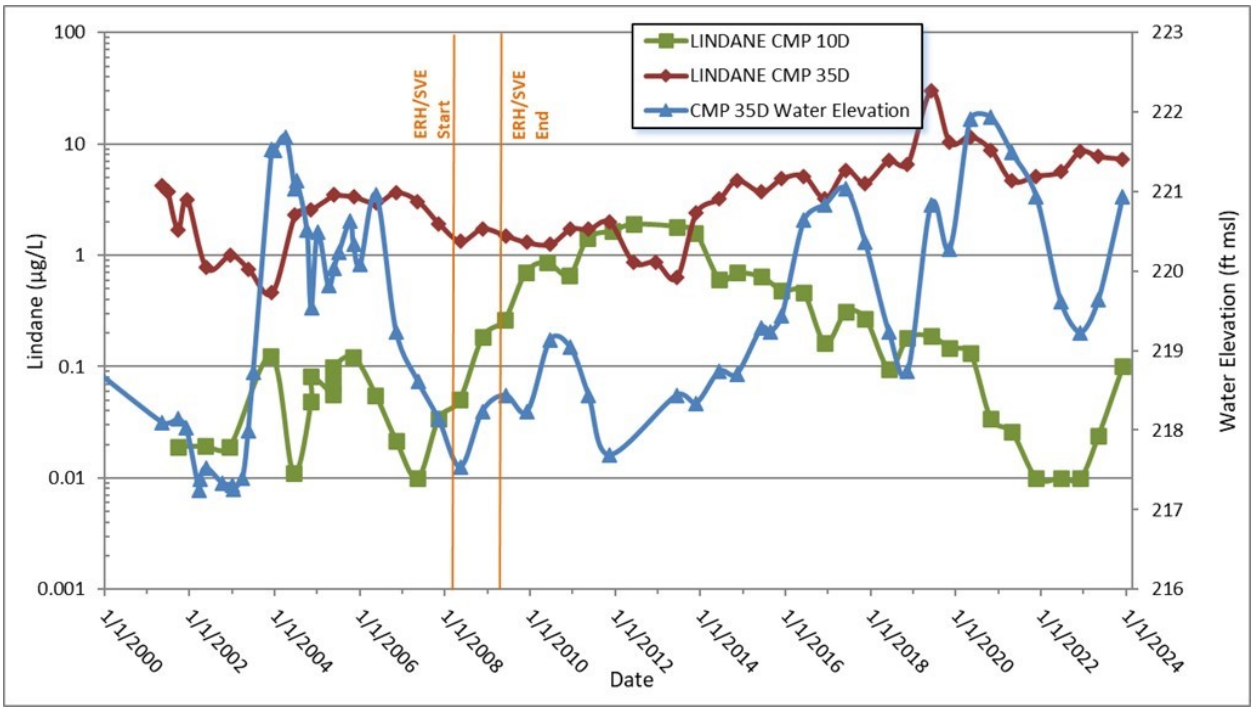


Figure D-8. Comparison of PCE and Lindane Trends in CMP 35D and CMP 10D

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Table D-1. Chronology of OU Events

Event	Date
Removal Action (Soil Excavation)	1984
Remedial Investigation Complete	October 1, 1997
Interim ROD Issuance	January 19, 2000
Interim Remedial Action Construction Start / Completion	December 10, 1999 / December 5, 2001
Interim Remedial Action Operations Start / Completion	April 23, 2001 / October 12, 2005
First Interim ROD Amendment Issuance	April 8, 2002
Second Interim ROD Amendment Issuance	October 21, 2003
ROD Issuance	May 10, 2005
Remedial Action Construction Start / Completion	April 6, 2006 / November 7, 2007
Remedial Action Operations Start / Completion	November 2007 / June 28, 2009
Previous Five-Year Remedy Reviews	February 12, 2004 / January 28, 2009 / February 4, 2014 / February 2, 2017 / December 9, 2020

Table D-2. CMP Pits RCOCs by Medium and Subunit with Final Remedial Goals

		Type of RCOC					
Area/Media of Concern	**RCOCs**	**ARAR**	**CM/ PTSM**	**HH**	**ECO**	**Cleanup Levels (mg/kg or mg/L)**	**Final Cleanup Level Basis**
Ballast Area	PCB	✓			✓	1.00E+00	ARAR
	Dieldrin			✓	✓	6.84E-02	Ecological
	Endrin				✓	3.97E-02	Ecological
	Heptachlor Epoxide				✓	2.10E-02	Ecological
	Dichlorodiphenyldichloro ethane (DDD)				✓	2.87E-01	Ecological
	Dichlorodiphenyldichloro ethylene (DDE)				✓	5.54E-01	Ecological
	Dichlorodiphenyldichloro trichloroethylene (DDT)			✓	✓	1.62E+00	Ecological
CMP Pits and Associated Field A Vadose Zone [2]	Dichloromethane		✓			2.48E-02	Contaminant migration
	Tetrachloroethylene		✓			3.07E+01	Contaminant migration
Groundwater	Alpha-benzene hexachloride			✓		5.33E-06	Future Resident
	Beta-benzene hexachloride			✓		1.84E-05	Future Resident
	Delta-benzene hexachloride			✓		1.84E-05	Future Resident
	Dieldrin			✓		2.09E-06	Future Resident
	Lindane	✓		✓		2.00E-04	ARAR
	Bis(2-ethylhexyl) phthalate	✓		✓		6.00E-03	ARAR
	Total Trihalomethanes[1]	✓		✓		0.80E-01	ARAR
	Carbon Tetrachloride	✓		✓		5.00E-03	ARAR
	Dichloromethane	✓		✓		5.00E-03	ARAR
	Tetrachloroethylene (PCE)	✓		✓		5.00E-03	ARAR
	Trichloroethylene (TCE)	✓		✓		5.00E-03	ARAR

1. Total Trihalomethanes includes chloroform and bromodichloromethane. Although these constituents are not ARAR COCs (Site concentrations pose a risk but do not exceed the MCL), they do have an MCL that is an ARAR and; as such, is the appropriate final RG.
2. Vadose zone cleanup levels apply anywhere in the vadose zone. The cleanup levels are target values based on available data. During remedial action implementation, vadose zone and groundwater monitoring may indicate that different values may be protective and meet the remedial action objective of preventing migration to groundwater.

ARAR = Applicable or Relevant and Appropriate Requirements

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

	FY2020	FY2021	FY2022	FY2023	FY2024	Five-Year Total
Total Actual O&M Costs ($)	204,180	266,508	221,805	216,084	158,153	1,066,730
Total ROD Estimated Direct O&M Costs ($)	36,897	36,897	36,897	36,897	50,205[a]	197,793

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

Table D-4. Comparison of Cleanup Levels and Groundwater and Surface Water Monitoring Data from 2023

	Cleanup Levels	Groundwater		Surface Water
RCOC	MCL (µg/L)*	2007 (Pre-ERH/SVE) Maximum Concentration (µg/L)	2023 Maximum Concentration (µg/L)	2023 Maximum Concentration (µg/L)
PCE	5.0	1.35E+03	2.6E+03	Non Detect
TCE	5.0	8.51E+02	1.4E+03	Non Detect
Lindane	0.2	3.05E00	7. 7E00	Not Analyzed[1]
Carbon Tetrachloride	5.0	2.46E+01	4.6E+01	Non Detect
Dichloromethane	5.0	2.09E00	1.1E00	Non Detect
Bromodichloromethane	80	1.6E+01	0.41E00	Non Detect
Chloroform	80	3.04E+01	5.7E+01	Non Detect

* MCL values are based on USEPA values available May 2024.
[1] Lindane is not required to be analyzed in surface water as part of the EMP.

Table D-5. Ballast Area Enhanced Bioremediation Soil Sample Confirmation Results

RCOC	Remedial Goal (µg/kg)	Maximum Result of Confirmation Samples (µg/kg)
PCB	1.0E+03	1.92E+02
Dieldrin	6.84E+01	4.09E+01
Endrin	4.0E+01	9.06E00
Heptachlor Epoxide	2.1E+01	8.55E00
Dichlorodiphenyldichloroethane (DDD)	2.87E+02	1.94E+02
Dichlorodiphenyldichloroethylene (DDE)	5.54E+02	4.96E+01
Dichlorodiphenyldichlorotrichloroethylene (DDT)	1.62E+03	3.22E+02

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

Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit

I. INFORMATION			
Site Name:	**Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit**	**Date of Inspection:**	**09/04/2024**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #24**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**75°F and partly sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Operation with a combination of Electrical Resistance Heating (ERH) and Soil Vapor Extraction (SVE) system (Field A); and passive SVE via BaroBalls™ (Field B) have been concluded. MNA is continuing.

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

II. INTERVIEWS (CLICK ALL THAT APPLY)

1. O&M Site Manager: Brian Hanshew (Name) | EC&ACP Post Closure Waste Site O&M Site Manager (Title) | 10/22/2024 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4949
Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Eric Barron (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/22/2024 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3395
Problems/Suggestions: ☐ Report Attached

Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

2. Other Interviews *(Optional):* ☐ Report Attached

On 10/22/2024, the EC&ACP Post Closure Waste Site Inspector/Maintenance Coordinators, Harold Rodgers (803-953-3363) and Donald Sahm (803-952-4145), were also interviewed.

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(CLICK ALL THAT APPLY)*

1. O&M Documents:

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

Remarks: See *Waste Unit Inspection and Maintenance, ER-SOP-019, Field Inspection Checklist for Chemical Metal and Pesticides Pits*, ER-IDS-019-062.

2. Health and Safety Plans (HASPs):

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

Remarks: Routine O&M activities do not require a Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response. A SSHASP is prepared if needed.

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

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

Attachment D-1. Five-Year Review Site Inspection Checklist – Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

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

4. Permits and Service Agreements:

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

Remarks:

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

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

7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A
Remarks: Water elevation records only.

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

9. Discharge Compliance Records:

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

Remarks:

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

Attachment D-1. Five-Year Review Site Inspection Checklist – Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

IV. O&M Costs
1. O&M Organization: ☐ State In-House ☐ Contractor for State ☐ PRP In-House ☐ Contractor for PRP ☒ Other: SRS
2. O&M Cost Records: ☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place ☒ Other: Project cost data is summarized in Section IV of this OU-specific review.
3. Unanticipated or Unusually High O&M Costs During Review Period Describe costs and reasons: N/A
V. ACCESS AND INSTITUTIONAL CONTROLS ☒ APPLICABLE ☐ N/A
A. Fencing
1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A Remarks: OU-specific fencing is not required by the remedial action.
B. Signs
1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A Remarks: Signs at this site are in good condition.

Attachment D-1. Five-Year Review Site Inspection Checklist – Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

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

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

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

Frequency: Once every five years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: April Coffman (Name) | OU Manager (Title) | 12/03/2024 (Date) | 803-952-7244 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks: Survey monuments were located and in good condition.

D. General

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

Remarks:

2. Land use changes onsite: ☒ N/A

Remarks:

3. Land use changes offsite: ☒ N/A

Remarks:

Attachment D-1. Five-Year Review Site Inspection Checklist – Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VI. GENERAL SITE CONDITIONS	
A. Roads	☒ **Applicable** ☐ **N/A**
1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:	
B. Other Site Conditions	
Remarks:	

VII. LANDFILL COVER/CONTAINMENT ☒ APPLICABLE ☐ N/A	
A. Landfill Surface	
1. Settlement (Low spots): ☐ Location shown on site map ☒ Settlement not evident Areal extent _____ Depth _____ Remarks:	
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks:	
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent _____ Depth _____ Remarks:	
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent _____ Depth _____ Remarks:	
5. Vegetative Cover: ☒ Grass ☒ Cover properly established ☒ No signs of stress Areal extent _____ Depth _____ Remarks: Vegetation mowed routinely.	

Attachment D-1. Five-Year Review Site Inspection Checklist – Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
6. Alternative Cover (armored rock, concrete, etc.): ☒ N/A Remarks:_____
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____
B. Benches ☐ **Applicable** ☒ **N/A** (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)
C. Letdown Channels ☐ **Applicable** ☒ **N/A** (Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

Attachment D-1. Five-Year Review Site Inspection Checklist – Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*				
D. Cover Penetrations	☒ **Applicable**	☐ **N/A**		
1. Gas Vents: ☐ Active ☐ Passive				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A	
Remarks:				
2. Gas Monitoring Probes:				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A	
Remarks:				
3. Monitoring Wells:				
☒ Properly secured/locked	☒ Functioning	☒ Routinely sampled	☒ Good Condition	
☐ Evidence of leakage at penetration		☐ Needs maintenance	☐ N/A	
Remarks:				
4. Leachate Extraction Wells:				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good Condition	
☐ Evidence of leakage at penetration		☐ Needs maintenance	☒ N/A	
Remarks:				
5. Settlement Monuments: ☐ Located		☐ Routinely Surveyed ☒	N/A	
Remarks:				
E. Gas Collection and Treatment	☐ **Applicable**	☒ **N/A**		
F. Cover Drainage Layer	☐ **Applicable**	☒ **N/A**		
G. Detention/Sedimentation Ponds	☐ **Applicable**	☒ **N/A**		
H. Retaining Walls	☐ **Applicable**	☒ **N/A**		

Attachment D-1. Five-Year Review Site Inspection Checklist – Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENT *(Continued)*
I. Perimeter Ditches/Offsite Discharge ☒ **Applicable** ☐ **N/A**
1. Siltation: ☐ Location shown on site map ☒ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth: ☐ Location shown on site map ☐ N/A ☒ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure: ☐ Location shown on site map ☒ N/A Remarks:_____
VIII. Vertical barrier Walls ☐ **APPLICABLE** ☒ **N/A**
IX. Groundwater/Surface Water Remedies ☒ **APPLICABLE** ☐ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**
C. Treatment System ☐ **Applicable** ☒ **N/A**
D. Monitoring Data ☒ **Applicable** ☐ **N/A**
1. Monitoring Data: ☒ Is routinely submitted on time ☒ Is of acceptable quality
2. Monitoring Data Suggests: ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining
E. Monitored Natural Attenuation ☒ **Applicable** ☐ **N/A**
1. Monitoring Wells (natural attenuation remedy): ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
X. OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Soil Vapor Extraction System ☐ **Applicable** ☒ **N/A**

Attachment D-1. Five-Year Review Site Inspection Checklist – Attachment D-1. Five-Year Review Site Inspection Checklist – Chemicals, Metals, and Pesticides (CMP) Pits (080-170G, -171G, -180G, -181G, -182G, -183G, and -190G) Operable Unit *(continued/end)*

XI. 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.
XII. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedial action for CMP Pits groundwater is MNA and LUCs to prevent exposure to contaminated groundwater above MCLs; the selected remedy for the Ballast Area is LUCs to prevent direct contact to PCB-contaminated soils above concentrations of 1 mg/kg. A combination of ERH to remove DNAPL and operation of the SVE system for Source Area (Field A) and of the passive soil vapor extraction system via BaroBalls™ for Source Area (Field B) have concluded their operation. The remedy is effective and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual (2020-2024) site inspections and site maintenance (addressing active ant mounds, removing overgrown vegetation and sediment in the drainage culvert) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the CMP Pits OU and the condition of its warning signs is good. There are no issues requiring corrective actions. 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. The well sampling schedules were not impacted.
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

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 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 - 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 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 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 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 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-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 had an exceedance of PCE above the MCL (5µg/L) in 2023. 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) was held on February 27, 2025. SRNS personnel were also present in the meeting. During the meeting, the participants viewed drone footage of DOSB OU and 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 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 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 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

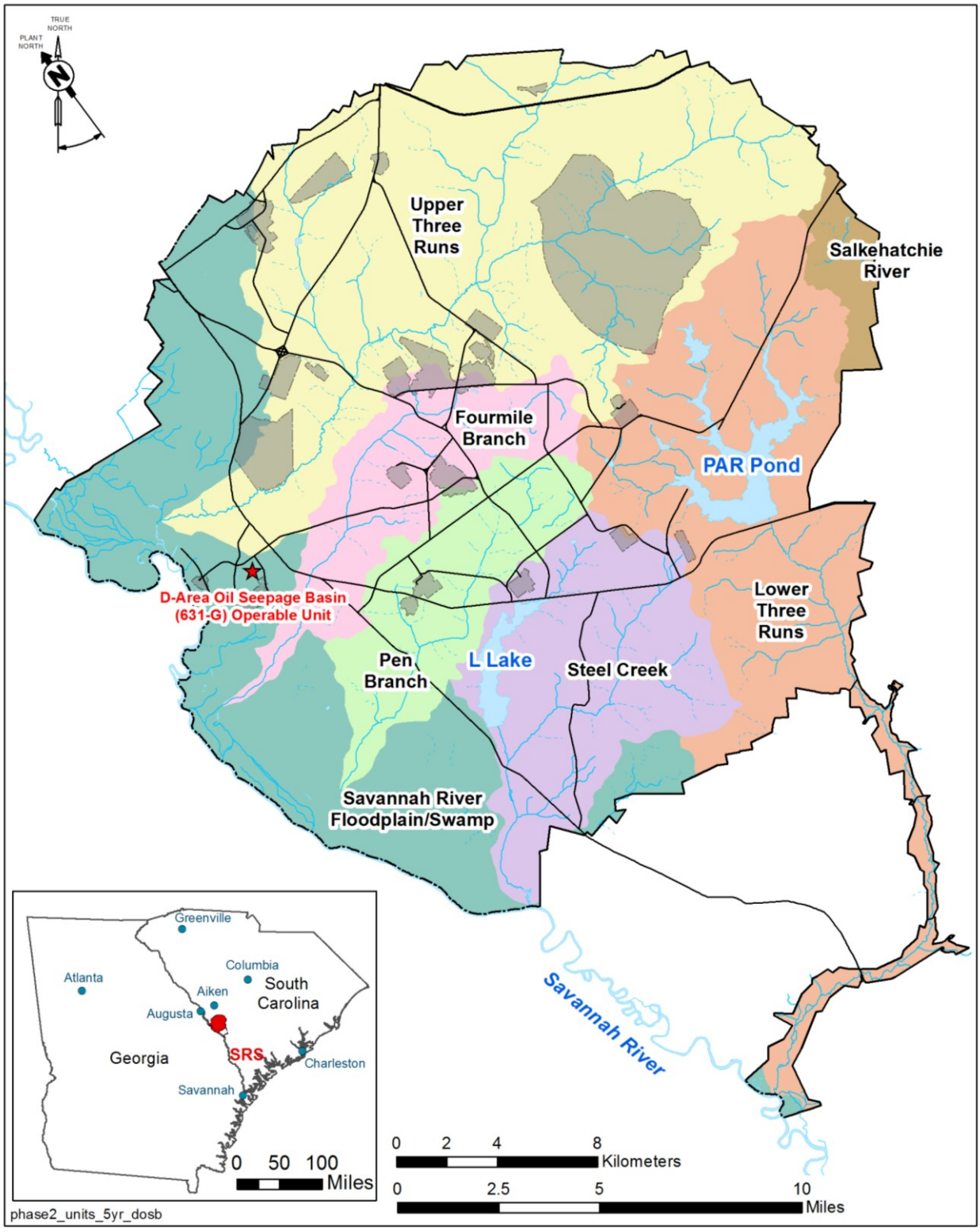


Figure E-1. Location of the D-Area Oil Seepage Basin Operable Unit within SRS

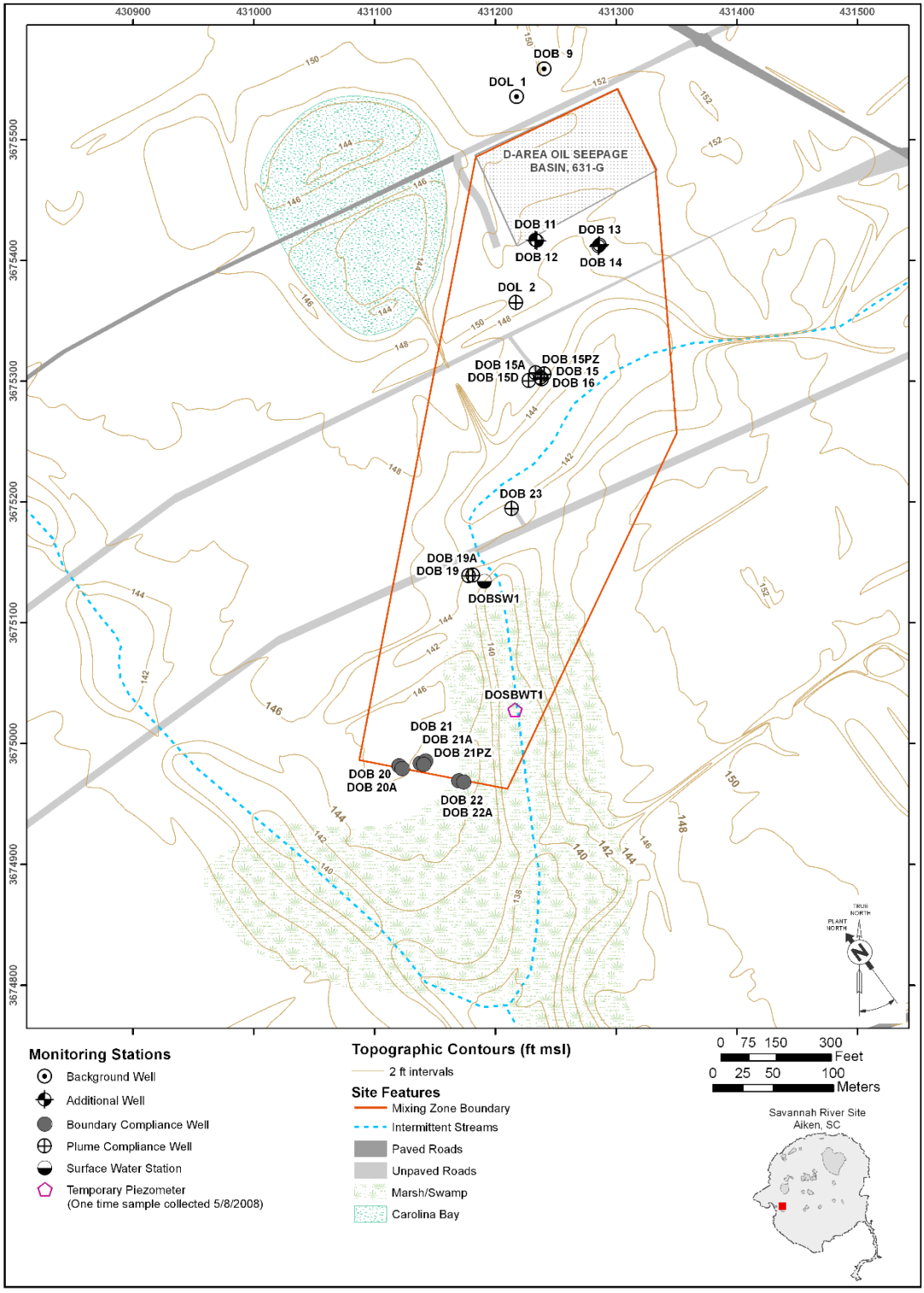


Figure E-2. D-Area Oil Seepage Basin Monitoring Well Location Map



Figure E-3. Photo of the D-Area Oil Seepage Basins Prior to 1975 Backfill Operations

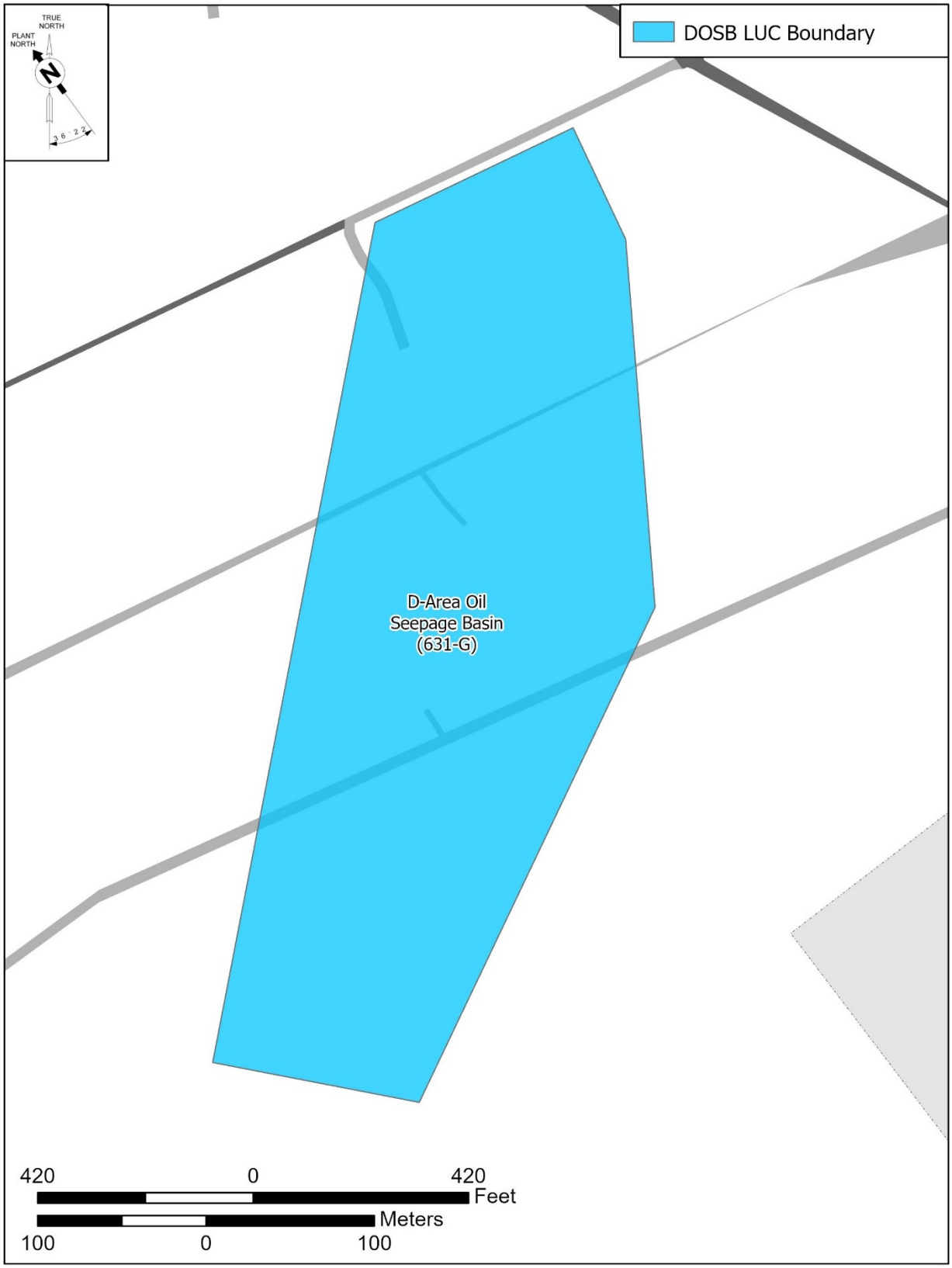


Figure E-4. Land Use Control Boundary for the DOSB OU



Figure E-5. Current (2024) Photographs of the DOSB

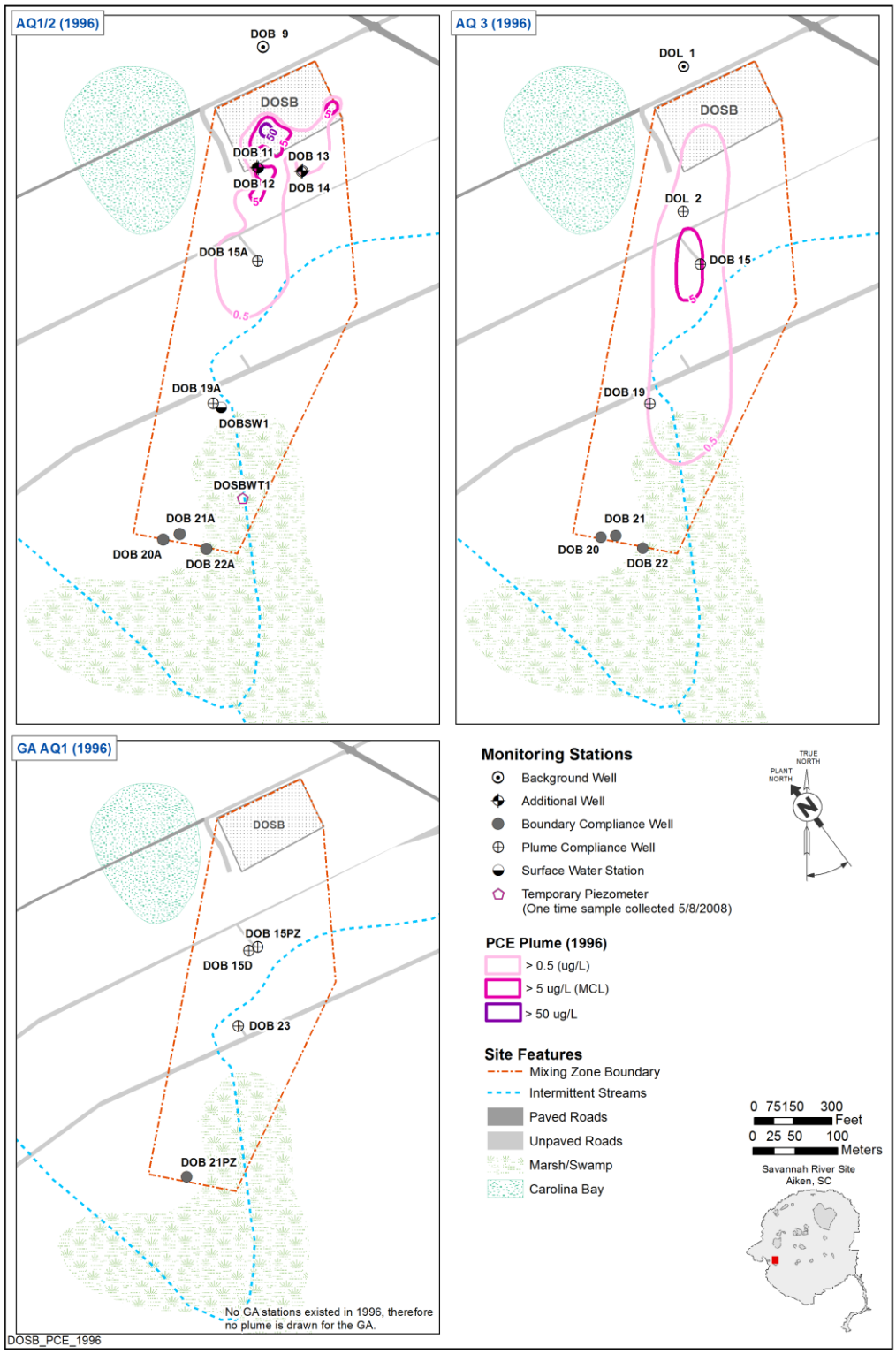


Figure E-6. DOSB PCE plume maps (1996 data) for Aquifers AQ1/2, AQ3, and GA-AQ1 (WSRC 1997a)

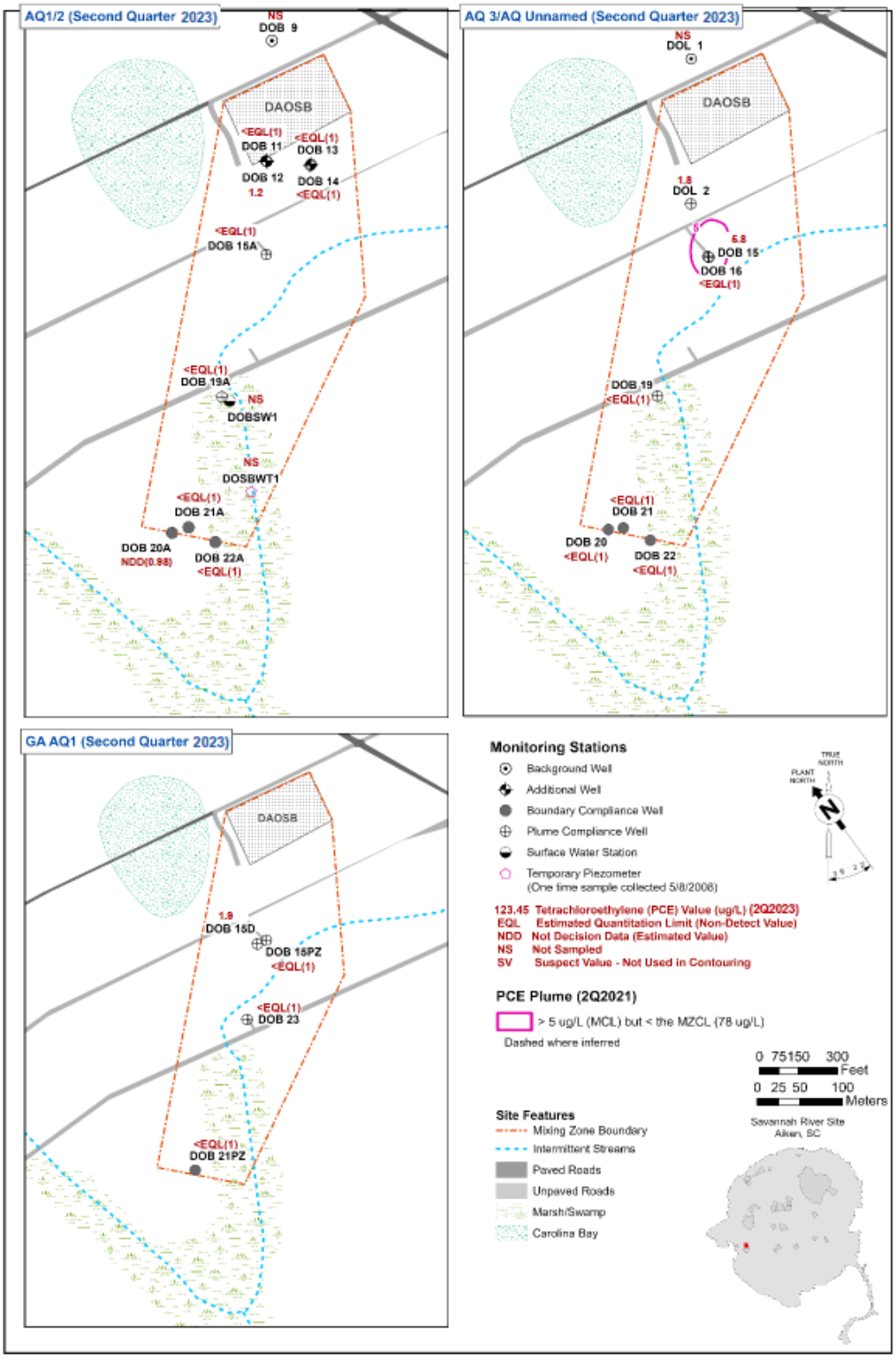


Figure E-7. DOSB PCE plume maps (2023 data) for Aquifers AQ1/2, AQ3, and GA-AQ1 (USDOE 2015)

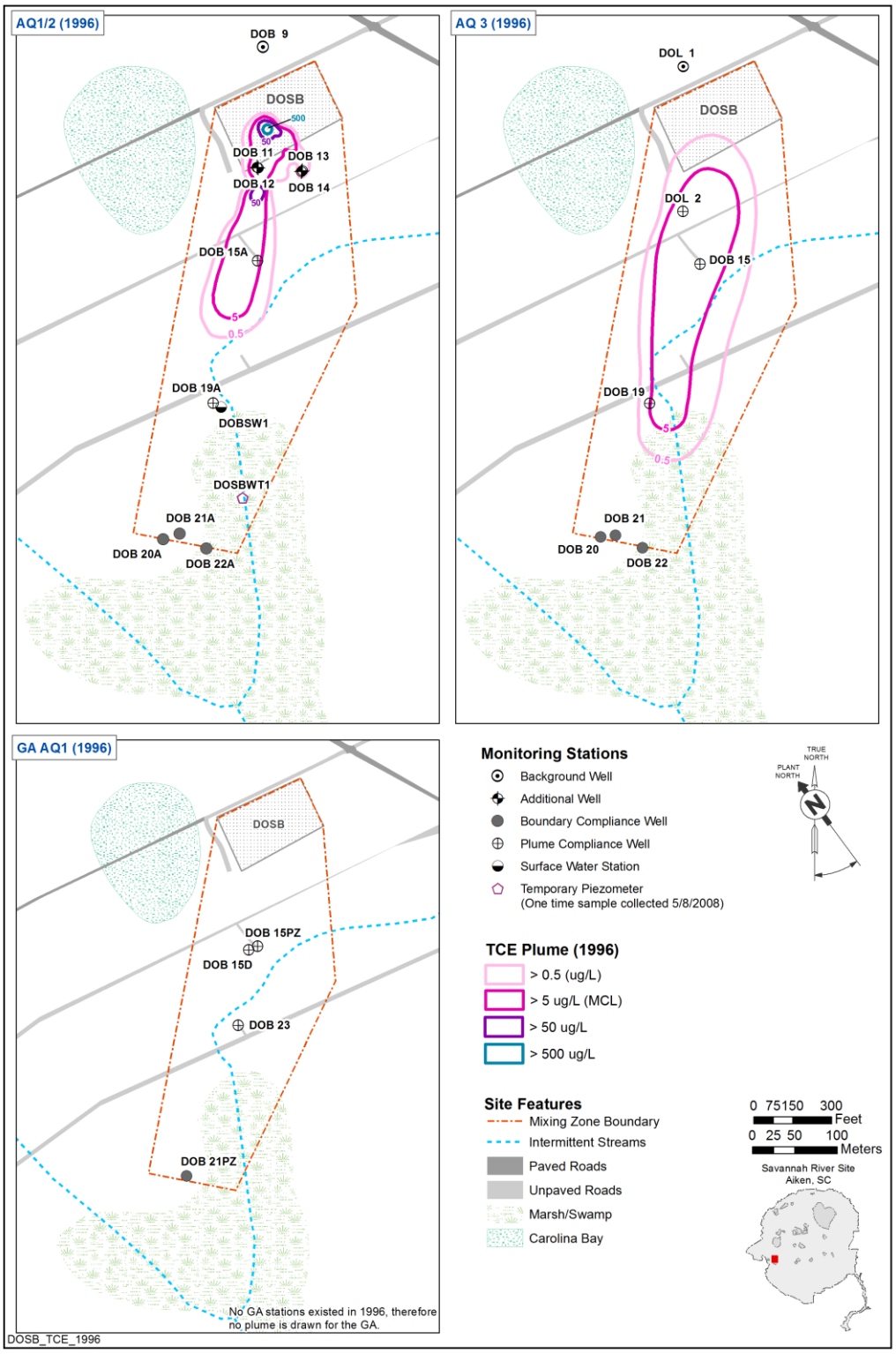


Figure E-8. DOSB TCE plume maps (1996 data) for Aquifers AQ1/2, AQ3, GA-AQ1 (WSRC 1997a)

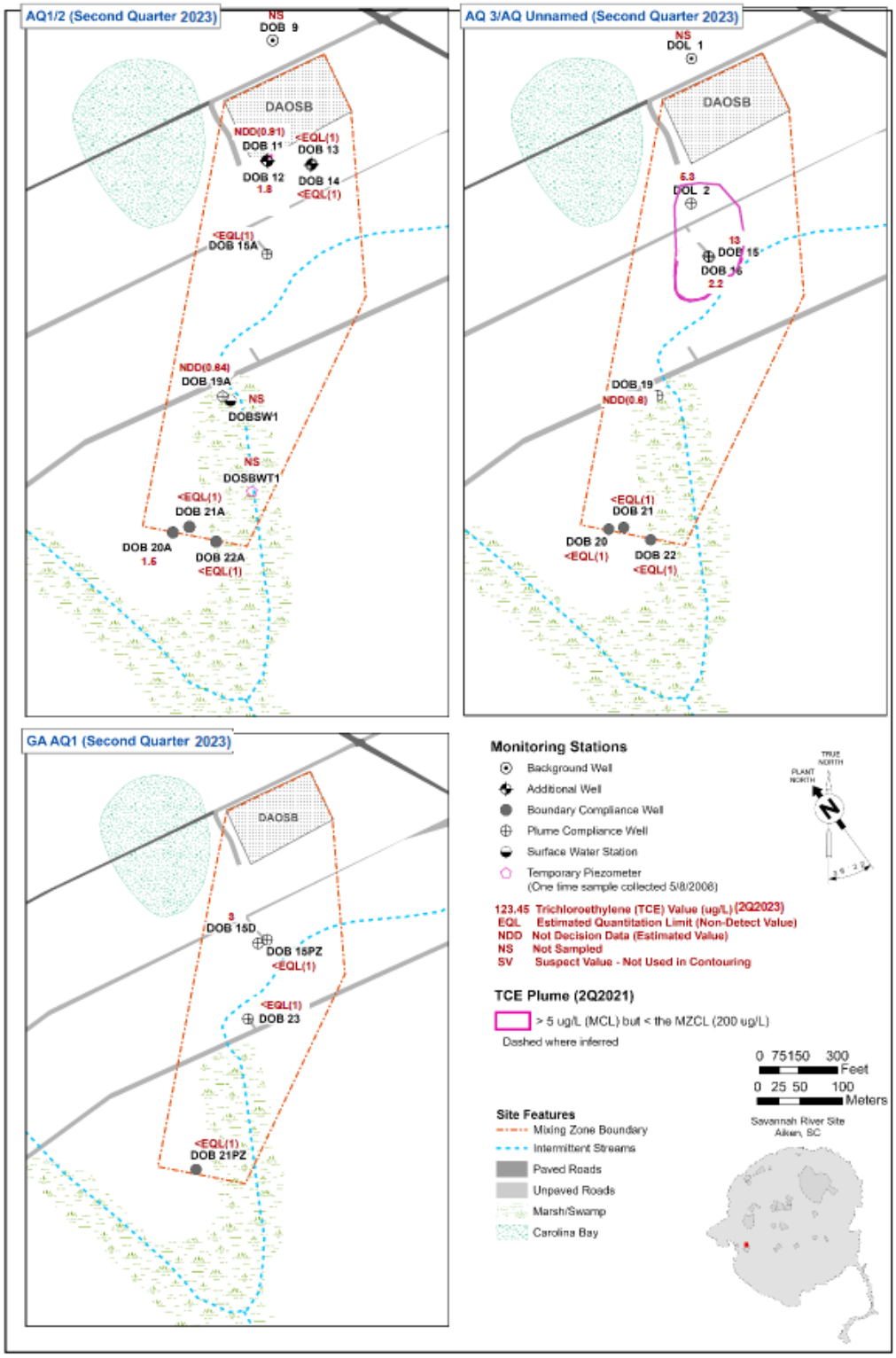


Figure E-9. DOSB TCE plume maps (2023 data) for Aquifers AQ1/2, AQ3, and GA-AQ1 (USDOE 2019)

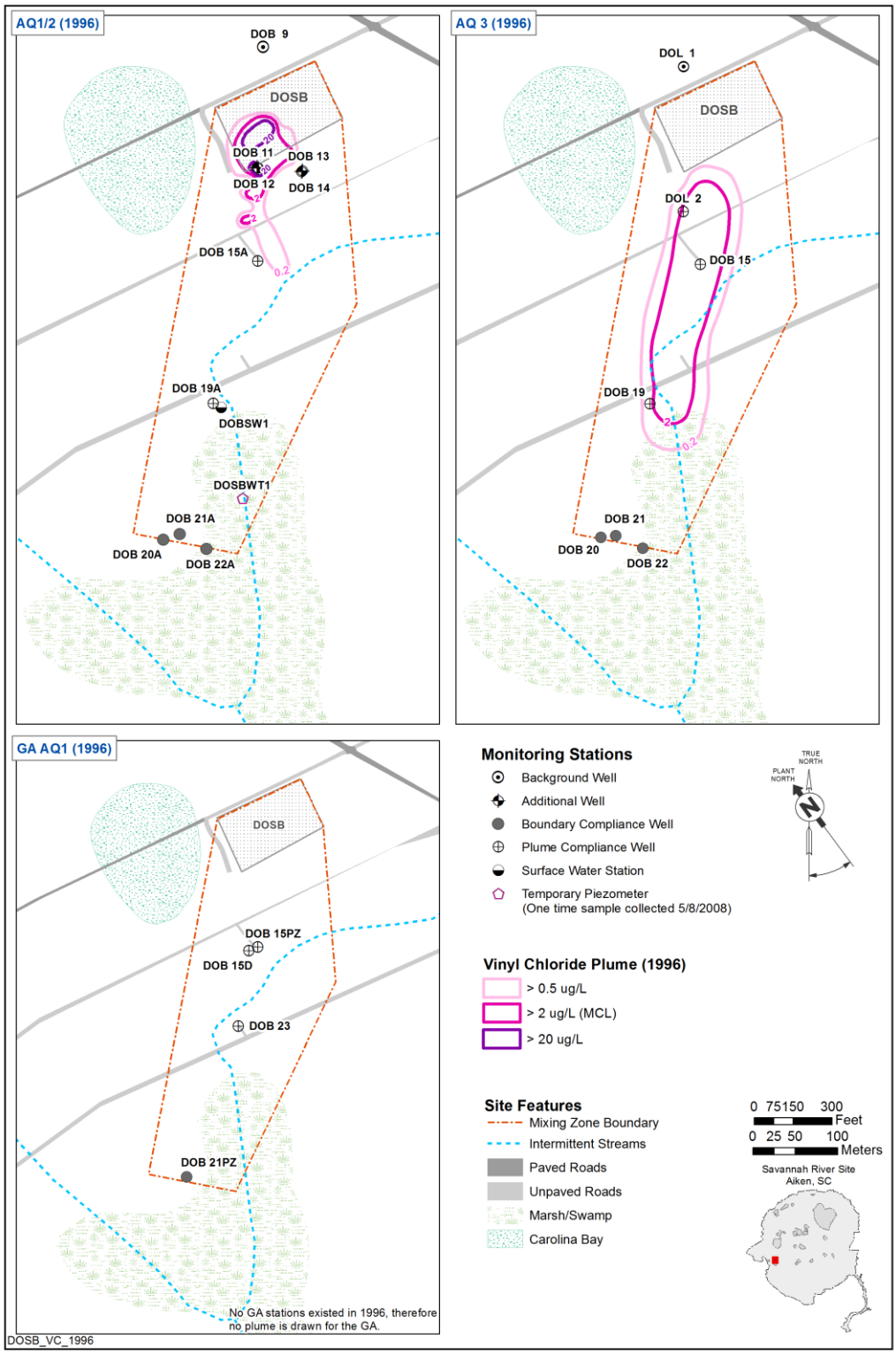


Figure E-10. DOSB Vinyl Chloride Plume Maps (1996 data) for Aquifers AQ1/2, AQ3, and GA-AQ1 (WSRC 1997a)

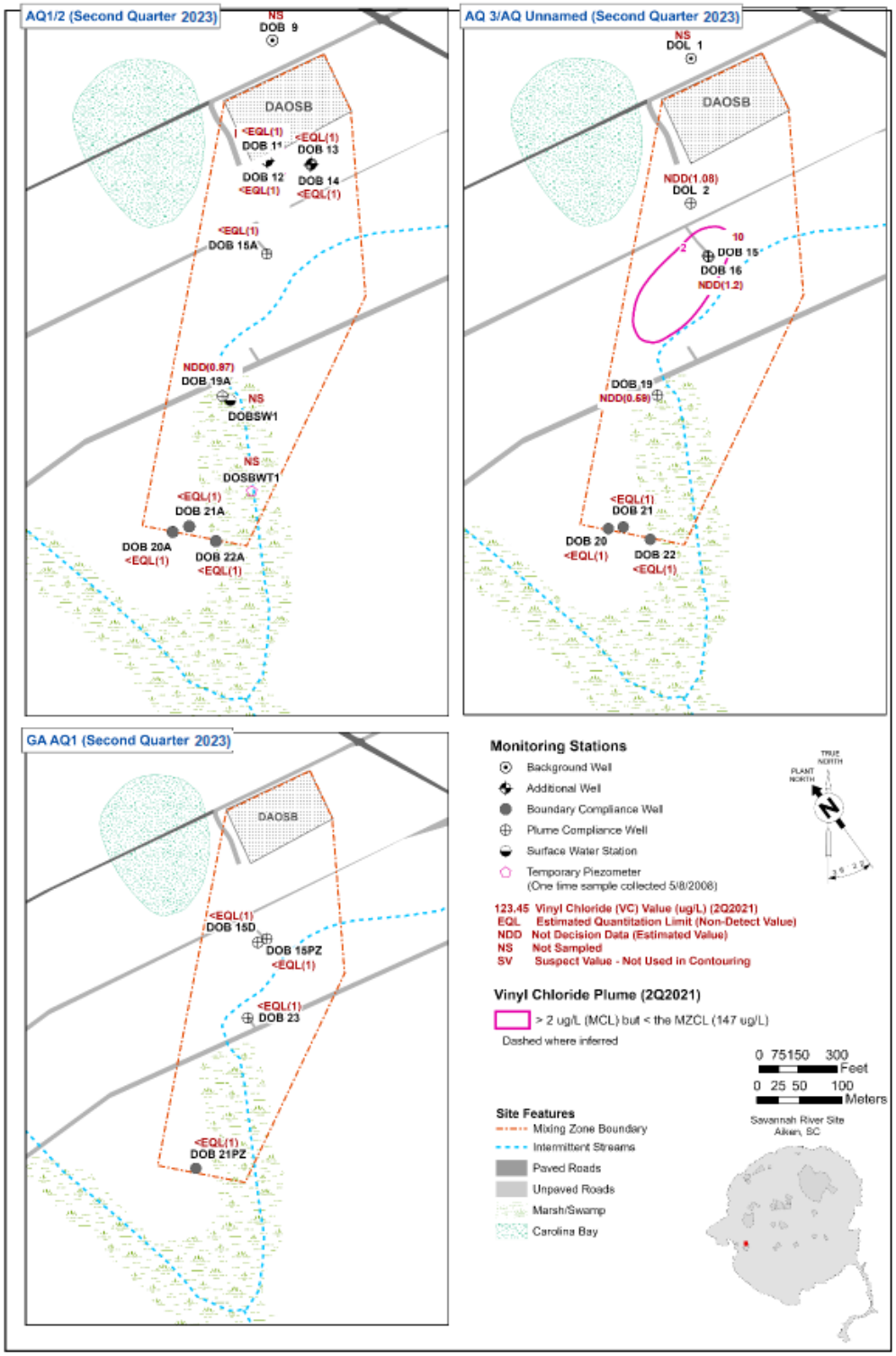


Figure E-11. DOSB Vinyl Chloride Plume Maps (2023 data) for Aquifers AQ1/2, AQ3 and GA-AQ1 (USDOE 2019)

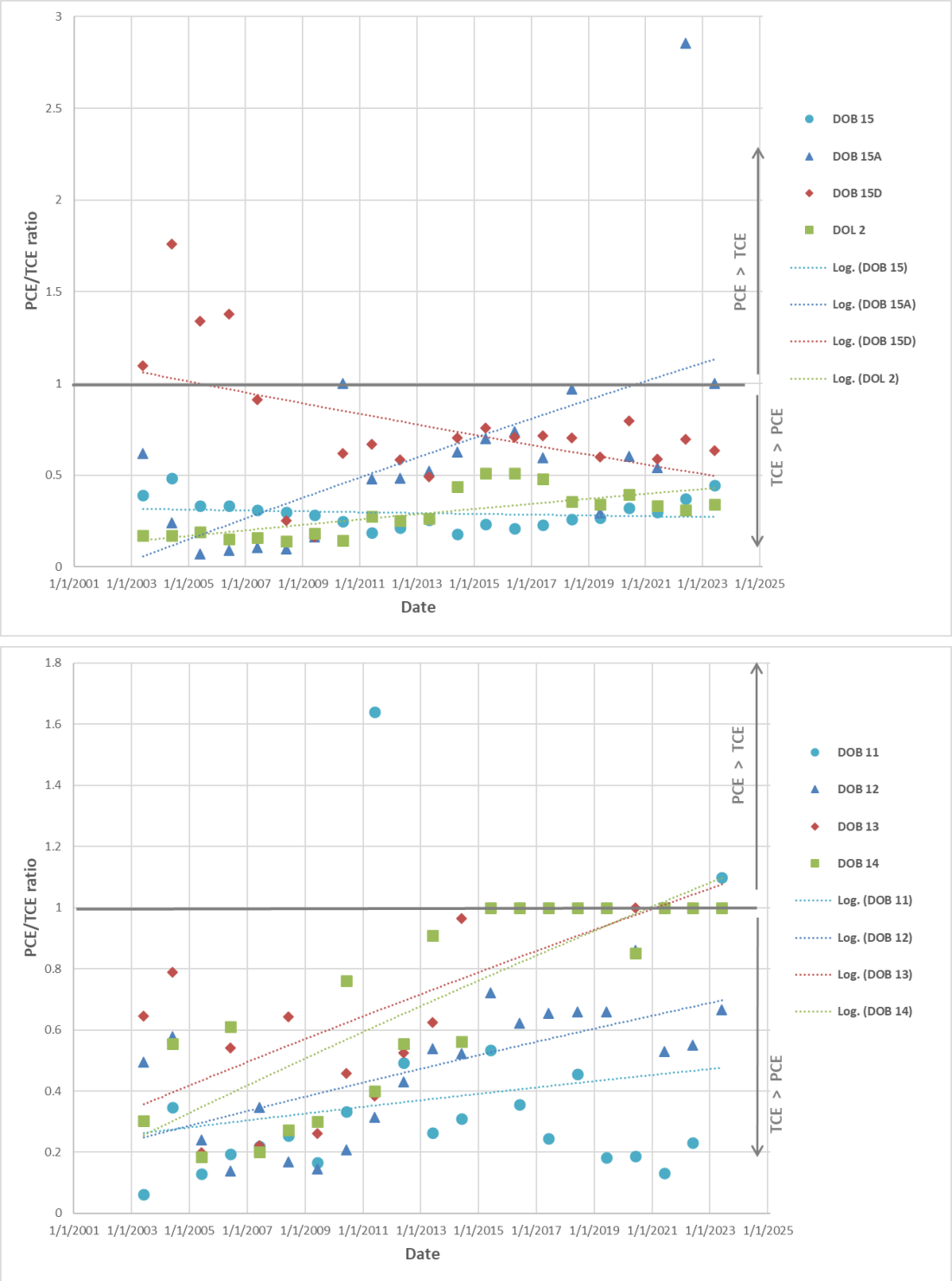


Figure E-12. Ratio of PCE verses TCE Concentrations for Plume Compliance Wells (DOB 15, 15A, 15D, and DOL 2) and Additional Wells (DOB 11, 12, 13, 14) at the DOSB OU

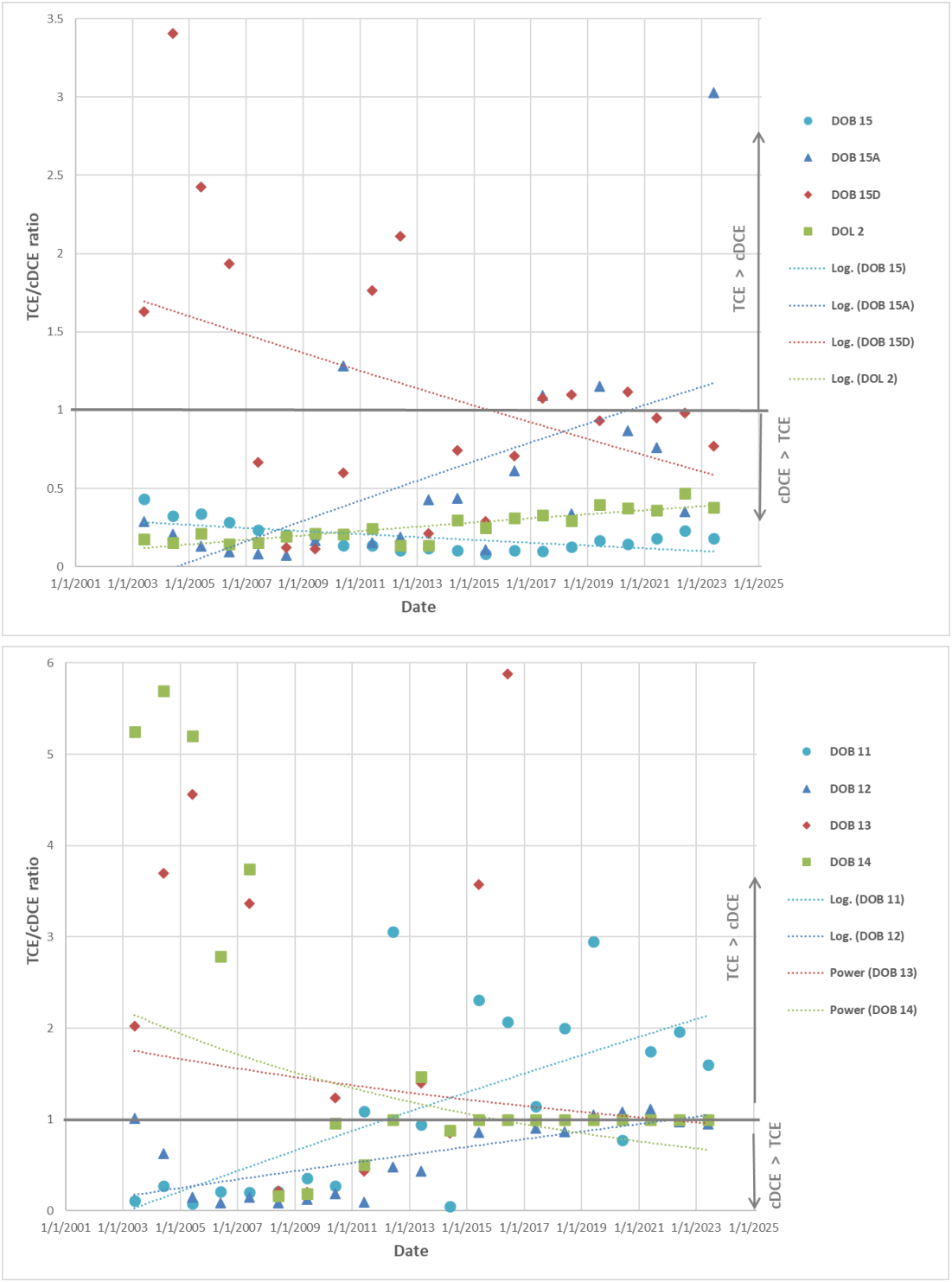


Figure E-13. Ratio of TCE verses cDCE Concentrations for Plume Compliance Wells (DOB 15, 15A, 15D, and DOL 2) and Additional Wells (DOB 11, 12, 13, 14) at the DOSB OU

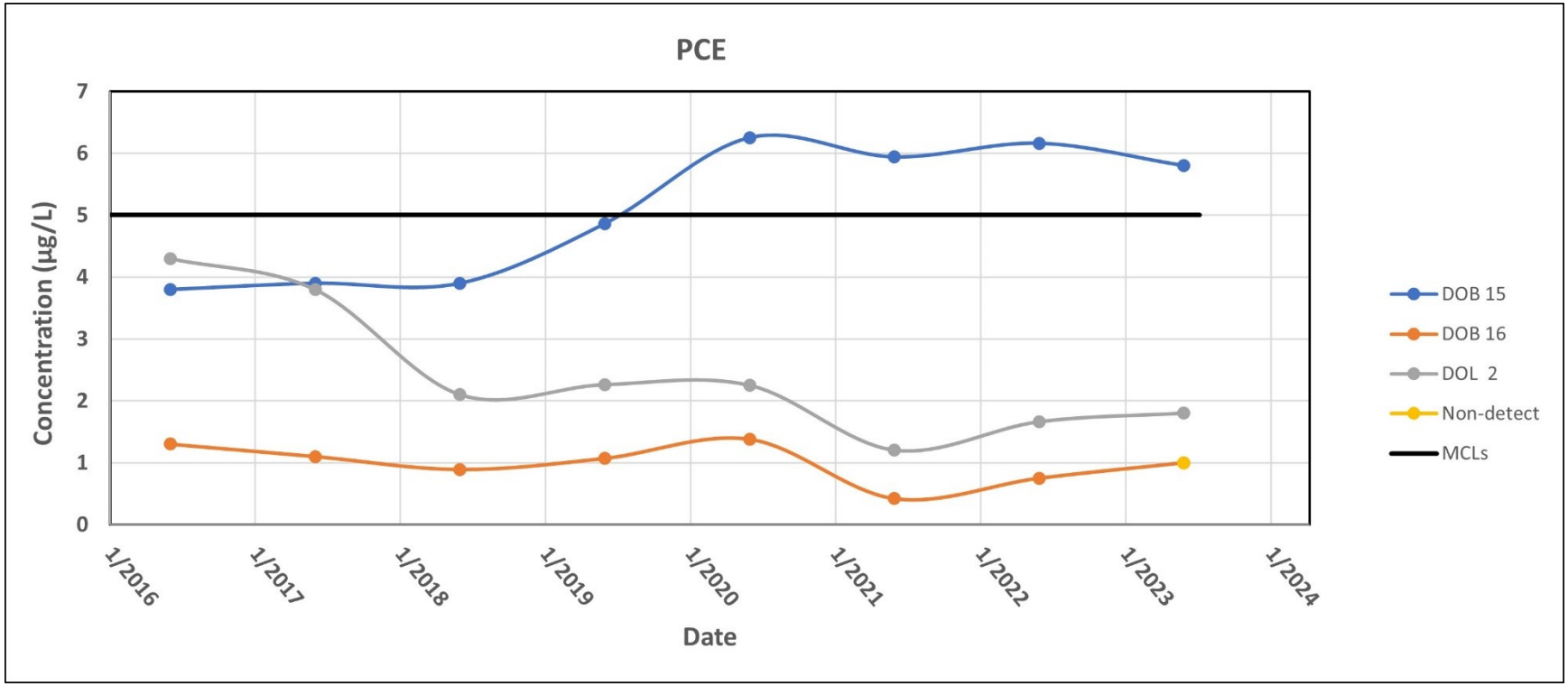


Figure E-14. Time Series Plots of PCE at Wells DOB 15, DOB 16, and DOL 2 at the DOSB OU

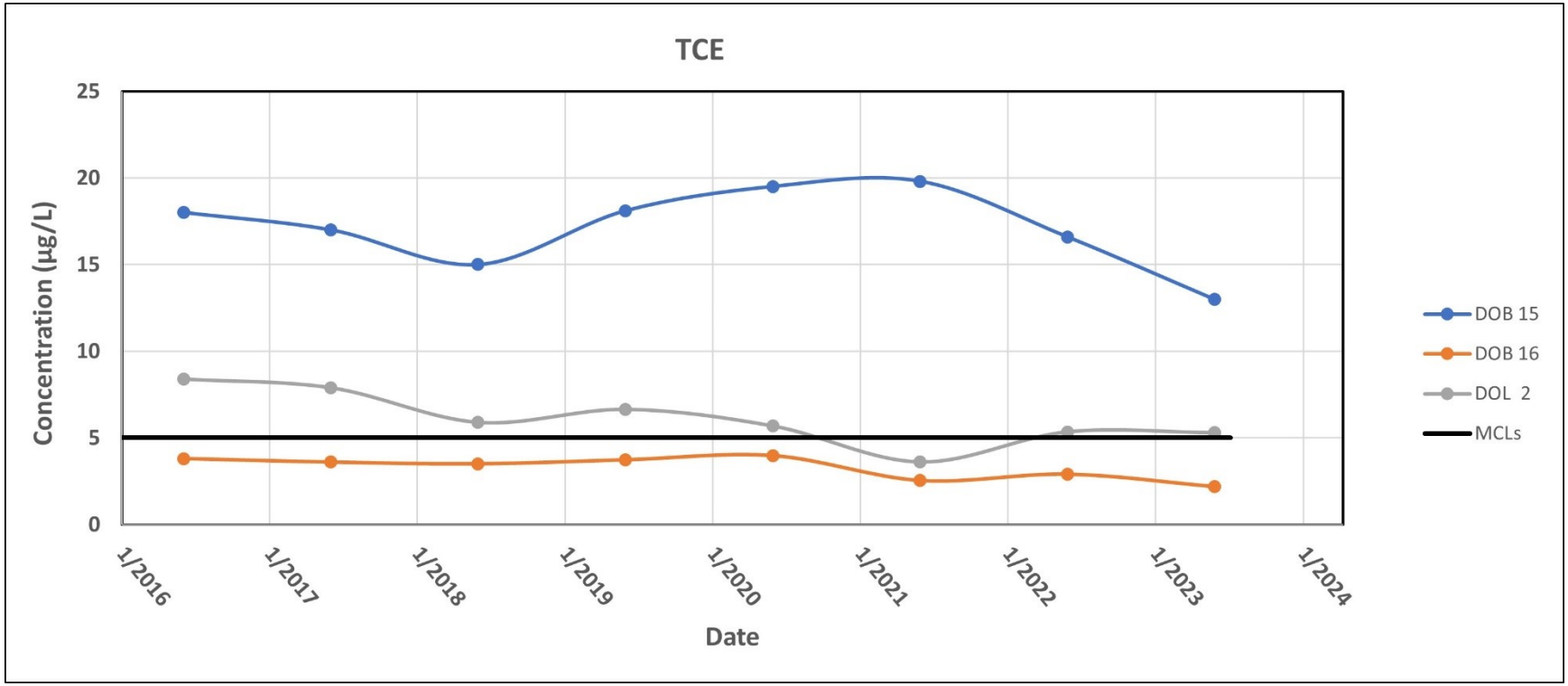


Figure E-15. Time Series Plots of TCE at Wells DOB 15, DOB 16, and DOL 2 at the DOSB OU

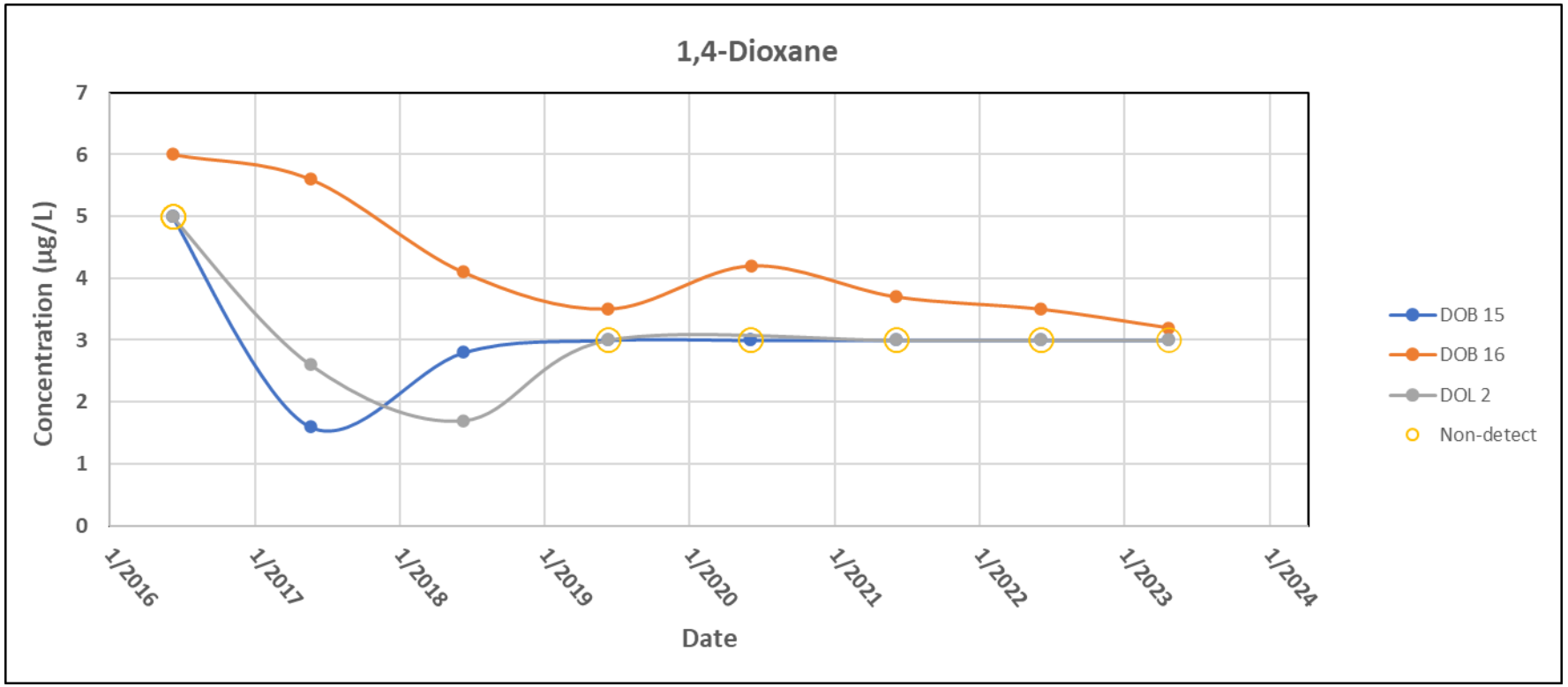


Figure E-16. Time Series Plots of 1,4-Dioxane at Wells DOB 15, DOB 16, and DOL 2 at the DOSB OU

Table E-1. Chronology of OU Events

Event	Date
RFI/RI Field Start/Complete	December 1995 / April 24, 1998
IROD Signature	March 6, 1995
Interim Remedial Action Start/Complete	August 13, 1996 / December 31, 1999
Final ROD Issuance	May 7, 1999
Remedial Action Start/Complete	September 3, 1999/ January 13, 2000
Previous Five-Year Remedy Reviews	August 27, 1997 / February 12, 2004 / January 28, 2009 / February 4, 2014 / February 2, 2017 / December 9, 2020

Table E-2. Final COCs with Selected Cleanup Levels

Final COCs	Maximum Concentration Detected (µg/L)	Average Concentration in Groundwater (2019-2023) (µg/L)	Selected Cleanup Levels (µg/L)
Tetrachloroethylene (PCE)	6.25	2.12	5.0
Trichloroethylene (TCE)	30.4	6.12	5.0
cis-1,2-Dichloroethene	136	16.65	70.0
Vinyl chloride	19.2	3.06	2.0
Benzene	2	0.47	5.0
Dichloromethane	5	1.05	5.0

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

	FY2020	FY2021	FY2022	FY2023	FY2024	Five-Year Total
Total Actual O&M Costs ($)	57,615	44,407	41,989	59,494	56,081	259,587
Total ROD Estimated Direct O&M Costs ($)	0	0	0	0	16,666[a]	16,666

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

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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Attachment E-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) Operable Unit

I. SITE INFORMATION			
Site Name:	**D-Area Oil Seepage Basin (631-G) Operable Unit**	**Date of Inspection:**	**9/10/24**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #27**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**Sunny 83**

Remedy Includes: *(Click all that apply)*

- ☐ Landfill Cover/Containment
- ☐ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Groundwater Mixing Zone Monitoring

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

II. INTERVIEWS (CLICK ALL THAT APPLY)

1. O&M Site Manager: Brian Hanshew (Name) — EC&ACP Post Closure Waste Site O&M Site Manager (Title) — 10/22/2024 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4949

Problems/Suggestions: ☐ Report Attached

2. O&M Staff: Eric Barron (Name) — EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) — 10/22/2024 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3395

Problems/Suggestions: ☐ Report Attached

Attachment E-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) Operable Unit *(continued)*

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

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

On 10/22/2024, the EC&ACP Post Closure Waste Site Inspector/Maintenance Coordinators, Harold Rodgers (803-953-3363) and Donald Sahm (803-952-4145), were also interviewed.

III. ONSITE DOCUMENTS & RECORDS VERIFIED (CLICK ALL THAT APPLY)

1. O&M Documents:

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

Remarks: Site Inspections for the surface unit portion of DOSB are not required by the ROD or LUCIP since the DOSB currently meets unrestricted land use criteria for soils, sediment and surface water. Site inspections performed are for the monitoring wells and the Five-Year Remedy Review Reports.

2. Health and Safety Plans (HASPs):

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

Remarks: Routine O&M activities do not require a Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response. A SSHASP is prepared if needed.

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

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

4. Permits and Service Agreements:

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

Remarks: _____

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

Remarks: _____

Attachment E-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) Operable Unit *(continued)*

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

6. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A
Remarks: _____

7. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A
Remarks: _____

8. Discharge Compliance Records:
- ☐ Air ☐ Readily Available ☐ Up to Date ☒ N/A
- ☐ Water (Effluent) ☐ Readily Available ☐ Up to Date ☒ N/A

Remarks: _____

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

IV. O&M Costs

10. O&M Organization:
- ☐ State In-House ☐ Contractor for State
- ☐ PRP In-House ☐ Contractor for PRP
- ☒ Other: SRS

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

12. Unanticipated or Unusually High O&M Costs During Review Period
Describe costs and reasons: N/A

Attachment E-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ **APPLICABLE** ☐ **N/A**

A. Fencing

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

Remarks: Gate and fencing around DOSB perimeter, although present, is not required. The fencing is a holdover from previous operations.

B. Signs

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

Remarks:

C. Institutional Controls

1. Implementation and Enforcement

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

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

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

Frequency: Once every five years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Khari Bell (Name) | Operable Unit Manager (Title) | 12/03/2024 (Date) | 803-952-5085 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks:

Attachment E-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

D. General

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

2. Land use changes onsite: ☒ N/A
Remarks: _____

3. Land use changes offsite: ☒ N/A
Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ **Applicable** ☐ **N/A**

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

A. Other Site Conditions

Remarks: _____

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

VIII. VERTICAL BARRIER WALLS ☐ **APPLICABLE** ☒ **N/A**

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **APPLICABLE** ☐ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**

C. Treatment System ☐ **Applicable** ☒ **N/A**

D. Monitoring Data ☒ **Applicable** ☐ **N/A**

1. Monitoring Data:
☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data Suggests:
☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒ **Applicable** ☐ **N/A**

1. Monitoring Wells (natural attenuation remedy):
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs maintenance ☐ N/A
Remarks: _____

Attachment E-1. Five-Year Review Site Inspection Checklist – D-Area Oil Seepage Basin (631-G) Operable Unit *(continued)*

X. OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Soil Vapor Extraction System ☐ **Applicable** ☒ **N/A**

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedial action for DOSB OU deep soil is considered no further action since RAOs have been achieved by the IRA and bioventing testing. The remedy for shallow soil, surface water, and sediment is no action because no COCs in those media were identified in the RFI/RI Report and Baseline Risk Assessment Report. The remedy for DOSB OU groundwater is monitored natural attenuation/groundwater mixing zone with institutional controls (i.e., LUCs). Results from the bioventing study indicate that the source of groundwater contamination (i.e., contaminants in the DOSB OU soil) was significantly reduced, as a result of the combined IRA and bioventing test, and no longer contributes to groundwater contamination. The remedy is effective and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Monitoring data indicates consistency with the modeling predictions from the GWMZ application. The concentrations should continue to decrease within the heart of the plume through natural attenuation to levels at or below MCLs. The O&M procedures consisting of site maintenance and site controls (SRS Site Use/Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the DOSB OU. There are no issues requiring corrective actions. 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. The well sampling schedules were not impacted.
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

APPENDIX F. L-AREA SOUTHERN GROUNDWATER OPERABLE UNIT

I. INTRODUCTION

This report is the fifth five-year remedy review for the L-Area Southern Groundwater (LASG) Operable Unit (OU). The review was conducted from June 2024 through December 2024. Contaminants have been left in place at the LASG OU at levels that do not allow for unlimited use and unrestricted exposure. The purpose of this review is to determine whether the remedy in place at the LASG OU is protective of human health and the environment. This report documents the results of the review.

II. OU CHRONOLOGY

Table F-1 lists the chronology of site events for the LASG OU.

III. BACKGROUND

The LASG OU is a Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media of concern is local groundwater. Surface water downgradient of the LASG OU is monitored to evaluate the effectiveness of the selected remedy.

Physical Characteristics

L Area is located in the southcentral portion of the SRS in Barnwell County, South Carolina (Figure F-1). LASG OU encompasses the groundwater from the L-Area groundwater divide south to L-Lake (Figure F-2). The original pre-work plan characterization outline for the LASG OU covered about 508 hectares (1,250 acres) and included several remediated/depleted source units, which supported past production activities (WSRC 2005). Groundwater characterization included the review of analytical data from 93 monitoring wells and 109 cone penetrometer technology (CPT) locations within the LASG OU (Figure F-3) between January 2000 and January 2004. The majority of the sampling occurred in 2000.

Operation activities in L Area have resulted in three contaminant plumes in the local groundwater:

- Western tritium plume, which originated at the L-Area Emergency Retention Basin (LAERB);
- Southwest commingled volatile organic compounds (VOCs) and tritium plume, which originated in the vicinity of the L-Area Disassembly Basin (LADB); and
- Southeast commingled VOCs and tritium plume, with likely sources from the L-Area Reactor Seepage Basin (LRSB), L-Area Oil and Chemical Basin (LAOCB), and L-Area Hot Shop (LAHS).

There are no active sources of groundwater contamination in the LASG OU. Historical sources have been remediated, depleted, or reconditioned for new missions.

Land and Resource Use

The land use control boundaries for LASG OU are predominantly outside of the industrial area for L-Area. However, shallow groundwater and surface water at SRS are not used for drinking water, hygiene, recreation, or process water. According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The future land use for this OU is reasonably anticipated to be industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

The L-Area Reactor achieved criticality in August 1954 and operated from 1954 to 1968 and 1984 to 1988. Tritium was produced in the reactor and VOCs were used as solvents and degreasers. Past activities at or near the source units listed above (LAERB, LADB, LRSB, LAOCB, and LAHS) have resulted in groundwater contamination in LASG OU. The tritium and VOC plumes are shown in Figure F-2.

The primary historical sources of contamination in the groundwater in the LASG OU have been remediated or depleted. Subsurface soils beneath these remediated waste sites were

the secondary sources of groundwater contamination. The contamination history of the source units is discussed below:

- The LAERB is no longer active and was never used as designed; however, tritiated water was released to the basin during testing in the 1980s. Rainwater flushed the original tritium source out of the unit into the groundwater through the permeable bottom of the basin.
- Groundwater in the vicinity of the LADB was previously contaminated by leaks and spills associated with previous operations. Upgrades to equipment and handling processes support its current mission as an active facility. Current data indicate the LADB is not an active source of groundwater contamination as tritium concentrations in adjacent wells have dramatically decreased from historical values. The LADB is being monitored for any new releases related to its new mission under a separate program.
- The LRSB is a L-shaped unlined earthen basin that was designed to hold contaminated wastewater from L-Area reactor operations that was not appropriate for discharge to local streams due to elevated radiological activity. Discharges to the LRSB were conducted from 1958 to 1968 and from 1985 to 1988. Contaminated soils posed a potential contaminant migration concern to groundwater. Contaminated soils and pipelines were consolidated in the basins and a low permeability soil cover was installed to reduce water infiltration while natural radioactive decay reduces the contaminant levels.
- The LAHS was primarily used for repairing equipment from the reactor areas, which may have been contaminated with radionuclides. Radionuclides deposited on the concrete floors of the LAHS buildings and the associated storage facilities and in the drain lines appear to be the primary source material. Remediation was completed in 2005, which consisted of the removal of contaminated drain lines, concrete floor slabs, and soils. Clean topsoil and vegetation were placed in the area.
- The LAOCB was constructed in 1961 as an unlined seepage basin to receive wastewater from the LAHS. The LAHS discharged decontamination wastewater

containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin. It also received wastewater from other areas of SRS that were transported in drums and tanker trucks, which included liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater. The LAOCB remained active until 1979. Remediation of the LAOCB was completed in 2001 and included consolidation of contaminated material, in-situ stabilization by grouting soil, and installation of a low permeability soil cover system.

Initial Response

There was no initial response for the LASG OU. There are no active sources of groundwater contamination in the LASG OU. Historical sources have been remediated, depleted, or reconditioned for new missions.

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 LASG OU.

The refined constituents of concern (RCOCs) for groundwater at LASG OU are tritium, tetrachloroethylene (PCE), and trichloroethylene (TCE). The highest contaminant levels observed in local groundwater, broken into four groups (Pre-remedial investigation [RI], RI, Post-RI, present), are summarized in Table F-2. CPT data are included in the pre-RI data set and contain high tritium values that are not seen in the monitoring well network; therefore, the pre-RI and RI tritium concentrations vary significantly. The cleanup levels for LASG OU are the MCLs as listed in Table F-2.

The bulk of contaminated groundwater is confined to the portion of the Upper Three Runs aquifer above the tan clay. Figure F-2 shows the LASG OU plumes. The western plume is only contaminated with tritium while the two plumes directly downgradient southwest and southeast of L Area are contaminated with tritium, PCE, and TCE. The analytical results for these three constituents are summarized in Table F-2. Surface water sample stations are shown on Figure F-2 and the results for tritium at these stations are listed in

Table F-3; SC26 and SC27 are at the L-Lake dam standpipe and spillway, respectively. PCE and TCE have not been detected in the surface water, except once in 2010 at station SC24 at levels below 1 µg/L.

Exposure of future industrial workers and/or residents to TCE, PCE, and tritium in groundwater above their respective MCLs could increase the risk of cancer. If land use controls (LUCs) are not maintained, exposure could occur through ingestion, dermal contact, and inhalation of contaminated groundwater. Groundwater contamination was evaluated against MCLs based on South Carolina Department of Environmental Services (SCDES) groundwater regulation R.61-58.5, which is protective for both future residential and future industrial scenarios.

IV. REMEDIAL ACTIONS

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 2007a), the selected remedy for the LASG OU is monitored natural attenuation (MNA) with institutional controls (i.e., LUCs). The selected remedial action for the LASG OU will address both of the commingled VOCs and tritium plumes of L Area and the tritium plume west of L Area. LUCs will minimize the potential for human exposure to contaminated groundwater until MCLs are achieved.

The following remedial action objectives (RAOs) have been identified for the LASG OU:

- Prevent human exposure to groundwater above MCLs.
- Treat and/or mitigate groundwater contaminated above MCLs to reduce the discharge of groundwater exceeding MCLs to L-Lake.

These RAOs are intended to protect current workers and future industrial workers, minimize the impact of groundwater discharging to surface water, and return groundwater to usable conditions. The cleanup levels for the LASG OU contaminants of concern are the MCLs.

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

- Preclude future residential development or potable water use of local contaminated groundwater;
- Maintain the integrity of any current or future remedial or monitoring systems or component such as monitoring wells until cleanup levels are achieved and restrictions are no longer warranted; and
- Prevent access to contaminated groundwater in the area as long as contaminant concentrations exceed MCLs for purposes other than implementing the selected remedy.

Remedy Implementation

The remedial action is meeting the RAOs, by implementing the following activities:

- Established a groundwater monitoring network by installing ten new monitoring wells (WSRC 2007b).
- Established a MNA program to monitor natural attenuation processes (dispersion, dilution, and radioactive decay) which are occurring at the LASG OU and are effective in reducing contaminant concentrations below remedial goals. Twenty-six groundwater monitoring wells and five surface water monitoring stations (Figure F-2) make up the monitoring network. Details of the requirements for MNA monitoring at the LASG OU are presented in the Effectiveness Monitoring Plan (EMP) (WSRC 2008) and the subsequent addendum to the EMP (SRNS 2013).
- There are no active, continuing sources of groundwater contamination at the LASG OU. As stated in the EMP, one of the groundwater monitoring data quality objectives is ensuring that there are no releases of contaminants from unknown or existing sources and that remediated or depleted sources are under control. The ROD or post-ROD documents for LRSB (WSRC 2002) and LAOCB (WSRC 1999) both required that evaluation of the effectiveness of those remedies would be addressed through monitoring implemented as part of the LASG OU.
- Established LUCs for 387 hectares (952 acres), which includes implementing LUCs at LASG OU (Figure F-4). This consists of general site access controls (gates, fences,

and patrol at the site boundary), use restrictions via the SRS Site Use/Site Clearance program, and future deed restrictions and notifications to prevent exposure of human receptors to contaminated groundwater if property is transferred to non-federal ownership.

Figure F-5 is a current photograph of a few of the wells monitoring the LASG OU.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Long-term monitoring of groundwater conditions in the plumes and surface water conditions in L-Lake, including maintenance of the monitoring network. The MNA monitoring results are reported via biennial Effectiveness Monitoring Reports (EMRs) or groundwater data summary report letters. MNA will be performed until cleanup levels are achieved (estimated in approximately 2090).
- LUCs are being enforced for all groundwater contaminated above MCLs within the OU and under adjacent portions of L-Lake. Restrictions on the use of groundwater within the LUC outline will be enforced as long as contaminant levels exceed MCLs.

The estimated operation and maintenance (O&M) costs associated with the selected remedy for LASG includes long-term groundwater monitoring and reporting and LUCs (WSRC 2007a). The estimated O&M cost from the ROD since the last remedy review for these activities is $188,040 for Fiscal Year (FY) 2020 through FY2024. The actual O&M cost for FY2020 through FY2024 is $639,467 (Table F-4). The actual costs are higher than expected due to the Effectiveness Monitoring Reports not being included in the estimated costs.

V. PROGRESS SINCE LAST REVIEW

This is the fifth five-year remedy review for the LASG OU. The previous protectiveness statement concluded that because the remedial actions are protective, the LASG OU 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 five-year remedy review:

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed implementation of the remedial action;
- Reviewed all process and performance monitoring data provided by biennial EMRs and provided a technical assessment of whether MNA is functioning as intended by the ROD;
- Inspected the OU, interviewed maintenance personnel, and documented the results on the Inspection Checklist provided in Attachment F-1 with the purpose of assessing the protectiveness of the remedy and the functionality of the access controls; and
- Reviewed changes in standards and to-be-considered guidance.

Data Review

Two biennial EMRs has been submitted and reviewed since the last five-year remedy review (SRNS 2020 and SRNS 2024). These reports included all sample results for tritium, PCE, and TCE collected from monitoring wells and surface water stations during 2018 through 2019 and 2022 through 2023, time-series plots at each station since 1993, and plume maps. In 2022, a biennial data summary letter report was submitted and reviewed; the letter report presented the sampling results from 2020 and 2021 and included plume maps (SRNS 2022).

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 LASG OU during these interviews. The LASG 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 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 was held on February 27, 2025. SRNS personnel were also present in the meeting. During the meeting, the participants viewed drone footage of LASG OU and 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 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.

Additionally, 2020 data results from the LRSB and LAOCB performance monitoring sampling showed there are no contaminant migration concerns associated with their associated surface units (Table F-5; Figure F-8).

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 LASG 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 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 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 LASG OU from being protective.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

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

X. PROTECTIVENESS STATEMENT(S)

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

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater. All threats to contaminated groundwater at LASG OU are being addressed through physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the LASG OU for industrial use only and 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, 2013. *Addendum to the Monitored Natural Attenuation Effectiveness Monitoring Plan for the L-Area Southern Groundwater Operable Unit (NBN)(U)*, SRNS-RP-2012-00857, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS 2014. *Explanation of Significant Differences for the Revision 1 Record of Decision Remedial Alternative Selection for the L-Area Southern Groundwater Operable Unit*

(NBN) (U), SRNS-RP-2012-00736, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *2020 Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the L-Are Southern Groundwater (LASG) Operable Unit (OU) (U) Data from 2018 through 2019*, SRNS-RP-2020-00332, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2022. *Biennial Effectiveness Monitoring Report (Sampling Summary) for the Monitored Natural Attenuation at the L-Area Southern Groundwater Operable Unit, 2020 through 2021*, IACD-22-172, dated August 25, 2022, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2024. *2024 Effectiveness Monitoring Report (EMR) for Monitored Natural Attenuation (MNA) at the L-Are Southern Groundwater (LASG) Operable Unit (OU) (U) Data from 2022 through 2023*, SRNS-RP-2024-00998, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

WSRC, 1999. *Corrective Measures Implementation/Remedial Design Report/Remedial Action Work Plan (CMI/RDR/RAWP) for L-Area Oil and Chemical Basin (904-83G) (U)*, WSRC-RP-97-844, Revision 1.4, Westinghouse Savannah River Company, LLC, Savannah River Site, Aiken SC

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

WSRC, 2004. *Groundwater Flow and Transport Model of the L-Area Southern Groundwater Operable Unit (U)*, WSRC-RP-2004-4082, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2005. *RCRA Facility Investigation/Remedial Investigation for the L-Area Southern Groundwater Operable Unit (U)*, WSRC-RP-2003-4171, Revision 1.1, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007a. *Record of Decision for the L-Area Southern Groundwater Operable Unit (NBN) (U),* WSRC-RP-2006-4052, Revision 1.1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2007b. *Corrective Measures Implementation/ Remedial Action Implementation Plan for the L-Area Southern Groundwater Operable Unit (NBN) (U)*, WSRC-RP-2007-4050, Revision 0, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2008. *Monitored Natural Attenuation Effectiveness Monitoring Plan for the L-Area Southern Groundwater Operable Unit (NBN) (U)*, WSRC-RP-2007-4048, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

WSRC, 2009. *Land Use Control Implementation Plan for L-Area Southern Groundwater Operable Unit (NBN) (U),* WSRC-RP-2007-4049, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC

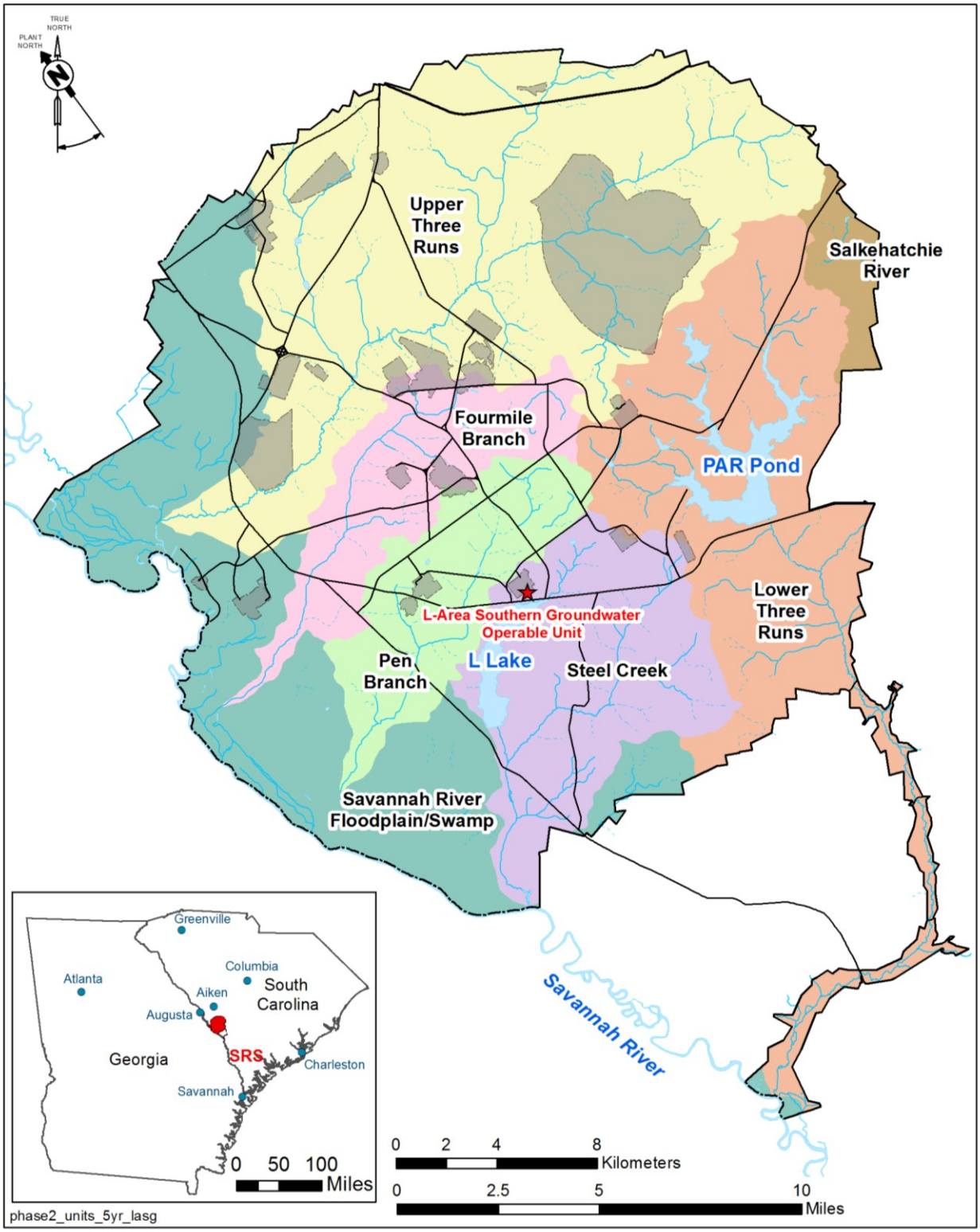


Figure F-1. Location of the L-Area Southern Groundwater OU at SRS

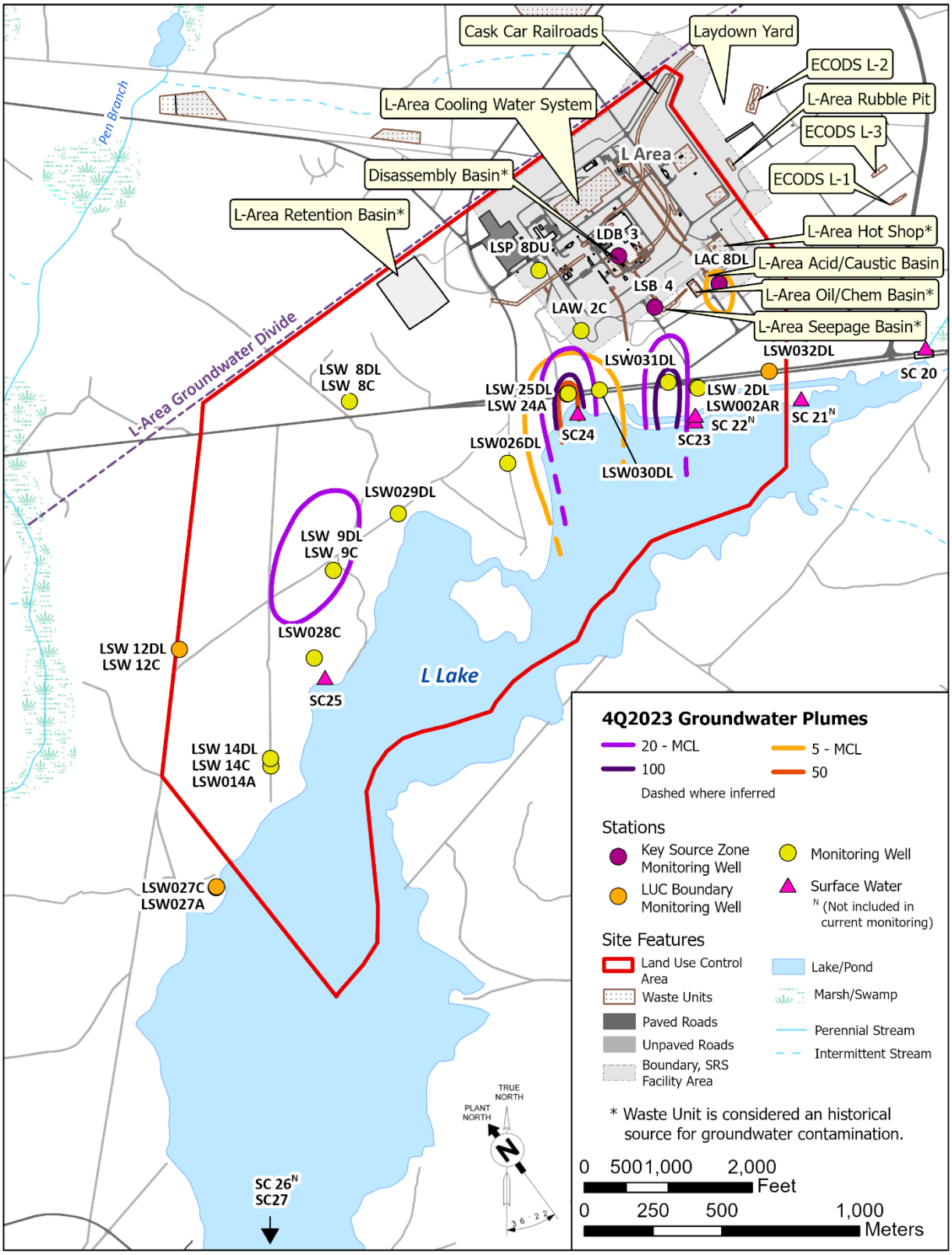


Figure F-2. Layout of the L-Area Southern Groundwater Operable Unit with Plumes

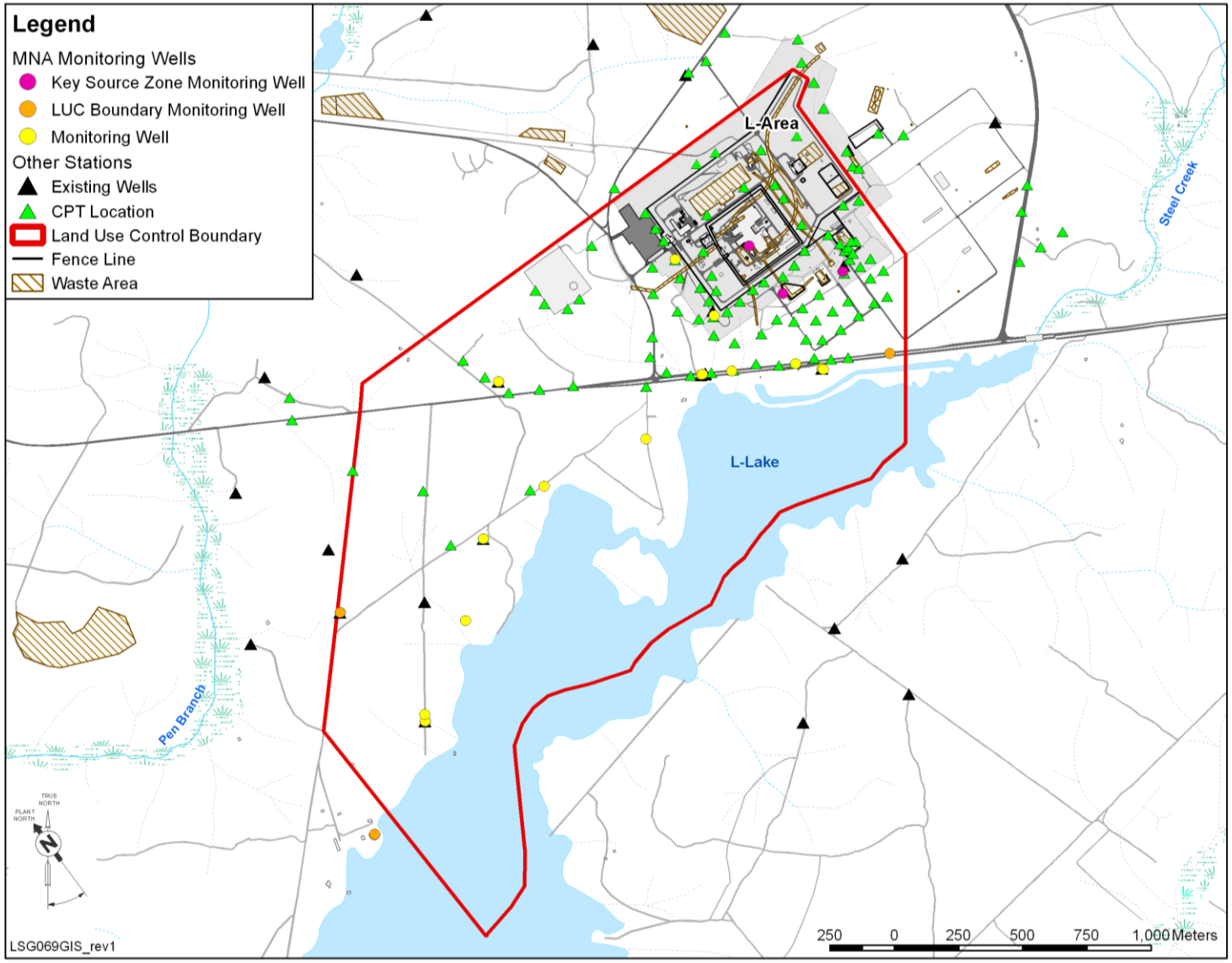


Figure F-3. Well and CPT Coverage Map

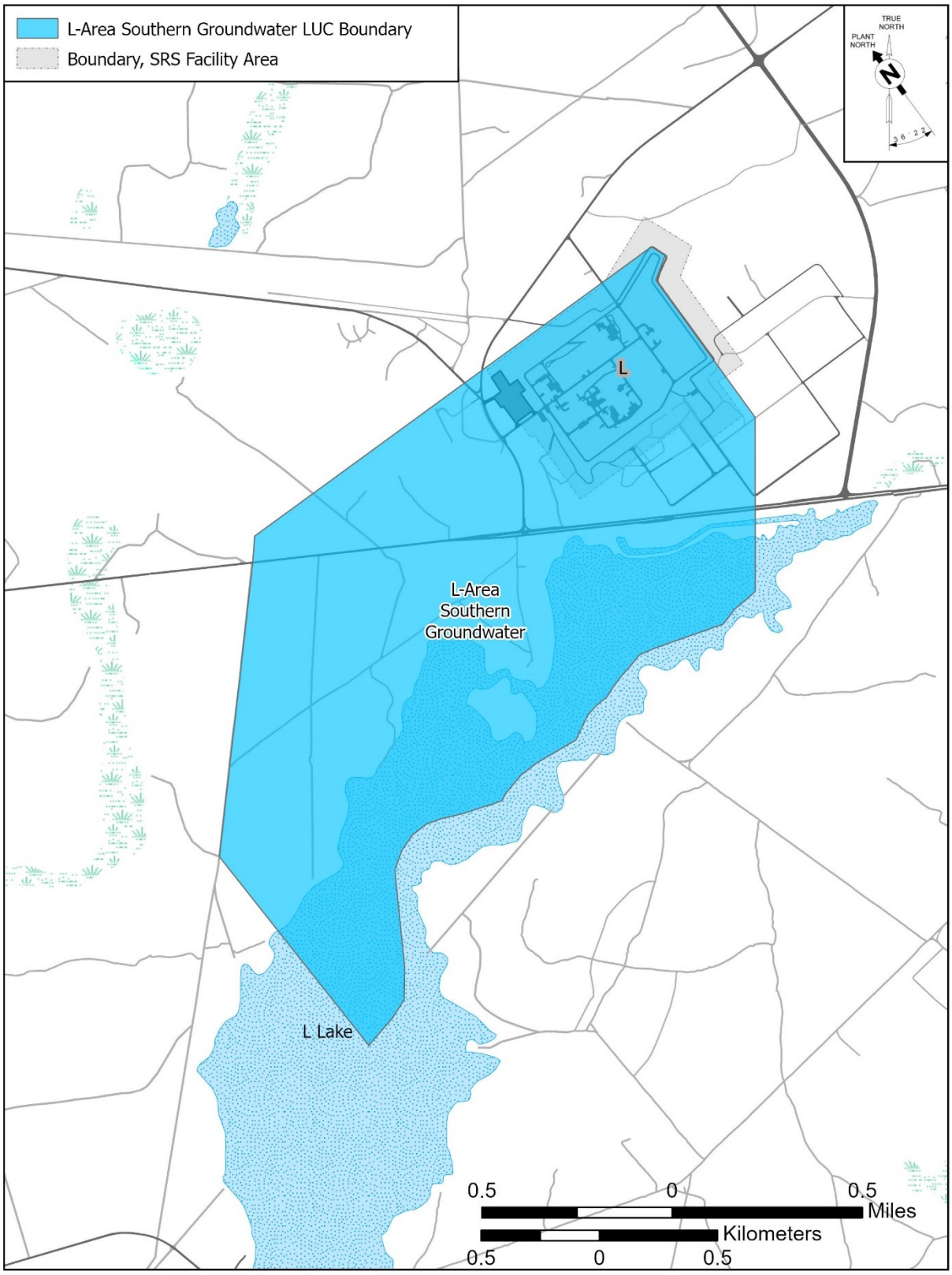


Figure F-4. Land Used Control Boundary for the L-Area Southern Groundwater OU



Figure F-5. Current (2024) Photo of LASG OU Monitoring Wells

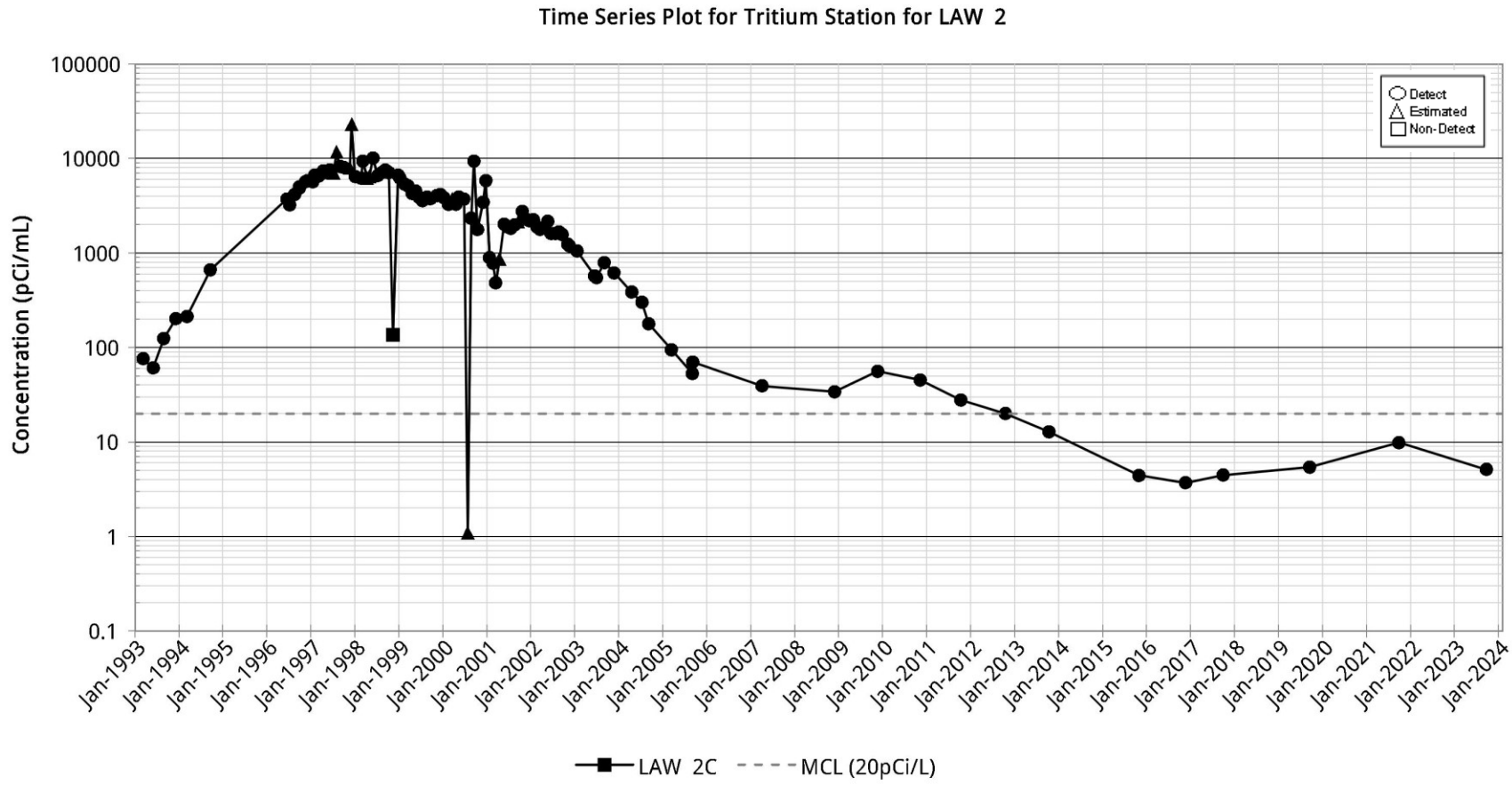


Figure F-6. Time Series Plot for Tritium for Source Zone Well LAW 2

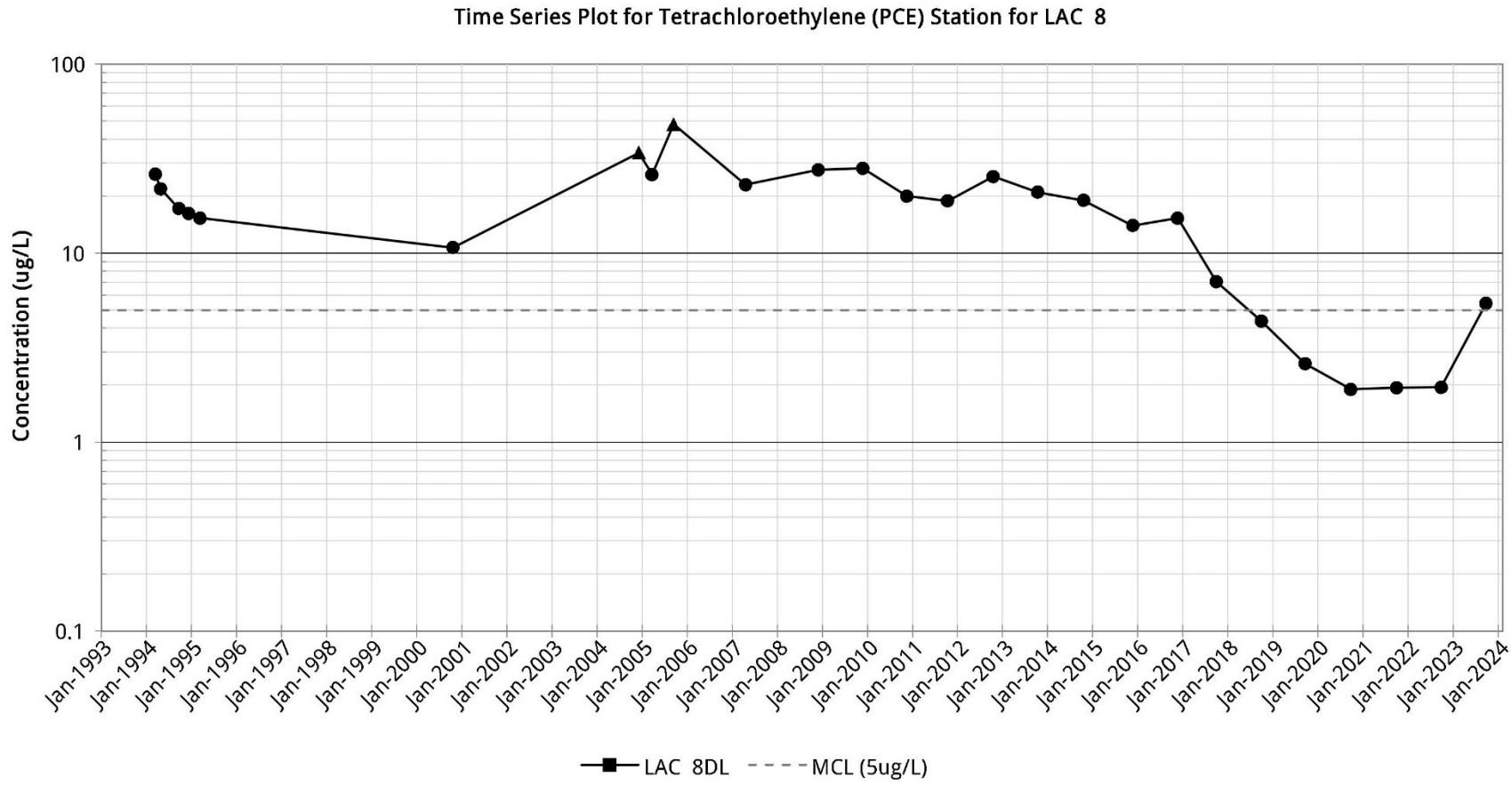


Figure F-7. Time Series Plot for PCE for Source Zone Well LAC 8DL

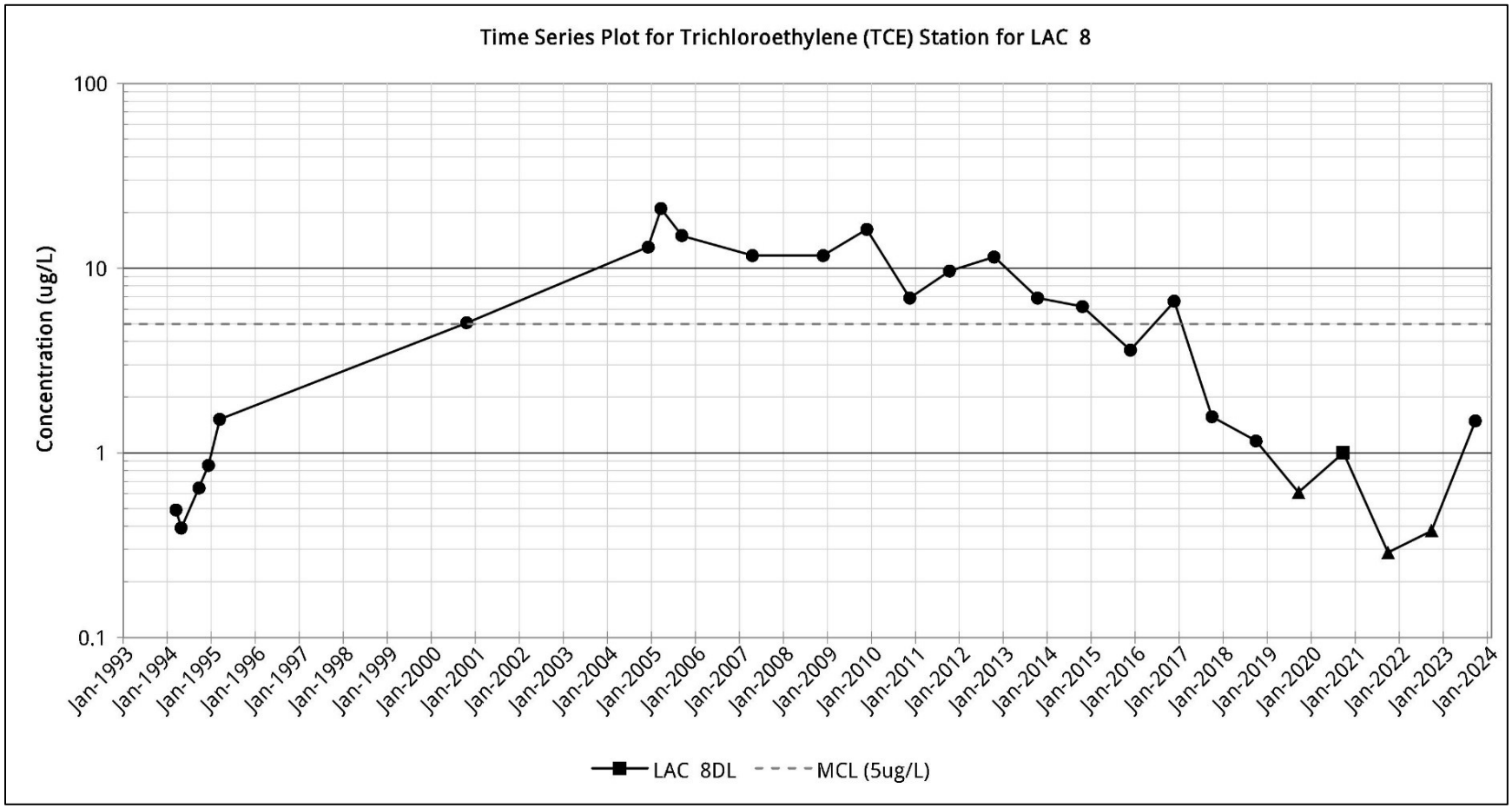


Figure F-8. Time Series Plot for TCE for Source Zone Well LAC 8DL

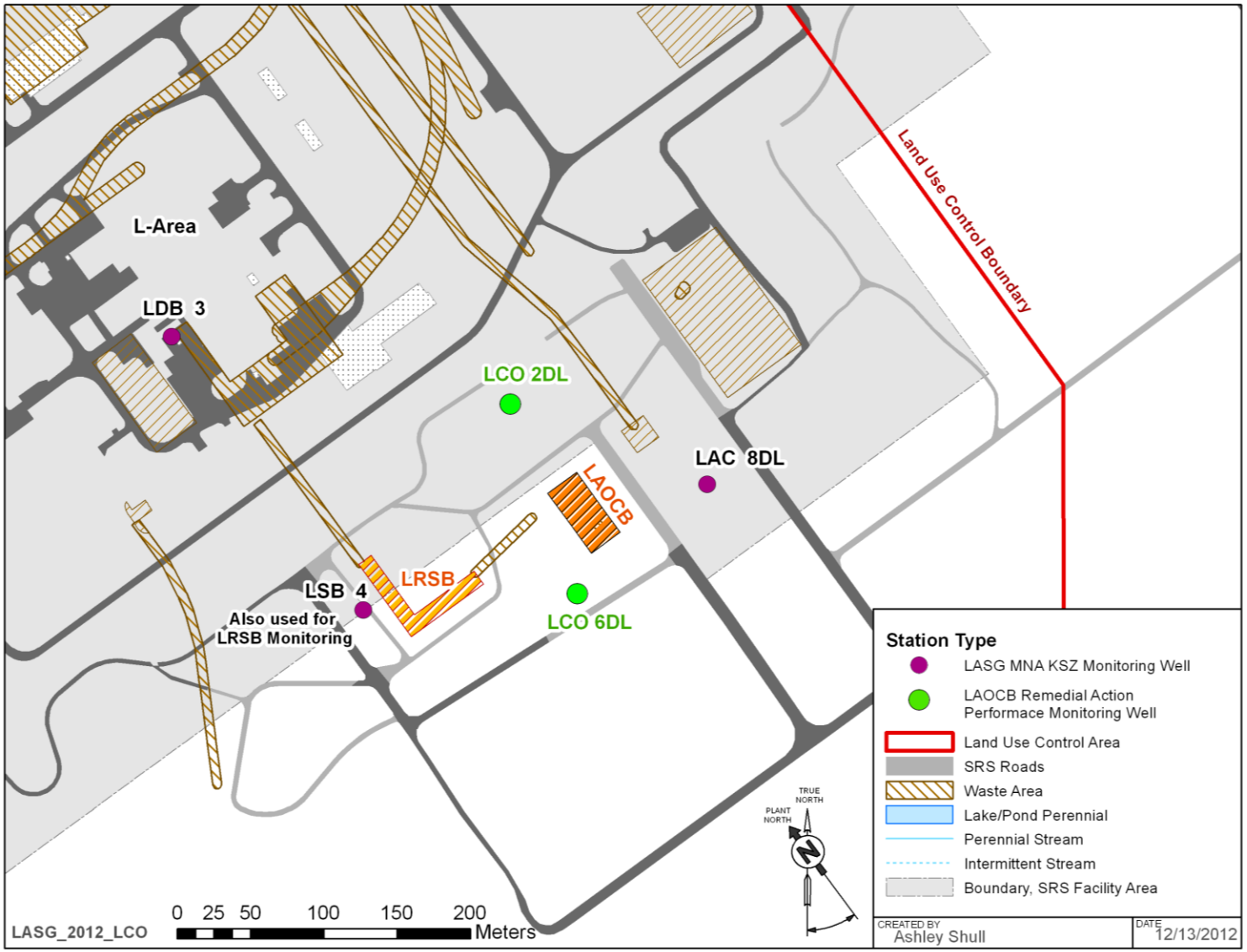


Figure F-9. LRSB and LAOCB Performance Monitoring Station Locations

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Table F-1. Chronology of Events

Event	Date
RI Start / Complete	August 2, 2000 / July 26, 2004
ROD Issuance	May 9, 2007
Remedial Action Construction Start / Complete	February 25, 2008 / May 7, 2008
Remedial Action Operations Start / Complete	December 8, 2008 / on-going
ESD Issuance	September 10, 2014
Previous Five-Year Remedy Review	January 28, 2009 / February 4, 2014 / February 2, 2017 / December 9, 2020

Table F-2. MCL Listing for LASG and Maximum Groundwater Results Summary

RCOC	MCL	Pre-RI 1981 - 1999	RI Jan '00 – Jul '04	Post-RI Jul 26, 2004 – 2013	Present
Range of dates		**Prior to 2001**	**2001 - 2004**	**2005 - 2013**	**2023**
Tritium (ρCi/mL)	20	26,200	5,850	1,230	377
PCE (µg/L)	5	165	58	60	61.6
TCE (µg/L)	5	124	9	21	3.15

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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 (4Q2020)

	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 (10/13/2020)	4.6 U	-3.17 U	3.49 J	1.66 U	0.633 U	0.155 U
LCO 6DL (10/12/2020)	358	0.239 U	2.31 U	1.02 U	0.939 U	0.78 J
LCO 6DL Lab Dup	NA	NA	NA	NA	0.124 U	0.871 J
LRSB Results						
LSB 4 (10/12/2020)	NA	NA	NA	NA	0.971 U	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

NA: Not Applicable

Attachment F-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater OU

I. SITE INFORMATION			
Site Name:	**L-Area Southern Groundwater OU**	**Date of Inspection:**	**09/04/2024**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #31**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**74°F and partly sunny**

Remedy Includes: *(Click all that apply)*

- ☐ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☐ Other _____

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

II. INTERVIEWS (CLICK ALL THAT APPLY)

1. O&M Site Manager: Brian Hanshew (Name) | EC&ACP Post Closure Waste Site O&M Site Manager (Title) | 10/22/2024 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4949
Problems/Suggestions: ☐ Report Attached _____

2. O&M Staff: Eric Barron (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/22/2024 (Date)

Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3395
Problems/Suggestions: ☐ Report Attached _____

Attachment F-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater OU (continued)

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

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

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

On 10/22/2024, the EC&ACP Post Closure Waste Site Inspector/Maintenance Coordinators, Harold Rodgers (803-953-3363) and Donald Sahm (803-952-4145), were also interviewed.

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(CLICK ALL THAT APPLY)*

1. O&M Documents:

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

Remarks: Monitoring wells are inspected per ER-SOP-011, "EC&ACP Monitoring Well Inspection and Maintenance".

2. Health and Safety Plans (HASPs):

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

Remarks: Routine O&M activities do not require a Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.120, Hazardous Waste Operations. A SSHASP is prepared if needed.

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

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

4. Permits and Service Agreements:

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

Remarks: _____

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

Remarks: _____

Attachment F-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater OU (continued)

III. Onsite Documents & Records Verified *(Continued)*
6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A Remarks:
8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
9. Discharge Compliance Records: ☐ Air ☐ Readily Available ☐ Up to Date ☒ N/A ☐ Water (Effluent) ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
IV. O&M COSTS
1. O&M Organization:
☐ State In-House ☐ Contractor for State ☐ PRP In-House ☐ Contractor for PRP ☒ Other: SRS
2. O&M Cost Records: ☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place ☒ Other: Project cost data is summarized in Section IV of this OU-specific review.
3. Unanticipated or Unusually High O&M Costs During Review Period Describe costs and reasons: N/A

Attachment F-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ **APPLICABLE** ☐ **N/A**

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks: OU-specific fencing is not required by the remedial action.

B. Signs

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

C. Institutional Controls

1. Implementation and Enforcement
Site conditions imply ICs are not properly implemented: ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs are not being fully enforced: ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown
Frequency: Once every five years
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Phil Prater (Name) | Operable Unit Manager (Title) | 12/03/24 (Date) | 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A
Violations have been reported: ☐ Yes ☐ No ☒ N/A
Problems/Suggestions: ☐ Report Attached

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

Attachment F-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater OU *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

D. General

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

2. Land use changes onsite: ☒ N/A
Remarks:

3. Land use changes offsite: ☒ N/A
Remarks:

VI. GENERAL SITE CONDITIONS

A. Roads ☒ **Applicable** ☐ **N/A**

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

B. Other Site Conditions

Remarks:

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

VIII. VERTICAL BARRIER WALLS ☐ **APPLICABLE** ☒ **N/A**

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **APPLICABLE** ☐ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**

C. Treatment System ☐ **Applicable** ☒ **N/A**

D. Monitoring Data ☒ **Applicable** ☐ **N/A**

1. Monitoring Data:
☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring Data Suggests:
☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation ☒ **Applicable** ☐ **N/A**

1. Monitoring Wells (natural attenuation remedy):
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs maintenance ☐ N/A
Remarks: All MNA groundwater monitoring wells were inspected. All well identification signs were in good condition.

Attachment F-1. Five-Year Review Site Inspection Checklist – L-Area Southern Groundwater OU *(continued)*

X.OTHER REMEDIES
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
A. Soil Vapor Extraction System ☐ **Applicable** ☒ **N/A**
XI.OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emissions, etc.). The remedial action for the LASG OU is MNA with institutional controls (i.e., LUCs) to prevent exposure to contaminants in groundwater. The remedy is effective and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The protectiveness of the completed remedial action is being monitored by continued groundwater sampling. The O&M procedures are effectively maintaining the monitoring wells. The wells are properly secured/locked, functioning and are in good condition. Institutional controls (i.e., LUCs) effectively prevent unauthorized access to the groundwater and include physical access controls to SRS (fences, guards, security patrols, etc.); administrative controls (SRS is a secured government facility with land use restrictions); and land use controls (SRS Site Use/Site Clearance Program). There are no issues requiring corrective actions. 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. The well sampling schedules were not impacted.
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

APPENDIX G. R-AREA OPERABLE UNIT

I. INTRODUCTION

This report is the fourth five-year remedy review for the R-Area Operable Unit (RAOU). Contaminants have been left in place at RAOU 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 RAOU is protective of human health and the environment. This report documents the results of the review.

II. OU CHRONOLOGY

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

III. BACKGROUND

The RAOU is listed as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media of concern is surface soil, rail bed materials, metal components, concrete, sediment, and groundwater.

An area-based remedial strategy has been implemented in R Area, excluding prior remedial decisions for the following operable units (OUs) as presented in their respective Records of Decision (RODs) documents:

- R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, and 904-104G) and 108-4R Overflow Basin (108-4R),
- R-Area Acid/Caustic Basin (904-77G),
- R-Area Bingham Pump Outage Pits (643-8G, 643-9G, and 643-10G), R-Area Unknown Pit #1 (RUNK-1), Pit #2 (RUNK-2), and Pit #3 (RUNK-3) (No Building Number [NBN]), and
- R-Area Burning/Rubble Pits (131-R and 131-1R) and R-Area Rubble Pile (631-25G).

RAOU remedial actions are addressed by the Early Action ROD for the C-, K-, L-, and R-Reactor Complexes (SRNS 2009b) and the ROD for the RAOU (SRNS 2010a). Removal actions were completed for the following units within R Area and the actions described in Decommissioning Project Final Reports, Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA), and EE/CA reports:

- R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (SRNS 2009c),
- Grouting of the R-Reactor Disassembly Basin at the Savannah River Site (USDOE 2002),
- R-Reactor Building (105-R) Complex (SRNS 2009d),
- P-Area Ash Basin (Including Outfall P-007) (188-P) and the R-Area Ash Basin (188-R) (SRNS 2010d),
- R-Area Process Sewer Line (RPSL) Combined Subunit (SRNS 2010e), and
- Primary Substation (151-1R) (High Volt 115/13.8KV) (SRNS 2010f).

Physical Characteristics

The RAOU is located in east-central SRS approximately 5.0 km (3.1 mi) east of the geographical center of SRS and about 7.0 km (4.3 mi) west of the nearest site boundary (Figure G-1). RAOU is approximately 70.8 hectare (175 acre) and is located primarily in the Lower Three Runs watershed. The northwestern portion of the RAOU lies within the Upper Three Runs Watershed. The RAOU has a flat to gently rolling topography and is approximately 88.4 m (290 ft) above mean sea level.

The RAOU is comprised of the following subunits and potential source areas (PSAs) (Figure G-2):

- R-Reactor Building (105-R) Complex:
    - R-Reactor Building (105-R) including the Engine Houses (108-1R and 108-2R):
        - R-Reactor Vessel,
        - R-Reactor Disassembly Basin, and

- R-Reactor Emergency Basin,

  - Area on the North Side of Building 105-R, Laydown Area North of 105-R, Release from the Decontamination of R-Area Reactor Disassembly Basin (NBN),
  - Combined Spills North of Building 105-R (NBN), and
  - Potential Release from the R-Area Disassembly Basin

- RPSL Combined Subunit:
  - R-Area Process Sewer Lines as Abandoned (NBN),
  - Process Water Storage Tank (106-R) PSA,
  - Cooling Water Effluent Sump (107-R), and
  - Purge Water Storage Basin (109-R)
- R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN),
- R-Area Ash Basin (188-R),
- R-Area Groundwater (RAGW) (NBN),
- R-Area Isolated Contamination Area (ICA) PSA (NBN),
- Process Storage Building (122-R),
- Potential Release of $NaOH/H_2SO_4$ from 183-2R,
- Power House (184-R) PSA,
- Cooling Tower (185-R) PSA,
- Former Coal Pile (NBN) PSA,
- Administrative and Maintenance Building (704-R) PSA,
- Maintenance Material Storage Building (711-R) PSA, and
- Eastern Volatile Organic Compound (VOC)/Tritium Groundwater Plume PSA.

Within the RAOU area are the following Deactivation and Decommissioning No Further Action (NFA) Facilities and Site Evaluation NFA Areas:

- Primary Substation (151-lR),
- Primary Substation (151-2R),
- Cooling Water Clarification Plant (183-1R),
- Filter and Softener Plant (183-2R),
- Cooling Water Reservoir (186-R),
- Cooling Water Pump House (190-R), and
- Potential Release from R-Area Concrete Lakes (183-1R/186-R)

Figures G-3 shows a before photo of RAOU (1999); Figures G-4 and G-5 show current (2024) photos of RAOU and R-Area Ash Basin , respectively.

Land and Resource Use

According to the *Savannah River Site Future Use Project Report* (USDOE 1996), residential uses of the SRS land should be prohibited. The *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999) designates much of RAOU as being within the site industrial support area. The land use control (LUC) boundaries for RAOU that encompass the groundwater plume are predominantly outside of the industrial area for R Area. However, shallow groundwater and surface water at SRS are not used for drinking water, hygiene, recreation, and process water. The future land use for RAOU is reasonably anticipated to remain industrial with the U.S. Department of Energy (USDOE) maintaining control of the land.

History of Contamination

In December 1953, R-Reactor began operations, and the facility was placed in shutdown status in 1964 due to decreased demand for nuclear materials. The primary sources of radioactive contamination in R Area are activation products, fission products, and tritium, the majority of which were the consequence of R-Reactor operations. Spills, leaks, accidental releases, or simply the operation itself resulted in releases of hazardous and/or radioactive substances. Tritium and VOCs released from reactor operations have created four contaminated groundwater plumes in R Area (Figure G-2). A Northern Tritium Plume

originates at the R-Reactor Seepage Basins, travels to the northwest, and discharges to surface water at Mill Creek. An Eastern Tritium Plume originates outside of the Purification Area of R-Reactor (105-R), travels to the northeast, and discharges to surface water at Joyce Branch. A Western Tritium Plume originates at the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN) at the western end of R-Reactor (105-R), migrates to the south, but decays to below detection concentrations prior to discharging to a surface water body. An Eastern VOC Plume originates outside the Assembly Area of R-Reactor (105-R), travels to the northeast, and discharges to surface water at Joyce Branch.

Initial Response

R-Reactor Building (105-R) and all other facilities within R Area have been decommissioned and/or are remnants that require no further action. The Early Action ROD for the C-, K-, L-, and R-Reactor Complexes (SRNS 2009b) documents the selected remedy for the R-Reactor Building (105-R) Complex as in situ decommissioning (ISD) with LUCs. Regulatory decisions were made previous to the RAOU ROD at selected RAOU subunits. Non-Time Critical Removal (NTCR) actions are documented in four RSER/EE/CAs and one EE/CA that include the following subunits and actions:

- R-Reactor Building (105-R) Complex (including the R-Reactor Building [105-R], the Engine Houses [108-lR and 108-2R], the R-Reactor Vessel, the R-Reactor Disassembly Basin, the R-Reactor Emergency Basin, the Area on the North Side of Building 105-R, Laydown Area North of 105-R, Release from the Decontamination of R-Area Reactor Disassembly Basin [NBN], Combined Spills North of Building 105-R (NBN), and the Potential Release from the R-Area Disassembly Basin [105-R]) – in situ decommissioning (SRNS 2009d),
- R-Reactor Disassembly Basin – evaporation and grouting (USDOE 2002),
- RPSL Combined Subunit (including the R-Area PSLs as Abandoned [NBN], Process Water Storage Tank [106-R], Purge Water Storage Basin [109-R], Cooling Water Effluent Sump [107-R] Subunit, Septic Tank [607-lR], outfalls, manholes,

miscellaneous weirs and boxes; sumps, etc.) – grouting access points and open structures (SRNS 2010e),

- R-Area Reactor Area Cask Car Railroad Tracks as Abandoned Subunit – excavation and disposal (SRNS 2009c), and
- R-Area Ash Basin (188-R) Subunit – soil cover (SRNS 2010d).

Basis for Taking Action

The nature and extent of contamination in soil, sediment, surface water, and groundwater at the RAOU were characterized. Results from the past characterization activities (SRNS 2009a) and recent monitoring have demonstrated that residual contaminants exceed the R-Reactor Building (105-R) Complex ISD cleanup levels at specific subunits. In addition, there are three tritium plumes and one VOC plume, which comprise the RAGW Subunit, that exceed the maximum contaminant levels (MCLs) (Table G-2). The shallow groundwater aquifers impacted by tritium and VOCs in R Area have never been used as drinking water; however, until tritium and VOCs are reduced below MCLs, the potential for human exposure requires action. ISD of the R-Reactor Building (105-R) left radionuclides, lead, and polychlorinated biphenyls (PCBs) in place at levels that present a potential for future contaminant migration to groundwater (SRNS 2010a). Therefore, monitoring of the R-Reactor Building (105-R) Complex ISD is required to ensure groundwater is not impacted by the residual contaminants. Table G-3 summarizes the refined constituents of concern (RCOCs) and cleanup levels determined for the RAOU subunits. RAOU subunits with contaminant levels that exceed 1.0E-06 risk for an industrial worker scenario required the following removal actions, LUCs, and monitoring to be protective of human health and the environment:

- The removal action for the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned Subunit (soil removal to 10 ρCi/g cesium-137) has been completed (SRNS 2012). This subunit will be managed with the LUCs selected for the entire RAOU to prevent unrestricted use.

- The removal action for the R-Reactor Disassembly Basin has been completed and radioactive contaminants have been grouted in place (SRNS 2012). This subunit will be managed with the LUCs selected for the entire RAOU to prevent unrestricted use.
- The removal action for the R-Reactor Building (105-R) Complex has been completed and radioactive contaminants have been grouted in place (SRNS 2012). This subunit will be managed with the LUCs selected for the entire RAOU to prevent unrestricted use.
- The removal action for the R-Area PSLs has been completed and radioactive contaminants have been left in place (SRNS 2012). This subunit will be managed with the LUCs selected for the entire RAOU to prevent unrestricted use.
- A contaminant migration analysis was performed to identify refined contaminant migration constituents of concern (COCs) (SRNS 2009a).
- A principal threat source material (PTSM) evaluation for the RAOU subunits determined refined COCs for the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned, R-Area PSLs, and R-Reactor Building (105-R) Complex subunits. The radioactive inventory located in the R-Reactor Building (105-R) has been estimated to be 6.39E+04 Ci (SRNS 2009d), and the cumulative risk for the R-Reactor Building (105-R) Complex was estimated at 5.61E+01 (SRNS 2009a).

IV. REMEDIAL ACTIONS

Remedy Selection

As stated in the ROD (SRNS 2010a), the selected remedy for the RAOU is monitored natural attenuation (MNA) with LUCs as follows:

- LUCs include: (1) institutional controls (i.e., administrative measures) and use restrictions for on-site workers via the Site Use/Site Clearance Program. Other administrative controls to ensure worker safety include work controls, worker training, and worker briefing of health and safety requirements; (2) engineering controls consisting of signage located at the RAOU LUC boundaries to discourage unauthorized entry and uses; and (3) SRS access controls to prevent exposure to trespasses including

a 24-hour surveillance system, control entry systems, and warning signs in place at the SRS boundary, and

- MNA.

As stated in the ROD (SRNS 2010a), the Remedial Action Objectives (RAOs) for the RAOU are as follows:

- Eliminate or control all routes of exposure to residual radioactive or chemical contamination posing risks exceeding 1E-06 to the industrial worker or the resident in media or structures associated with the R-Reactor Building (105-R) Complex, the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned, the RPSL Combined Subunit, the R Area ICA PSA, the R-Area Ash Basin (188-R), and the RAGW,
- Prevent the migration of contaminants from residual water in the Process Water Storage Tank (106-R) PSA to groundwater at concentrations exceeding regulatory standards (MCLs),
- Prevent human exposure to tritium and VOCs in groundwater that exceed regulatory standards (MCLs) and restore contaminated groundwater to below regulatory limits (MCLs) for the RAGW Subunit, and
- Prevent exposure of potential contamination in media or structures to a residential receptor associated with the following subunits:
  - Process Storage Building (122-R) Subunit
  - Potential Release of $NaOH/H_2SO_4$ from 183-2R Subunit
  - Power House (184-R) PSA
  - Cooling Tower (185-R) PSA
  - Former Coal Pile (NBN) PSA
  - Administrative and Maintenance Building (704-R) PSA
  - Maintenance Material Storage Building (71 l-R) PSA
  - Eastern VOC/Tritium Groundwater Plume PSA

The following LUC objectives have been developed to ensure the protectiveness of the remedy described above:

- Restrict unauthorized access and prevent contact, removal, or excavation of contaminated waste, pipelines, equipment and buildings;
- Prohibit industrial use of the R-Area ICA PSA;
- Prohibit the development and use of property for residential housing, elementary schools, childcare facilities and playgrounds;
- Maintain the integrity of any current or future remedial or monitoring systems such as soil covers, or groundwater monitoring wells;
- Prevent access to or use of contaminated groundwater until cleanup levels are met; and
- Prevent construction of inhabitable buildings without an evaluation of indoor air quality to address vapor intrusion.

Remedy Implementation

The selected remedial action was based on successful completion of the NTCR actions as listed below:

- Removed 53.6 m^3 (70 yd^3) of contaminated media at the R-Reactor Cask Car Railroad Tracks by excavating and transporting to the E-Area Slit Trench Disposal Units for disposal. The excavated area was backfilled with structural fill material and approximately 10-cm (4-in) of crusher run was placed, graded, and compacted on the backfilled area.
- Placed a 6.1-hectare (15-acre), 0.6-m (2-ft) thick soil cover over the R-Area Ash Basin (188-R). The multi-layer cover system consisted of a 45-cm (18-in) thick compacted common fill, 10-cm (4-in) thick topsoil, and sod.
- Isolated/plugged the R-Area PSLs; grouted associated underground structures, manholes, weirs and boxes; select removal of process equipment external to the R-Area PSLs; sealed/plugged the outfalls; transported 60,000 gallons of radiologically

contaminated water from the 106-R Process Water Storage Tank to R-Area Disassembly Basin for evaporation.

- ISD of the R-Reactor Building (105-R) Complex included:
  - Leaving the R-Reactor Building (105-R) (Process, Purification, and Assembly Areas) and the Actuator Tower in place,
  - Installing a forced-evaporation system to treat the R-Reactor Disassembly Basin water; Trucking R-Reactor Disassembly Basin water to P-Reactor for faster evaporation; Grouting the below grade portions of the R-Reactor Building (105-R) including Disassembly Basin and the Purification Area (94,055 m^3 [122,948 yd^3] total) to stabilize contaminants,
  - Grouting the Reactor Vessel in place (109.4 m^3 [143 yd^3]) and placing a 1.2-m (4-ft) thick constructed concrete cover over the Reactor Vessel; cover is sloped to allow water runoff in the event of future rainwater ingress,
  - Demolishing the above-grade structure of the R-Reactor Disassembly Area to grade-level and transported 10,254 m^3 (13,404 yd^3) of debris to the E-Area Low-Level Waste Facility,
  - Placed a 0.57 hectare (1.4 acre), 17.5-cm (7-in) thick sloped 4000 psi reinforced concrete cover over the grouted R-Reactor Disassembly Basin, including the contaminated soil and slabs in the area north of the R-Reactor Building (105-R),
  - Removing the stack above the plus 16.8-m (55-ft) elevations,
  - Constructing a new partial roof over the shield door slots to prevent rainwater ingress,
  - Leaving the Process Room, an above-grade structure, in its current state,
  - Monitoring the groundwater adjacent to the R-Reactor Building (105-R) in order to verify the effectiveness of the ISD remedy, and
  - Sealing all R-Reactor Building (105-R) exterior openings.

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

- MNA for the RAGW Subunit (SRNS 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. 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 was held February 27, 2025. SRNS personnel were also present in the meeting. During the meeting, the participants viewed drone footage of RAOU and 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 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-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.

VIII. ISSUES

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

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

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

X. PROTECTIVENESS STATEMENT(S)

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

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to contaminated soil at the RAOU have been addressed through implementation of soil covers, ISD, physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the RAOU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

XI. NEXT REVIEW

The 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, 2009a. *RCRA Facility Investigation / Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment and Corrective Measures Study / Feasibility Study (CMS/FS) for R-Area Operable Unit (U)*, WSRC-RP-2008-4035, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009b. *Early Action Record of Decision Remedial Alternative Selection for the C-, K-, L-, and R-Reactor Complexes (U)*, SRNS-RP-2009-00707, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009c. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (U)*,

WSRC-RP-2008-4090, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2009d. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the R-Reactor Building (105-R) Complex (U)*, SRNS-RP-2009-00801, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010a. *Record of Decision Remedial Alternative Selection for the R-Area Operable Unit (RAOU) (U)*, SRNS-RP-2010-01062, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010b. *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, 2010c. *Effectiveness Monitoring Plan for the R-Area Operable Unit (U)*, SRNS-RP-2010-01259, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010d. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the P-Area Ash Basin (Including Outfall P-007) (188-P) and the R-Area Ash Basin (188-R) (U)*, SRNS-RP-2009-01064, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010e. *Removal Site Evaluation Report / Engineering Evaluation / Cost Analysis (RSER/EE/CA) for the R-Area Operable Unit (RAOU) R-Area Process Sewer Line (RPSL) Combined Subunit (NBN) (U)*, SRNS-RP-2009-01341, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010f. *Decommissioning Project Final Report 151-1R, Primary Substation (High Volt 11KV5/13.8KV)*, V-PCOR-R-00016, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *Post Construction Report (PCR) for the R-Area Operable Unit (U)*, SRNS-RP-2011-01574, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2019. *Addendum to the Effectiveness Monitoring Plan (EMP) for the R-Area Operable Unit (U)*, SRNS-RP-2019-00211, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2022. *R-Area Groundwater (NBN) Biennial Effectiveness Monitoring Report Submittal in Support of R Area Operable Unit (U)*, January 2019 through December 2020, SRNS-RP-2021-03617, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2024. *R-Area Groundwater (NBN) Biennial Effectiveness Monitoring Report in Support of R-Area Operable Unit (U)*, January 2021 through December 2022, SRNS-RP-2023-00758, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

USDOE, 1996. *Savannah River Site Future Use Project Report*, *Stakeholder Recommendations for SRS Land and Facilities*, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

USDOE, 2002. *Engineering Evaluation/Cost Analysis for the Grouting of the R-Reactor Disassembly Basin at the Savannah River Site*, DOE/EE/CA-0001, U.S. Department of Energy, Savannah River Operations Office

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

Various – Inspection Data Sheets – *Field Inspection Checklists for the R-Area Operable Unit Ash Basin 188-R*, ER-IDS-019-051, Inspections conducted 2019 through 2024 (annually)

Various – Inspection Data Sheets – *Field Inspection Checklists for the R-Area Operable Unit (RAOU)*, ER-IDS-019-064, Inspections conducted 2019 through 2024 (annually)

Various – Inspection Data Sheets – *Field Inspection Checklists for the R-Area Operable Unit Reactor Building and Disassembly Basin*, ER-IDS-019-063, Inspections conducted 2019 through 2024 (annually)

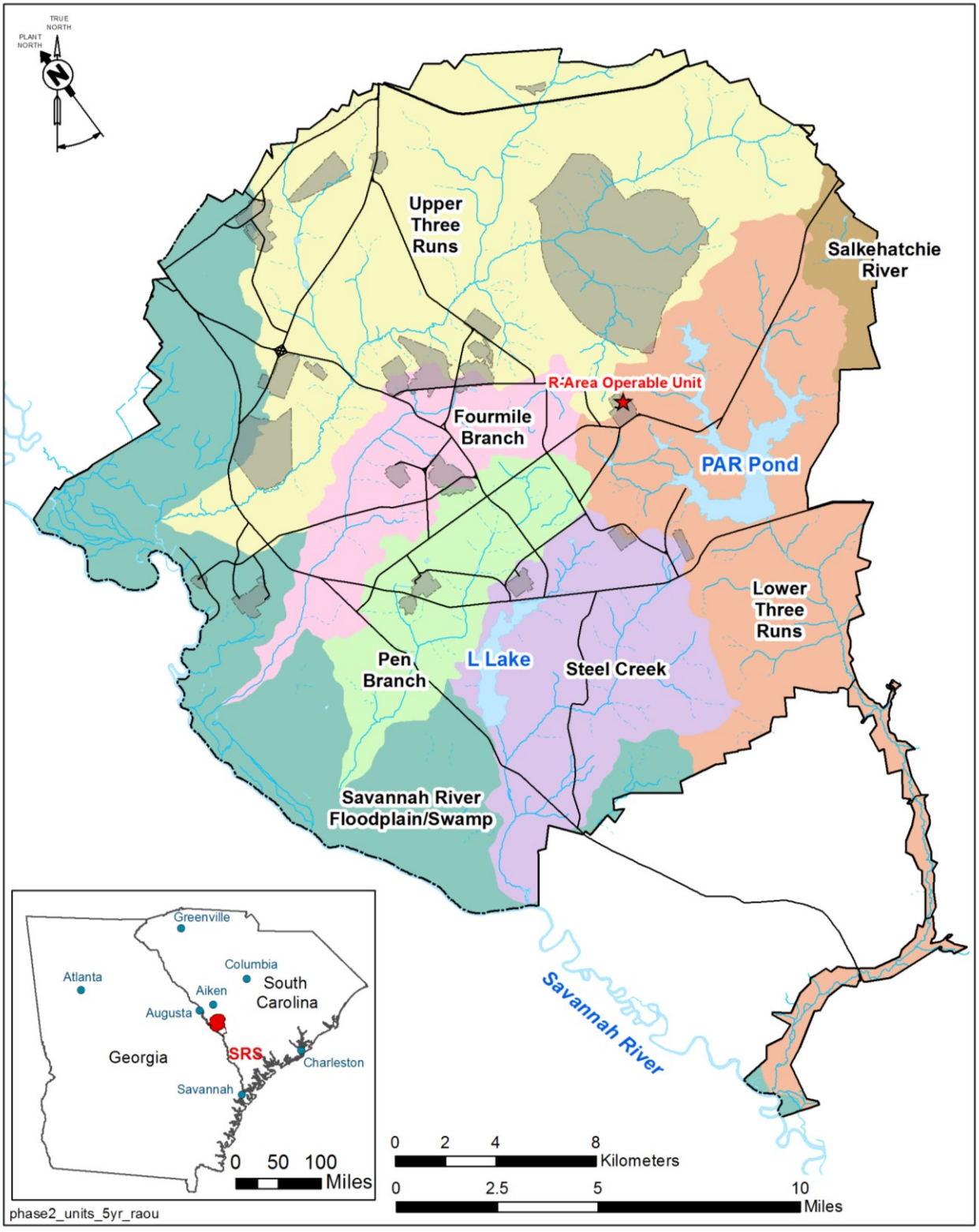


Figure G-1. Location of RAOU at Savannah River Site

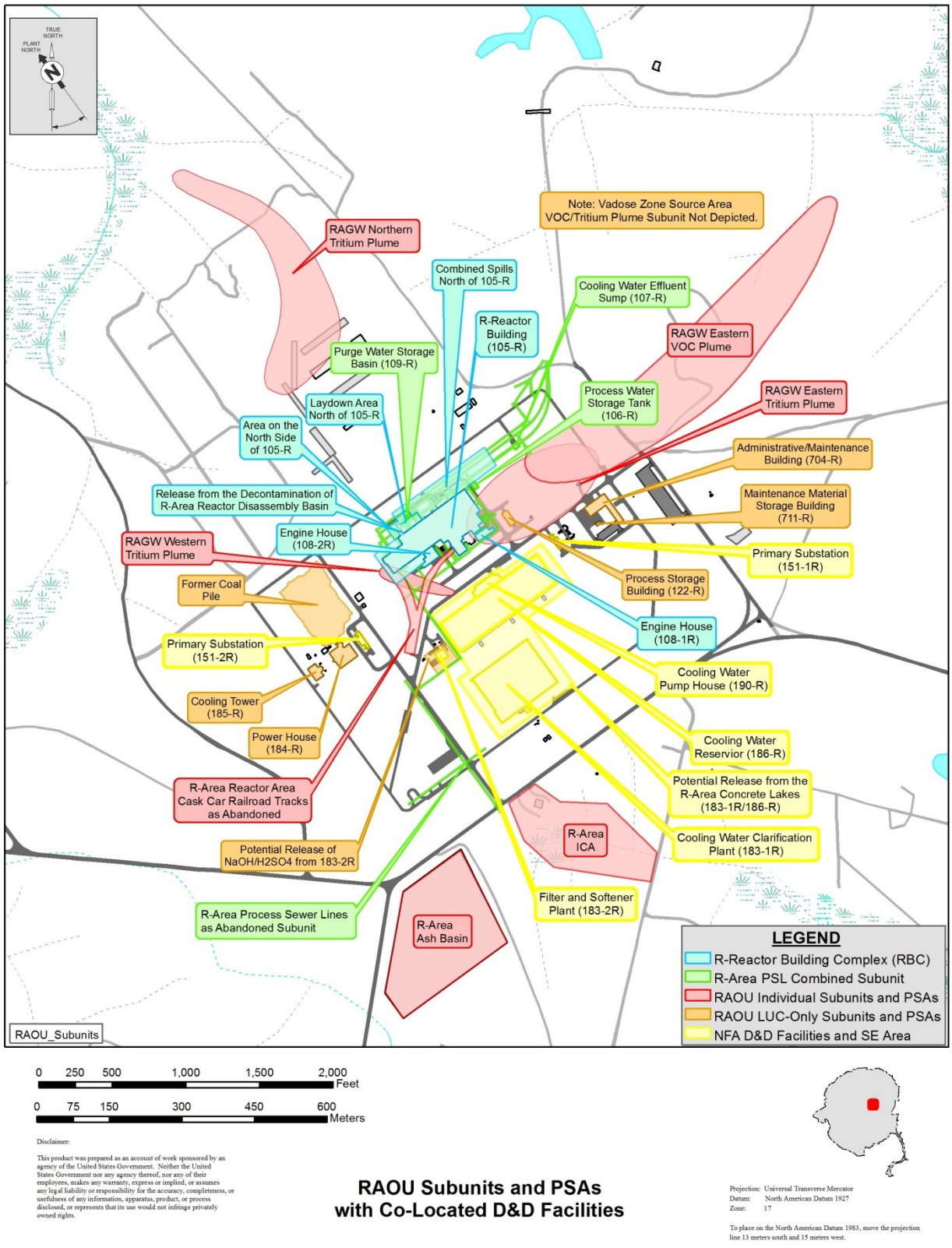


Figure G-2. Location of RAOU Subunits



Figure G-3. Photo of RAOU before Remediation Activities (1999)



Figure G-4. Current Photos of RAOU (2024)



Figure G-5. Current Photo of R-Area Ash Basin (2024)

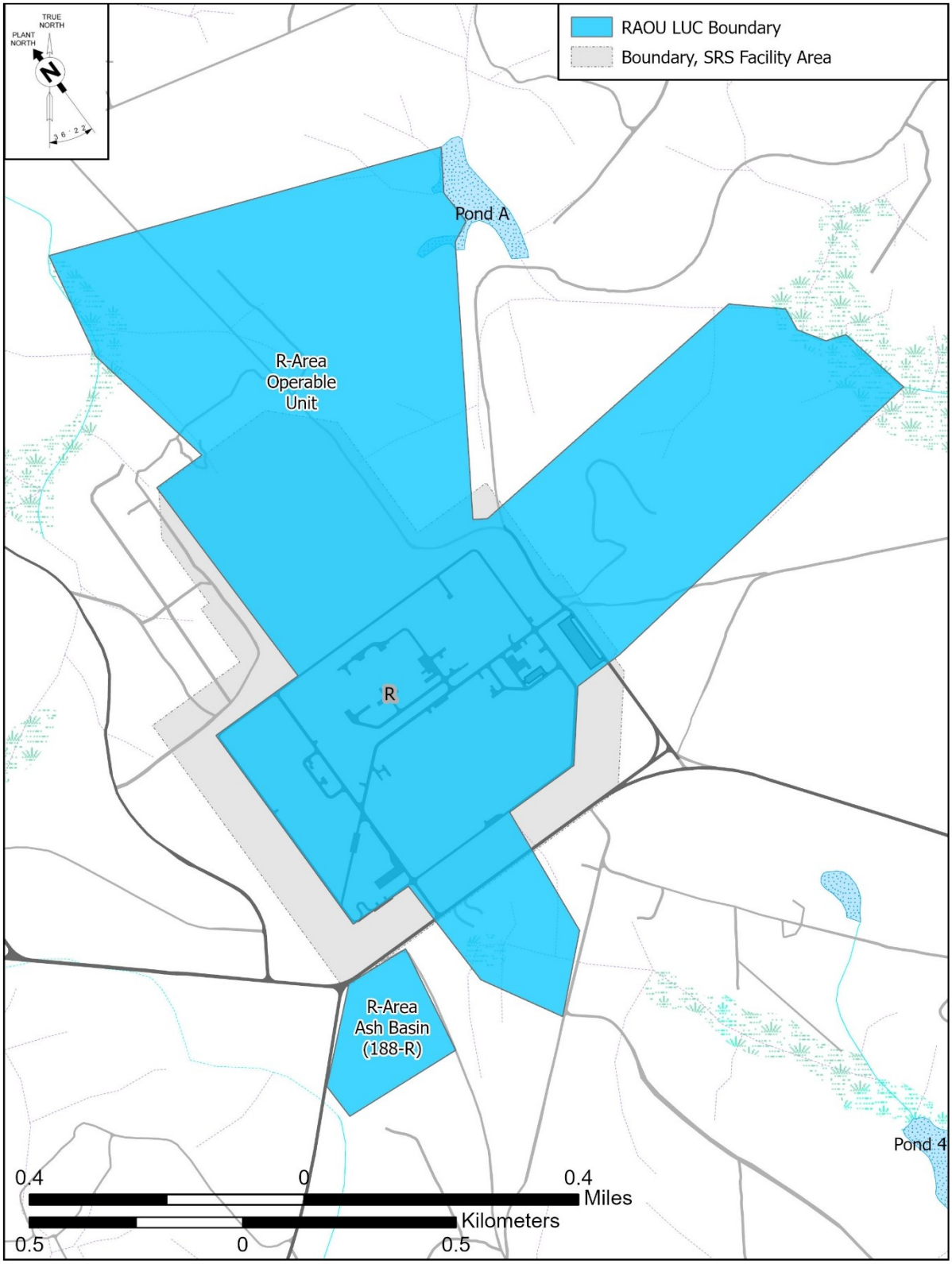


Figure G-6. Land Use Control Boundary for the RAOU

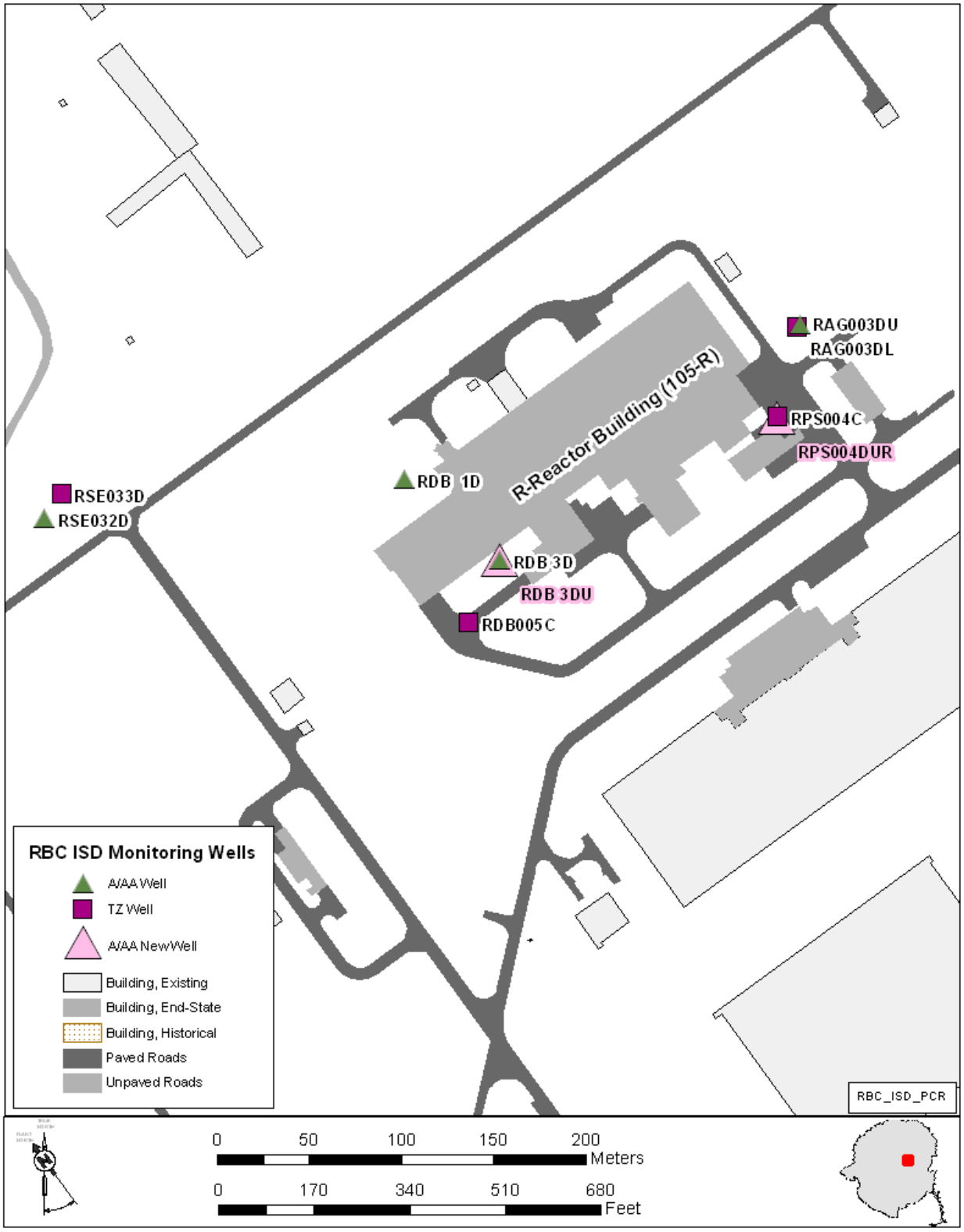


Figure G-7. ISD Monitoring Stations for R-Reactor Building (105-R) Complex

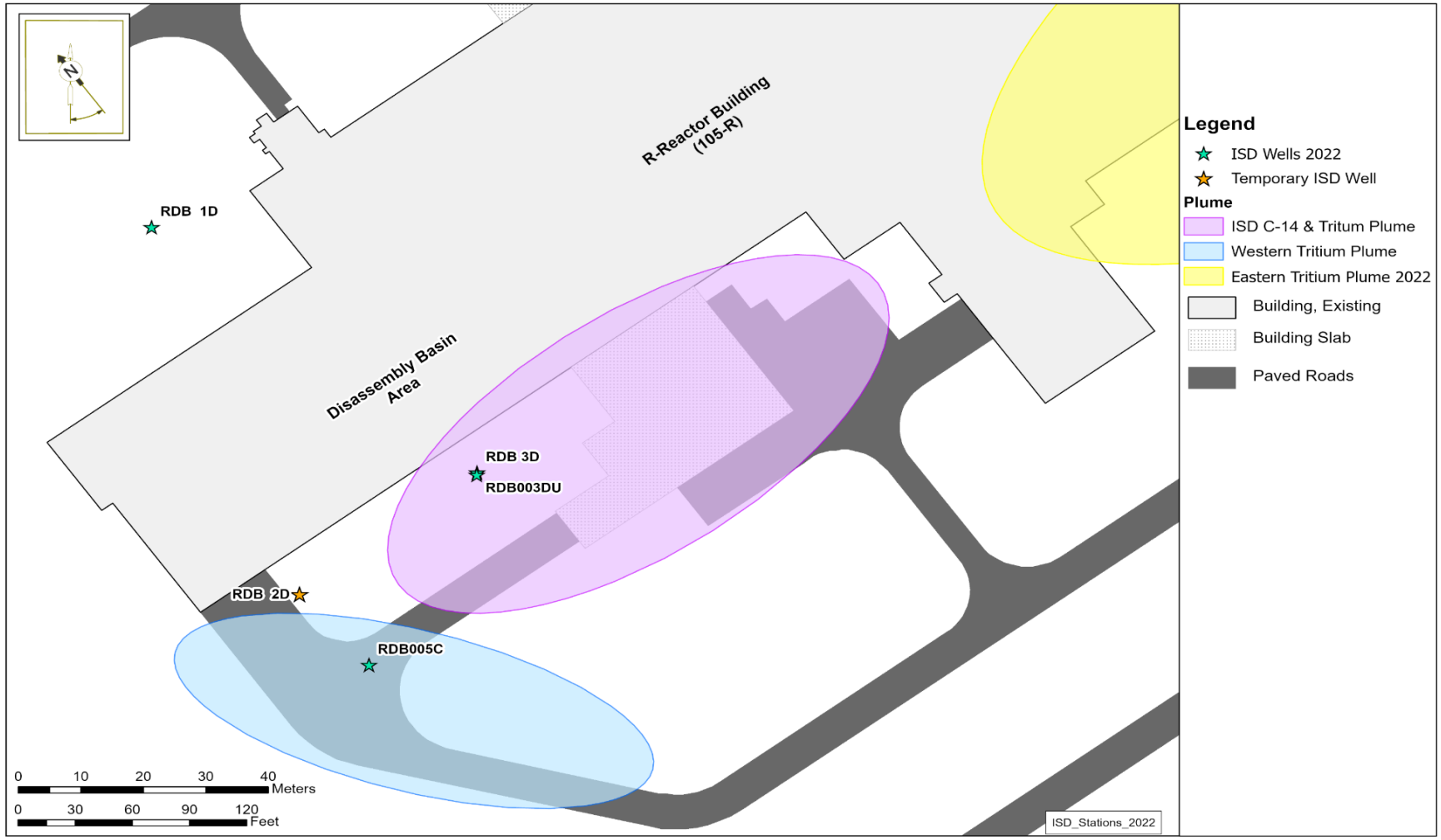


Figure G-8. Annual ISD Monitoring Stations (2022)

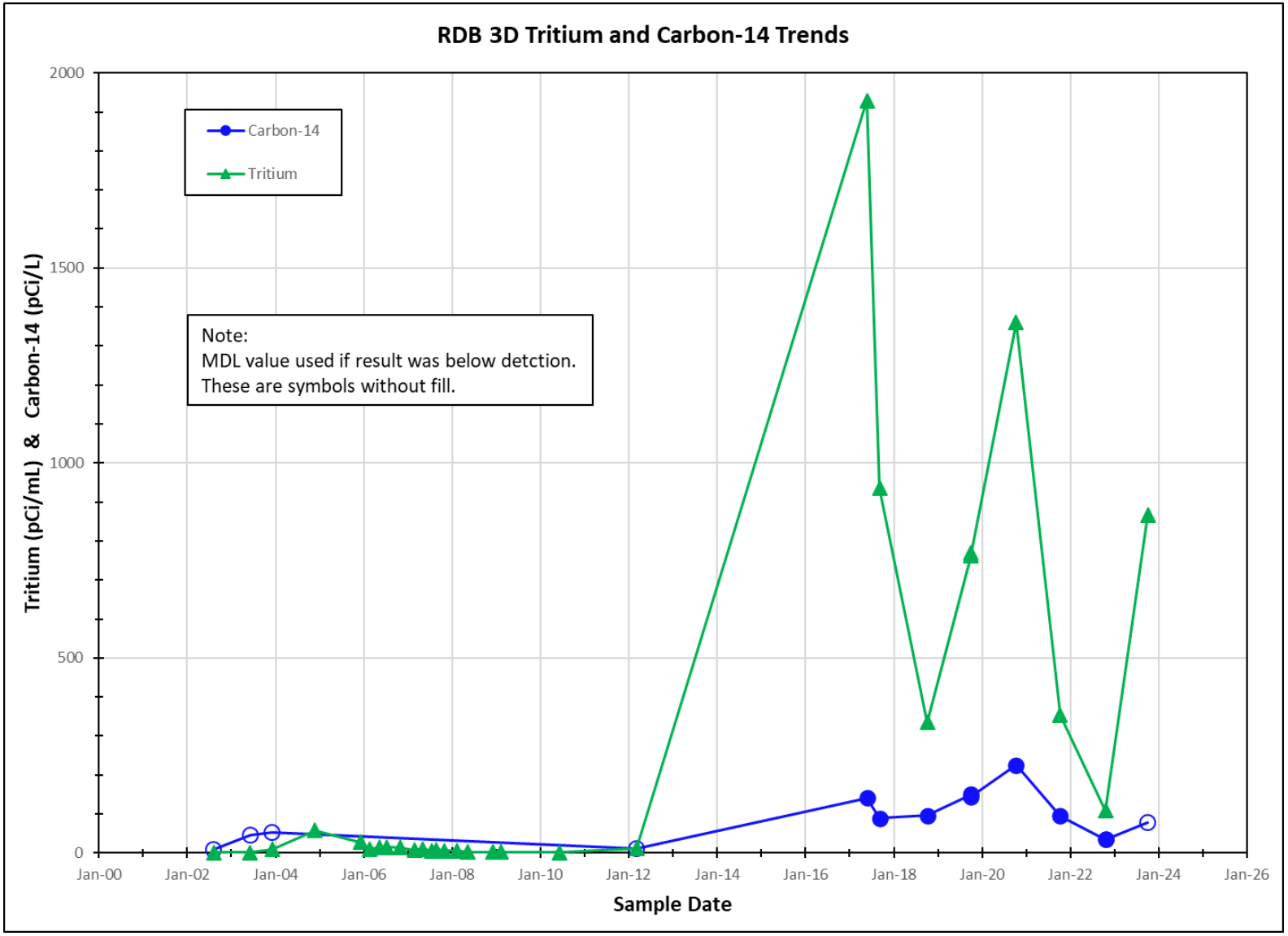


Figure G-9. Tritium and Carbon-14 Trend Data in well RDB 3D at RAOU

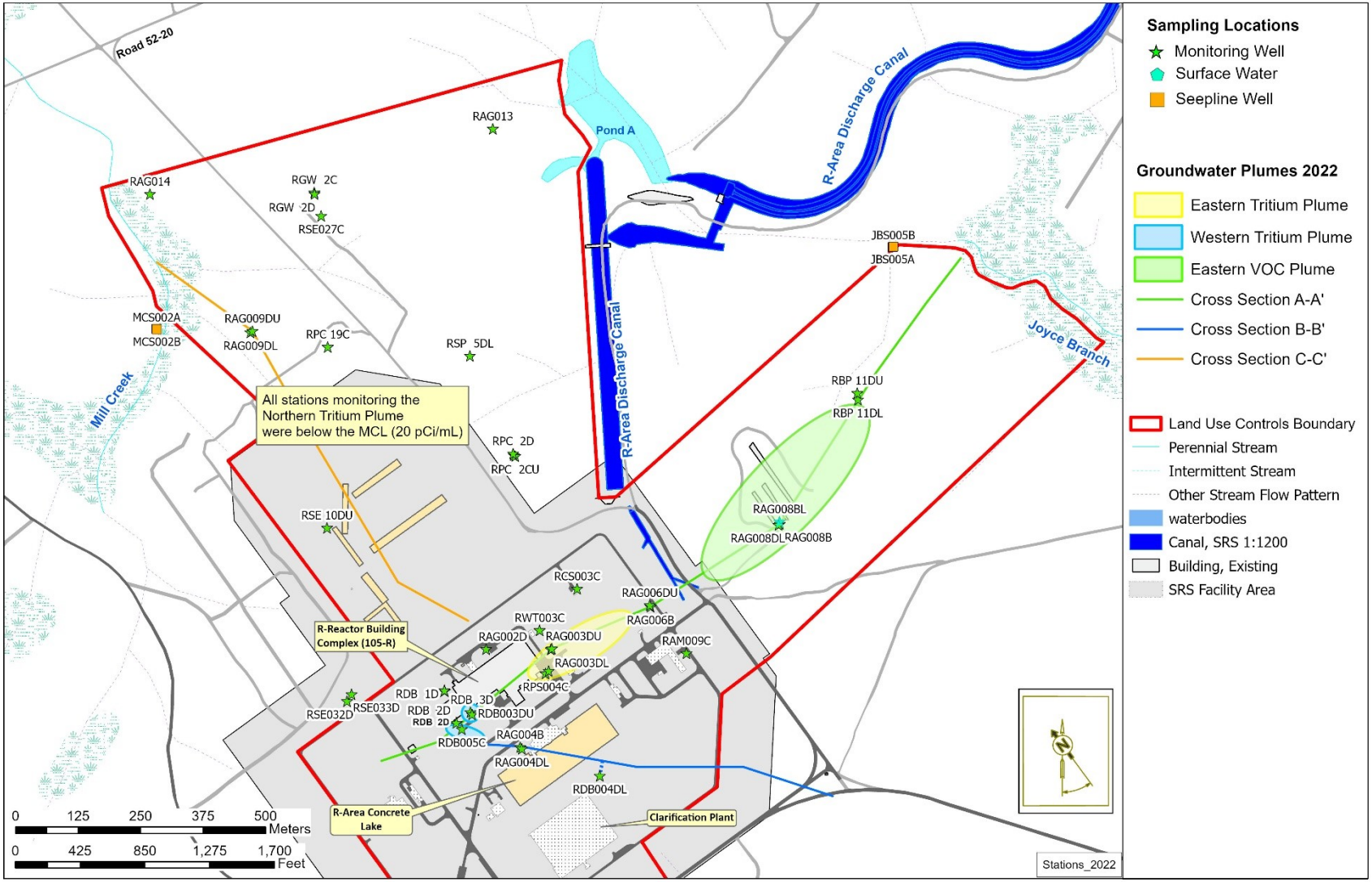


Figure G-10. MNA Monitoring Stations for RAGW Plumes (2022)

Table G-1. Chronology of OU Events

Event	Date
Early Action R-Reactor Disassembly Basin Grouting Start / Finish	October 1, 2002 / April 29, 2003
Early Action R-Reactor Disassembly Basin (Forced Evaporation and Grouting) Start / Finish	April 29, 2003 / November 30, 2010
Issue Early Action ROD for the C-, K-, L-, and R-Rx Complexes	December 8, 2009
Issue Record of Decision Remedial Alternative Selection for RAOU	April 20, 2011
Remedial Action Start / Finish	May 25, 2011 / September 22, 2011
Final Regulatory Walk down – LUCIP and EMP Implementation	September 22, 2011
Previous Five-Year Remedy Reviews	February 4, 2014 / February 2, 2017 / December 9, 2020

Table G-2. RAGW and R-Reactor Building (105-R) Complex ISD Groundwater Monitoring Cleanup Levels

RAGW Refined COCs	2023 Maximum Concentration	Cleanup Levels (MCL)	Units
Tritium	7.84E+1	2.0E+01	ρCi/mL
TCE	2.48E+01	5.0E+00	µg/L
Cis-1,2-Dichloroethylene	1.35E+01	7.0E+01	µg/L
Vinyl Chloride	1.51E+00	2.0E+00	µg/L
Carbon Tetrachloride	All Results < Detection Limit	5.0E+00	µg/L
Chloroform	All Results < Detection Limit	7.0E+01	µg/L
R-Reactor Building Complex ISD Refined Contaminant Migration COCs	**2023 Maximum Concentration**	**RG (MCL or PRG)**	**Units**
Carbon-14	All Results < Detection Limit [a]	2.0E+03	ρCi/L
Chlorine-36	Not Sampled[b]	7.0E+02	ρCi/L
Iodine-129	Not Sampled[b]	1.0E+01	ρCi/L
Lead	Not Sampled[b]	NA	µg/L
Molybdenum-93	Not Sampled[b]	NA	ρCi/L
Nickel-59	Not Sampled[b]	NA	ρCi/L
Niobium-94	Not Sampled[b]	NA	ρCi/L
Potassium-40	Not Sampled[b]	NA	ρCi/L
PCBs	Not Sampled[b]	NA	µg/L
Silver-108m	Not Sampled[b]	NA	ρCi/L
Tritium	8.66E+02[c]	2.0E+01	ρCi/mL

a = Carbon-14 result observed for the first time in R Area at well RDB 3D near R-Reactor Disassembly Basin.
b = The RAOU EMP Addendum (SRNS 2019) limited monitoring to the most mobile constituents (carbon-14, chlorine-36, iodine-129, and tritium) every 5 years (i.e., 2017, 2022, 2027,…), which would be the first indications of contamination to the groundwater from R-Reactor post-ISD.
c = Highest tritium concentration observed for R-Reactor monitoring wells, previous maximum tritium result for ISD wells was 1,740 ρCi/mL on 3/19/08 at well RPS004C.
COC = Constituent of Concern
NA = Not applicable

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Table G-3. RAOU RCOCs and Cleanup Levels

RAOU Subunit or PSA		RCOC	Human Health (HH)	Ecological	PTSM	CM	Cleanup Levels	Units	Cleanup Levels Source
R-Reactor Building (105-R) Complex	R Reactor Building (105-R) and Engine Houses (108-1R and 108-2R)	Arsenic	X				1.59E00	mg/kg	PRG
		Aroclor 1254	X			X	5.0E-01	µg/L	MCL
		Americium-241 (+D)	X				7.76E00	ρCi/g	PRG
		Americium-243 (+D)	X				3.44E-01	ρCi/g	PRG
		Cesium-137 (+D)	X		X		1.13E-01	ρCi/g	PRG
		Cobalt-60	X		X		6.02E-02	ρCi/g	PRG
		Lead				X	1.5E+01	µg/L	MCL
		Strontium-90 (+D)	X				1.43E+01	ρCi/g	PRG
	R-Area Disassembly Basin[1]	Cesium-137 (+D)	X		X		1.13E-01	ρCi/g	PRG
		Cobalt-60	X		X		6.02E-02	ρCi/g	PRG
		Europium-154	X		X		8.5E-02	ρCi/g	PRG
		Tritium	X		X		4.23E00	ρCi/g	PRG
	R-Reactor Emergency Basin	Iodine-129				X	1.0E00	ρCi/L	MCL
	R-Reactor Vessel[1]	Barium-133	X		X		3.06E-01	ρCi/g	PRG
		Cesium-137	X		X		1.13E-01	ρCi/g	PRG
		Chlorine-36				X	7.00E+02	ρCi/L	MCL
		Cobalt-60	X		X		6.02E-02	ρCi/g	PRG
		Europium-152	X		X		7.37E-02	ρCi/g	PRG
		Lead				X	1.5E+01	µg/L	MCL
		Molybdenum-93				X	1.42E+01	ρCi/L	PRG
		Nickel-59				X	3.0E+02	ρCi/L	MCL
		Nickel-63	X		X		5.55E+04	ρCi/g	PRG
		Niobium-94	X		X	X	6.13E00	ρCi/L	PRG
		Potssium-40				X	1.93E00	ρCi/L	PRG
		Silver-108m	X		X		3.26E-02	ρCi/g	PRG
Area on North Side of Building 105-R, Laydown Area North of 105-R, and Combined Spills North of Building 105-R (NBN), and Release from the Decontamination of R- Area Reactor Disassembly Basin (NBN), and Potential Release from the R-Area Disassembly Basin Subunits		Cesium-137 (+D)	X				1.0E+01	ρCi/g	Other[2]
R-Area Process Sewer Lines as Abandoned (NBN) Subunit		Radionuclides[3]	X		X		NA	ρCi/g	PRG

Table G-3. RAOU RCOCs and RGs *(continued/end)*

RAOU Subunit or PSA	RCOC	Human Health (HH)	Ecological	PTSM	CM	Cleanup Levels	Units	Cleanup Levels Source
R-Area Reactor Area Cask Car Railroad Tracks as Abandoned (NBN) Subunit	Cesium-137 (+D),	X		X		1.0E+01	ρCi/g	Other[2]
	Uranium-235 (+D)	X				3.94E-01	ρCi/g	PRG
R-Area Ash Basin (188-R) Subunit	Arsenic	X				1.59E00	mg/kg	PRG
	Potassium-40	X				2.71E-01	ρCi/g	PRG
	Radium-226 (+D)	X				2.55E-02	ρCi/g	PRG
	Uranium-235 (+D)	X				3.94E-01	ρCi/g	PRG
	Uranium-238 (+D)	X				1.79E00	ρCi/g	PRG
R-Area Reactor Groundwater Subunit[4]	Trichloroethylene	X				5.0E00	µg/L	MCL
	cis-1,2-Dichloroethylene	X				7.0E+01	µg/L	MCL
	Vinyl chloride	X				2.0E00	µg/L	MCL
	Carbon tetrachloride	X				5.0E00	µg/L	MCL
	Chloroform	X				7.0E+01	µg/L	MCL
	Tritium	X				2.0E+01	ρCi/mL	MCL
R-Area Isolated Contamination Area PSA	Arsenic	X				1.59E00	mg/kg	PRG
	Cesium-137 (+D)	X				1.12E-01	ρCi/g	PRG
	Cobalt-60	X				5.96E-02	ρCi/g	PRG
	Potassium-40	X				2.71E-01	ρCi/g	PRG
	Radium-226 (+D)	X				2.55E-02	ρCi/g	PRG

1. The HH Risk Assessment and PTSM discussions identify several radiological and hazardous constituents as HH RCOCs or PTSM, but only the major risk drivers for the individual subunits are presented in this table.
2. A concentration of 10 ρCi/g and LUCs established as RG based on Core Team agreement.
3. Radiological constituents are qualitatively identified as HH and PTSM RCOCs based on process history and the potential for fixed residual contamination on the inside surfaces of the R-Area Process Sewer Lines as Abandoned (NBN).
4. These are based on MCLs rather than a HH Risk Assessment evaluation. Only the constituents forming plumes are listed in Table G-3.

MCL = Maximum Contaminant Level
PRG = Preliminary Remediation Goal
NA = Not Applicable
CM = Contaminant Migration
PTSM = Principal Threat Source Material

Table G-4. Actual versus Estimated O&M Costs

	FY2020	FY2021	FY2022	FY2023	FY2024	Five-Year Total
Total Actual O&M Costs ($)	156,936	218,958	218,742	303,197	285,865	1,183,697
Total ROD Estimated Direct O&M Costs ($)	67,300	47,300	67,300	47,300	62,300	291,500

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

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Attachment G-1. Five-Year Review Site Inspection Checklist – R-Area Operable Unit

I. SITE INFORMATION			
Site Name:	**R-Area Operable Unit**	**Date of Inspection:**	**07/31/2024**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS # 95**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**96°F and sunny**

Remedy Includes: *(Click all that apply)*

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other ISD by grouting, grouting R-Area PSLs, forced evaporation

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

II.Interviews (CLICK ALL THAT APPLY)

1. **O&M Site Manager:** Brian Hanshew (Name) — EC&ACP Post Closure Waste Site O&M Site Manager (Title) — 10/22/2024 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4949
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Eric Barron (Name) — EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) — 10/22/2024 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3395
   Problems/Suggestions: ☐ Report Attached

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

II. INTERVIEWS (CLICK ALL THAT APPLY) (CONTINUED)

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

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

On 10/22/2024, the EC&ACP Post Closure Waste Site Inspector/Maintenance Coordinators, Harold Rodgers (803-953-3363) and Donald Sahm (803-952-4145), were also interviewed.

III. ONSITE DOCUMENTS & RECORDS VERIFIED *(CLICK ALL THAT APPLY)*

1. O&M Documents:

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

Remarks: See *Waste Unit Inspection and Maintenance*, ER-SOP-019, *Field Inspection Checklist for RAOU Ash Basin 188-R*, ER-IDS-019-051, *Field Inspection Checklist for the RAOU Reactor Building and Disassembly Basin*, ER-IDS-019-063, and *Field Inspection Checklist for R-Area Operable Unit*, ER-IDS-019-064.

2. Health and Safety Plans (HASPs):

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

Remarks: Routine O&M activities do not require a Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.120, Hazardous Waste Operations. A SSHASP is prepared if needed.

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

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

4. Permits and Service Agreements:

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

Remarks: _____

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

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Continued)
5. Gas Generation Records: ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
6. Settlement Monument Records: ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
7. Groundwater Monitoring Records: ☒ Readily Available ☒ Up to Date ☐ N/A Remarks:
8. Leachate Extraction Records: ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
9. Discharge Compliance Records: ☐ Air ☐ Readily Available ☐ Up to Date ☒ N/A ☐ Water (Effluent) ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
10. Daily Access/Security Logs: ☐ Readily Available ☐ Up to Date ☒ N/A Remarks:
IV. O&M COSTS
1. O&M Organization: ☐ State In-House ☐ Contractor for State ☐ PRP In-House ☐ Contractor for PRP ☒ Other: SRS
2. O&M Cost Records: ☐ Readily Available ☐ Up to Date ☐ Funding mechanism/agreement in place ☒ Other: Project cost data is summarized in Section IV of this OU-specific review.
3. Unanticipated or Unusually High O&M Costs During Review Period Describe costs and reasons: N/A

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

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ **APPLICABLE** ☐ **N/A**

A. Fencing

1. Fencing Damage: ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks: OU-specific fencing is not required by the remedial action.

B. Signs

1. Signs and Other Security Measures: ☐ Location shown on site map ☐ N/A
Remarks: Signs at this site are in good condition.

C. Institutional Controls

1. Implementation and Enforcement

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

Type of monitoring (e.g., self-reporting, drive-by, etc.) Walkdown
Frequency: Once every five year
Responsible Party/Agent: USDOE Savannah River Field Office
Contact: Phil Prater (Name) Operable Unit Manager (Title) 12/03/24 (Date) 803-952-9333 (Phone No.)

Reporting is up-to-date: ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency: ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met: ☒ Yes ☐ No ☐ N/A
Violations have been reported: ☐ Yes ☐ No ☒ N/A
Problems/Suggestions: ☐ Report Attached

2. Adequacy: ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks: The ICs are adequately maintaining the RAOU protective systems. When maintenance activities are identified during inspections (e.g., woody vegetation removal from the roof), repairs are scheduled and performed.

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

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
D. General
1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident Remarks:_____
2. Land use changes onsite: ☒ N/A Remarks:_____
3. Land use changes offsite: ☒ N/A Remarks:_____
VI. GENERAL SITE CONDITIONS
A. Roads ☒ **Applicable** ☐ **N/A**
1. Roads damaged: ☒ Location shown on site map ☒ Roads adequate ☐ N/A Remarks:_____
B. Other Site Conditions
Remarks:_____
VII. LANDFILL COVER/CONTAINMENT ☒ **APPLICABLE** ☐ **N/A**
A. Landfill Surface
1. Settlement (Low spots): ☐ Location shown on site map ☒ Settlement not evident Areal extent_____ Depth_____ Remarks:_____
2. Cracks: ☐ Location shown on site map ☒ Cracking not evident Lengths_____ Widths_____ Depths_____ Remarks: No cracking evident that would impact the low-permeable barrier. Cracking evident in the concrete cover of the disassembly basin does not impact the protectiveness of the remedy.
3. Erosion: ☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____

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

VII. LANDFILL COVER/CONTAINMENT (CONTINUED)			
4. Holes: ☐ Location shown on site map ☒ Holes not evident Areal extent_____ Depth_____ Remarks:_____			
5. Vegetative Cover: ☐ Grass ☒ Cover properly established ☐ No signs of stress Areal extent_____ Depth_____ Remarks:_____			
6. Alternative Cover (armored rock, concrete, etc.): ☒ Applicable ☐ N/A Remarks: Concrete Cover system			
7. Bulges: ☐ Location shown on site map ☒ Bulges not evident Areal extent_____ Depth_____ Remarks:_____			
8. Wet Areas / Water Damage: ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent_____ ☐ Ponding ☐ Location shown on site map Areal extent_____ ☐ Seeps ☐ Location shown on site map Areal extent_____ ☐ Soft subgrade ☐ Location shown on site map Areal extent_____ Remarks:_____			
9. Slope Instability: ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent_____ Remarks:_____			
B. Benches	☐ **Applicable**	☒ **N/A**	
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)			
C. Letdown Channels	☐ **Applicable**	☒ **N/A**	
(Channel lined with erosion control mates, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)			
D. Cover Penetrations	☐ **Applicable**	☒ **N/A**	
E. Gas Collection and Treatment	☐ **Applicable**	☒ **N/A**	
F. Cover Drainage Layer	☐ **Applicable**	☒ **N/A**	
G. Detention/Sedimentation Ponds	☐ **Applicable**	☒ **N/A**	
H. Retaining Walls	☐ **Applicable**	☒ **N/A**	
I. Perimeter Ditches/Offsite Discharge	☐ **Applicable**	☒ **N/A**	

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

VIII. VERTICAL BARRIER WALLS	☐ **APPLICABLE**	☒ **N/A**		
IX. Groundwater/Surface Water Remedies	☒ **APPLICABLE**	☐ **N/A**		
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ **Applicable**	☒ **N/A**		
B. Surface Water Collection Structures, Pumps, and Pipelines	☐ **Applicable**	☒ **N/A**		
C. Treatment System	☐ **Applicable**	☒ **N/A**		
D. Monitoring Data	☒ **Applicable**	☐ **N/A**		
E. Monitored Natural Attenuation	☒ **Applicable**	☐ **N/A**		

1. Monitoring Wells (natural attenuation remedy):

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

Remarks:_____

_____

X. OTHER REMEDIES

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

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

Attachment G-1. Five-Year Review Site Inspection Checklist – R-Area 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.). The remedial action for RAOU includes MNA, ISD, cover system, and LUCs to prevent exposure to contaminated groundwater above MCLs. The remedy is effective and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections and site maintenance (vegetation removal, structures integrity and warning signs) and site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the RAOU and the condition of its warning signs is good. There are no issues that impact the protectiveness of the remedy that require corrective actions. 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. The well sampling schedules were not impacted.
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

APPENDIX H. R-AREA REACTOR SEEPAGE BASINS (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) AND 108-4R OVERFLOW BASIN OPERABLE UNIT

I. INTRODUCTION

This report is the fifth five-year remedy review for the R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin (RRSB) Operable Unit (OU). Contaminants have been left in place at the RRSB OU 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 RRSB OU is protective of human health and the environment. This report documents the results of the review.

II. OU CHRONOLOGY

Table H-1 lists the chronology of site events for the RRSB OU.

III. BACKGROUND

RRSB OU is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for Savannah River Site (SRS) (FFA 1993). The media associated with the RRSB OU are soil and groundwater.

The RRSB OU consists of the following: six seepage basins, process sewer lines, sanitary sewer system (sewer lines and sanitary discharge lagoon), an area of contaminated vegetation north of R-Reactor Building (105-R), surface water and sediment, RRSB groundwater, and the 108-4R Overflow Basin.

Physical Characteristics

R Area is located in the east-central portion of SRS, west of PAR Pond (Figure H-1). The RRSB OU is located north of the R-Reactor Building (105-R) (Figure H-2) and straddles the boundary between the Upper Three Runs and Lower Three Runs watersheds. Prior to

initiation of remedial actions, the entire area, 10.9 hectares (27 acres), was fenced and approximately 45%, 4.9 hectares (12 acres), was paved.

Six unlined earthen basins were constructed to receive radioactively contaminated purge water from R-Reactor's spent fuel storage process. All six basins were constructed between June 1957 and March 1958. The basins varied in depth from 2 to 5 m (6.6 ft to 16.4 ft) below ground surface. Basin 1 was L-shaped, with each leg approximately 61 m (200 ft) long by 12.2 m (40 ft) wide. Basin 2 was 61 m (200 ft) long by 15.2 m (50 ft) wide. Basin 3 was 91.4 m (300 ft) long by 9.1 m (30 ft) wide. Basin 4 was 99.1 m (325 ft) long by 9.1 m (30 ft) wide. Basin 5 was 114.3 m (375 ft) long by 12.2 m (40 ft) wide. Basin 6 was 167.6 m (550 ft) long by 15.2 m (50 ft) wide (WSRC 1997).

Process sewer lines conveyed process water from the R-Reactor disassembly basin to the six seepage basins. The pipelines to Basins 1 through 5 were 7.6 cm (3 in) polyvinyl chloride (563.3 m [1,848 ft] in total length) and the pipeline to Basin 6 was 10.2 cm (4 in) steel (345.9 m [1,135 ft] in total length) (WSRC 1997).

A 15.2 cm (6 in) and 30.5 cm (12 in) terra cotta sanitary sewer line that supported a housing camp during construction of the R-Reactor extended through the RRSB OU to convey wastewater to a sanitary discharge lagoon (WSRC 1997).

Three small surface areas, called the eastern, western, and northern contamination areas, were contaminated near the basins ranging in size respectively [6.1 x 12.2 m (20 x 40 ft), 4.6 x 9.1 m (15 x 30 ft), and 3.7 x 4.6 m (12 x 15 ft)] (SRNS 2008).

The 108-4R Overflow Basin is located 76.2 m (250 ft) southwest of the R-Reactor and approximately 152.4 m (500 ft) southwest of R-Reactor Seepage Basins. The basin was constructed to collect overflow from two adjacent underground storage tanks (USTs) within a vault (108-3R) that stored diesel fuel for standby generators in the R-Reactor. The unlined basin was approximately 18.3 m x 18.3 m x 2.4 m (60 ft x 60 ft x 8 ft) deep. A soil berm up to 0.6 m (2 ft) above grade was placed around the basin's perimeter. The USTs were removed in March 1990 and the associated piping was abandoned in place after being

flushed and purged as directed by South Carolina Department of Environmental Services (SCDES).

The RRSBs lie north of and adjacent to R-Reactor on an elevated divide between Mill Creek and the primary discharge canal northeast of the R-Area perimeter fence (Figure H-2). The OU is situated between drainage to PAR Pond located 2.7 km (1.7 mi) to the southeast (beyond the boundaries of the figure) and the headwaters of Mill Creek located 0.4 km (0.25 mi) to the northwest. The western edge of the basin area slopes towards the west. Surface water drainage from the RRSB OU flows north and west into Mill Creek or east into the R-Area Discharge Canal and Pond A.

Groundwater in the shallow water table aquifer, a horizon of the Upper Aquifer Zone of the Upper Three Runs Aquifer, has been contaminated. Historically, large fluctuations in the water table elevation occur as a result of changes in precipitation, resulting in occurrences of groundwater coming close to or in contact with contamination in the bottom of the basins. Groundwater flow is primarily vertical from the A to AA horizon to the Transmissive Zone, where flow becomes more lateral and moves radially away from the basins. A review of water table elevations from the currently monitored wells indicate increasing levels since the last five-year remedy review, which is consistent with the increased rainfall since then.

Land and Resource Use

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

History of Contamination

The six basins received an estimated 5-million gallons of purge water, containing approximately 3,276 Ci total activity, from the R-Reactor disassembly basin. Primary

radionuclides present were strontium-90, cesium-137, and tritium. A non-routine discharge, due to a calorimeter test failure in 1957, released approximately 2,700 Ci of radionuclides primarily to Basin 1 with Basins 2 through 5 receiving a lesser amount. A sanitary sewer system was breached during the construction of Basins 1 and 5 and received the contaminated water discharged to the basins (WSRC 1997).

Basins 1 through 5 were retired and backfilled during the period 1958 through 1959. The backfill operation involved placement of clean soil followed by a cover of a thin asphalt emulsion to restrict the infiltration of surface water and to inhibit the growth of vegetation. Between 1960 and 1963, clay dikes were placed around Basin 1 and the northwest end of Basin 3. The dikes extended down to a clay layer at an approximate depth of 4.6 m (15 ft) and 2.4 m (8 ft) at Basins 1 and 3, respectively. Clay caps were then placed over the diked areas to control exposure to radioactively contaminated surface soils and infiltration of surface water (WSRC 1997). Basin 6 was retired in 1964, when operations at R-Reactor ceased. In 1977, this basin was backfilled with soil and covered with a thin asphalt emulsion (WSRC 1997).

In 1996, the asphalt emulsion over all the basins was determined to be contaminated with radioactive soil, vegetation, and fire ant mounds. The surface contamination was being spread by surface water runoff and wind (WSRC 1997). Figure H-3 shows a photograph of one of the basins prior to any remedial action.

The 108-4R Overflow Basin was in operation from 1953 to 1964. The USTs were removed in March 1990, and associated piping was abandoned in place after being flushed and purged to less than 20 percent of the lower explosive limit as directed by SCDES. Soil and groundwater samples taken during excavation of the USTs indicated no detectable levels of contamination. The groundwater samples were collected from groundwater that seeped into the excavation (WSRC 1990).

Initial Response

The *Removal Site Evaluation Report for the R-Reactor Seepage Basin, Erosion Control Activities and Asphalt Cover Refurbishment* (WSRC 1996) determined that the spread of

contamination due to the deteriorated condition of the asphalt emulsion cover warranted action. A removal action was performed during the summer of 1996, which included a 4.3 hectares (10.7 acres) cover system over the existing asphalt emulsion. The cover system consisted of a 10.2 cm (4 inch) thick layer of asphalt over 0.6 m (1.5 ft) minimum thick layer of clean soil. Prior to the cover system installation, the surfaces of the basins were treated with herbicides and insecticides, and the surface was recontoured to promote drainage.

Basis for Taking Action

Because of the large quantity of radioactivity in the historical releases, it was concluded that the subsurface soil associated with the basin bottoms, the process sewer lines, and the contaminated sections of the sanitary sewer line should be considered principal threat source material (PTSM). Refined contaminants of concern (RCOCs)and associated cleanup levels were developed for the RRSB (WSRC 2002, 2003) (Table H-2).

The 108-4R Overflow Basin, Surface Water, and Sediment subunits were characterized under a separate soil investigation from February to April 1996. No RCOCs were identified for soil or groundwater. Therefore, there is no problem warranting action at the 108-4R Overflow Basin, surface water, and sediment. With approval of SCDES and U.S. Environmental Protection Agency (USEPA), this subunit was backfilled and covered by a vegetative layer.

The basis for taking action was due to potential exposure of residents or industrial workers to unacceptable levels of carcinogenic contaminants in soils and groundwater, and due to the potential continuing impact to groundwater due to leaching from contaminated soils. Risks were highest for exposures to soils attributable to the presence of multiple radionuclides, including cesium-137 and strontium-90. Potential risks associated with exposure to groundwater are attributed to the presence of strontium-90. No ecological risks were associated with this OU.

IV. REMEDIAL ACTIONS

Remedy Selection

As stated in the Record of Decision (ROD) (WSRC 2003), the selected remedial action for the RRSB OU is placement of a reinforced concrete intruder barrier system with granite monuments over the PTSM, excavation of PTSM outside of the boundary fence and disposal on-unit, excavation and on-unit disposal of contaminated vegetation, installation of an asphalt bioturbation barrier, mixing zone for groundwater, and institutional controls. The cleanup levels for groundwater RCOCs are based on achieving their respective maximum contaminant level (MCL) values in all monitoring wells.

As stated in the ROD (WSRC 2003), the remedial action objectives (RAOs) for the four RRSB OU subunits that require remedial actions include the following:

Seepage Basins

- Minimize transport of soil contaminants to groundwater above MCLs;
- Prevent industrial worker exposure to contamination (including contaminated vegetation) in the long-term;
- Consider treatment or removal to address PTSM to the extent practicable; and
- Prevent residential development within the RRSB OU and any exposure to basin contents.

Abandoned Process Sewer Lines

- Prevent industrial worker exposure to the pipelines;
- Consider treatment alternatives to address PTSM (pipelines) to the extent practicable; and
- Prevent residential development within the OU and any exposure to the pipelines.

Sanitary Sewer System

- Prevent industrial worker exposure to the sanitary sewer lines and associated subsurface soil contaminants;
- Prevent industrial worker exposure to contaminated vegetation;
- Prevent future transfer of subsurface soil contaminants towards the surface through biotic uptake or bioturbation;
- Consider treatment alternatives to address PTSM (sanitary sewer line) to the extent practicable; and
- Prevent residential development within the OU and any exposure to the sewer lines.

Groundwater

- Prevent industrial worker exposure to groundwater contaminated above MCLs.
- Reduce strontium-90 concentrations in groundwater to below MCLs.
- Minimize the spread of groundwater contamination and prevent discharge of contaminated groundwater to surface water; and
- Prevent residential development within the OU and any exposure to contaminated groundwater.

The following LUC objectives have been developed to ensure the protectiveness of the remedy described above:

- Prevent contact, removal, or excavation of contaminated soil and pipelines;
- Preclude residential use of the area; and
- Prevent unauthorized access to contaminated groundwater in the area.

Remedy Implementation

Implementation of these remedial actions included the following activities (SRNS 2008):

- Consolidated PTSM in a PTSM Waste Trench, which included excavation of all contaminated process and sanitary sewer lines, and associated soil located outside of the OU boundary, and contaminated soils in the contamination areas (CAs). The PTSM consisted of approximately 229 m^3 (300 yd^3) of process pipes and associated soil, 54 m^3 (70 yd^3) of soil from the three CAs, seven 208 liters (55 gallon) drums of solidified residual water collected from the process sewer lines and five thrust blocks (0.6 m x 0.6 m x 0.6 m [2 ft x 2 ft x 2 ft]). The CAs were backfilled using adjacent soils (in two CAs) or common fill (in one CA). Where practical, the pipes were grouted prior to removal to contain contaminants. The excavated areas were backfilled with clean fill material.

- Consolidated contaminated trees from the RRSB OU and the Warner's Pond OU, secondary waste and track hoe in areas where contaminated vegetation had grown. The contaminated trees were cut down, chipped, stockpiled, composted, and blended with the first foot of soil where contaminated vegetation had previously grown. The secondary waste consisted of pre-existing concrete markers, galvanized corrugated metal pipe and miscellaneous job control waste and personal protective equipment.

- Installed a concrete intruder barrier covering 2.2 hectares (5.5 acres) over all PTSM located in all six basins, the PTSM Waste Trench, and the process sewer lines inside the boundary fence (Figure H-2). The barrier consisted of a 15.2 cm (6 in) minimum reinforced concrete placed directly on the existing asphalt cover or over a 15.2 cm (6 in) minimum thick layer of clean, compacted structural fill on soils and newly placed asphalt. The barrier extended 3 m (10 ft) beyond the edge of the PTSM.

- Installed an asphalt bioturbation barrier covering 5.1 hectares (12.6 acres) where contaminated vegetation had previously grown (Figures H-2). The barrier consists of a 10.2 cm (4 in) minimum thick asphalt layer over a 15.2 cm (6 in) minimum thick layer of clean, compacted structural fill. The barrier extended 6.1 m (20 ft) beyond the edge of the area.

- Installed five granite monuments on the concrete intruder barrier to warn future inadvertent intruders.
- Established a mixing zone monitoring well network by installing 15 monitoring wells and abandoning 30 existing monitoring wells.
- Installed 23 access control warning signs and fencing along the perimeter of the RRSB OU.
- Established land use controls (LUCs) for 15.3 hectares (37.8 acres) (Figure H-4) including: 1) requiring a Site Use and Site Clearance Permit for any proposed use of land within the OU area, which is applicable to all activities and personnel on site; 2) maintaining the site access controls (24-hour surveillance system, artificial and natural barriers, control entry systems, and warning signs) in place at the SRS boundary to comply with the security requirements for a Resource Conservation and Recovery Act-permitted facility; and 3) in the long-term, if the property ever is transferred to non-federal ownership, the US Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site (WSRC 2003).

Figure H-5 shows current (2024) photos of the RRSB OU.

System Operations/Operation and Maintenance

There are no system operational requirements.

The following maintenance activities are ongoing:

- Groundwater mixing zone monitoring program has been implemented. Groundwater Mixing Zone Reports were being issued biennially through 2014, with the first report submitted in August 2010 (SRNS 2010, SRNS 2012, SRNS 2014). After 2014, reports are to be submitted every four years (2014, 2018, 2022, etc.), with letter reports submitted in between (2016, 2020, 2024, etc.). Two letter reports (SRNS 2020, SRNS 2024) and one Groundwater Mixing Zone Report (SRNS 2022) have been submitted

since the last five-year remedy review. Groundwater is being monitored for strontium-90, americium-241 (well RSE 26DL), and water elevation.

- Annual site inspections and site maintenance (i.e., intruder and bioturbation barriers maintenance, repair of erosion damage, fencing and warning signs) (WSRC 2008). Minor repairs (e.g., seal small cracks, remove vegetation growth) to the RRSB bioturbation asphalt barrier are completed soon after discovery. Major repairs (e.g., complete asphalt resurfacing) are anticipated approximately every fifth year.
- Site controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented.

Costs associated with the selected remedy for RRSB include operation and maintenance (O&M) costs of the cover, groundwater mixing zone monitoring, and institutional controls (i.e., LUCs). The ROD estimated O&M cost, including Five-Year Remedy Review costs, associated with the selected remedy is $19,145,000, which was discounted at 3.9% per year (WSRC 2003). This is a present worth cost, including 30 years of maintenance activities. The estimated O&M costs applicable to FY2020 through FY2024 are $1,613,432. The actual O&M cost from FY2020 to FY2024 is $1,371,042. The actual costs (Table H-3) are lower than expected due to optimization of the groundwater monitoring program. Based on inspections conducted from FY2020 through FY2024, the various maintenance activities completed at RRSB OU included sealing asphalt, concrete repair, applying herbicide to vegetation (i.e., on fence, in expansion joints on cover, and both sediment basins), cutting vegetation in sediment basins, and treating active ant mounds.

V. PROGRESS SINCE LAST REVIEW

This is the fifth five-year remedy review for the RRSB OU. The previous protectiveness statement concluded that because the remedial actions of LUCs is protective, the RRSB OU is protective of human health and the environment.

There were no recommendations for 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;
- 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 was held February 27, 2025. SRNS personnel were also present in the meeting. During the meeting, the participants viewed drone footage of RRSB and 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 were identified during the inspection.

Scheduled annual site inspection conducted from FY2020 to FY2024 identified overgrown vegetation on the fence, standing and fallen dead trees, small pine samplings growing

through cracks in the asphalt, minor erosion at the inlets to the sediment basin, cracks present in the asphalt, concrete spalling and deteriorated sealant in control joints. These findings were documented on the field inspection checklist and resolved soon after discovery. The asphalt received a complete sealant coating in 2019. Concrete was repaired and joint sealants re-applied in 2023 and 2024.

VII. TECHNICAL ASSESSMENT

Is the Remedy Functioning as Intended by the Decision Document?

The remedies selected for the RRSB OU are functioning as intended, as demonstrated below:

The review of documents, applicable or relevant and appropriate requirements, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD. The consolidation of PTSM and contaminated trees and materials from RRSB OU and Warner's Pond OU, followed by placement of a concrete intruder barrier over PTSM contaminated materials and process sewer lines within the boundary fence is effective in preventing industrial worker exposure to contamination. This remedy component is minimizing rainwater infiltration, thus preventing the mobilization of contaminant migration RCOCs to groundwater above MCLs. The remedy component of MNA by radioactive decay is effective in reducing strontium-90 concentrations in the groundwater. The mixing zone groundwater data verifies that groundwater has not exceeded MCLs at the compliance points (boundary monitoring wells). The remedial action has achieved the RAOs for this OU. The effective implementation of institutional controls (i.e., LUCs) has prevented exposure to contaminated materials (i.e., soil, pipelines, vegetation) that remain beneath the cover system.

The LUCs that are in place include (1) physical access controls to prevent unauthorized entry to SRS and the OU (fences, guards, security patrols, etc.); (2) administrative controls that maintain the OU for industrial use only (SRS is a secured government facility with land use restrictions); and (3) fencing, warning signs and LUCs (SRS Site Use/Site Clearance Program). The *Land Use Control Implementation Plan for RRSB OU* governs

LUC implementation, maintenance, monitoring, reporting, and enforcement of LUCs (WSRC 2008). No activities were observed that would have violated the institutional controls (i.e., LUCs).

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 RRSB 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 for the RRSB OU as shown in Appendix B. The changes to the values for RCOCs at the RRSB 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 at the RRSB OU from being protective.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

There are no recommendations and follow-up actions concerning RRSB OU

X. PROTECTIVENESS STATEMENTS

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

Exposure pathways that could result in unacceptable risks are being controlled by institutional controls (i.e., LUCs) to prevent exposure to or ingestion of contaminated groundwater and soil media. All threats to contaminated soil at the RRSB OU have been addressed through excavation, consolidation, backfilling of excavated areas, and implementation of physical access controls to prevent unauthorized entry to SRS (fences, guards, security patrols, etc.), administrative controls that maintain the RRSB OU for industrial use only, and warning signs and use restrictions via the SRS Site Use/Site Clearance Program.

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, 2008. *Post-Construction Report for the R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) Operable Unit (U)*, WSRC-RP-2005-4070, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2010. *2009 Biennial Groundwater Mixing Zone Report for the R-Area Reactor Seepage Basins and 108-4R Overflow Basin Operable Unit (U)*, SRNS-RP-2010-00999, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2012. *2011 Biennial Groundwater Mixing Zone Report for the R-Area Reactor Seepage Basins and 108-4R Overflow Basin Operable Unit (U)*, SRNS-RP-2012-00349, Revision 1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2014. *2012/2013 Groundwater Mixing Zone Report for the R-Area Reactor Seepage Basins and 108-4R Overflow Basin Operable Unit (U)*, SRNS-RP-2014-00318, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2020. *Groundwater Mixing Zone Sampling Summary Report for the R-Area Reactor Seepage Basin / 108-4R Overflow Basin Operable Unit 2019 (U)*, IACD-20-161, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2022. *2021 Groundwater Mixing Zone Report for the R-Area Reactor Seepage Basins and 108-4R Overflow Basin Operable Unit (U)*, SRNS-RP-2022-00212, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

SRNS, 2024. *Groundwater Mixing Zone Sampling Summary Report for the R-Area Reactor Seepage Basin / 108-4R Overflow Basin Operable Unit 2023 (U)*, RDDD-24-141, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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

WSRC, 1990. *Site Assessment of the 108-R Underground Storage Tank System at the Savannah River Site*, under cover from J.V. Odum to J.R. Hess (SCDHEC), ESH-FSG-900260, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC.

WSRC, 1996. *Removal Site Evaluation Report for the R Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) Erosion Control Activities and Asphalt Cover*

Refurbishment (U), WSRC-RP-96-141, Revision 1, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 1997. *Preliminary Characterization Report Phase 1 RFI/RI for the R-Reactor Seepage Basins/108-4R Overflow Basin (U)*, WSRC-RP-97-196, Revision 0, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

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

WSRC, 2002. *RCRA Facility Investigation/Remedial Investigation Report with Baseline Risk Assessment for the R-Area Reactor Seepage Basins/ 108-4R Overflow Basin Operable Unit (U)*, WSRC-RP-98-314, Revision 1.2, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2003. *Record of Decision for the R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) and 108-4R Overflow Basin Operable Unit (U)*, WSRC-RP-2003-4093, Revision 1, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2004. *R-Area Reactor Seepage Basins and 108-4R Overflow Basin Operable Unit Mixing Zone (U)*, WSRC-RP-2002-4053, Revision 1.2, Westinghouse Savannah River Company LLC, Savannah River Site, Aiken, SC

WSRC, 2008. *Land Use Control Implementation Plan for the R-Area Reactor Seepage Basins (904-57G, -58G, -59G, -60G, -103G, -104G) Operable Unit (U)*, WSRC-RP-2004-4032, Revision 1.1, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

Various - Inspection Data Sheets – *Field Inspection Checklist, R-Reactor Seepage Basins 904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G (U)*, ER-IDS-019-048, Inspection period 2019 through 2024 (annually)

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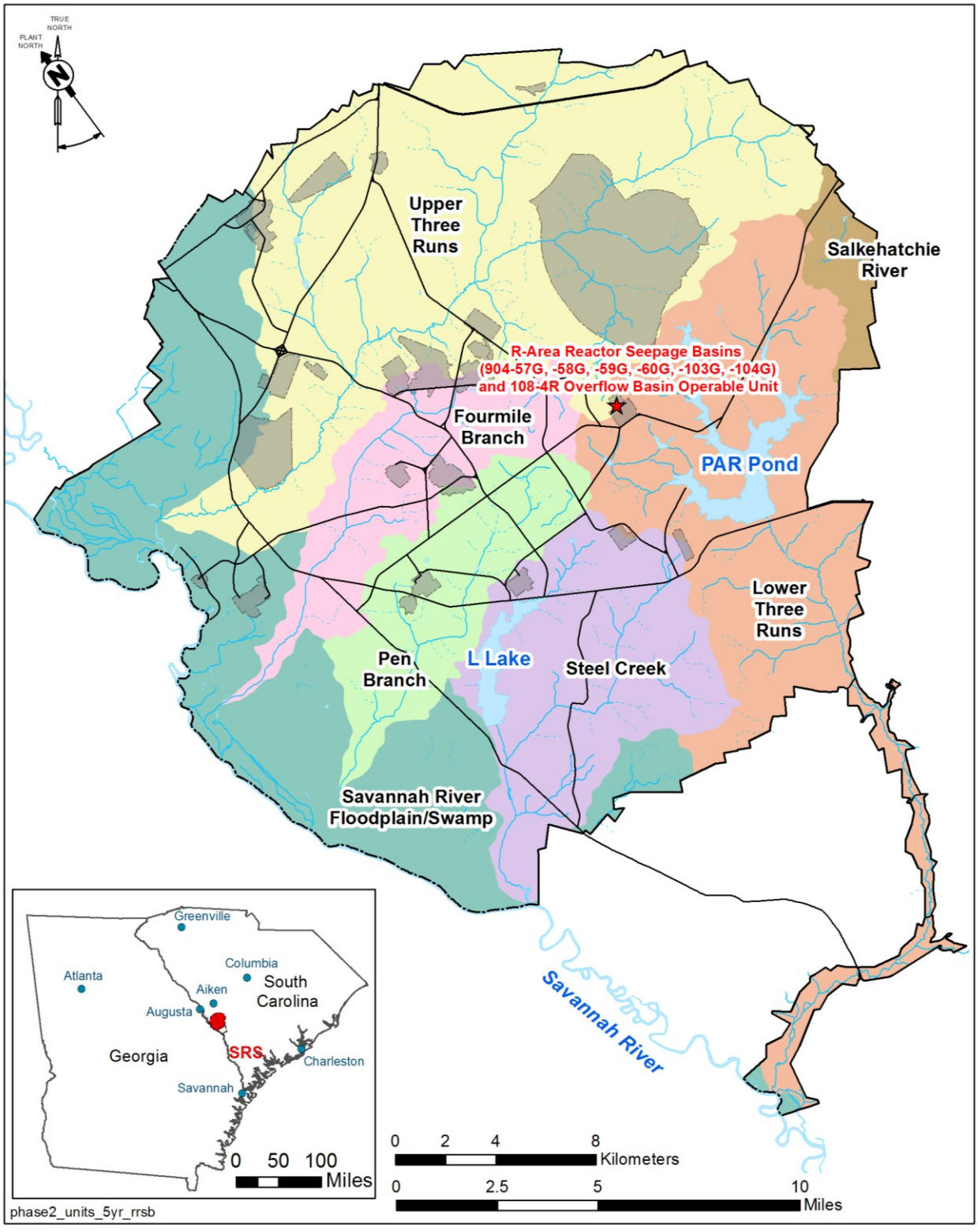


Figure H-1. Location of R-Area Reactor Seepage Basins Operable Unit at SRS

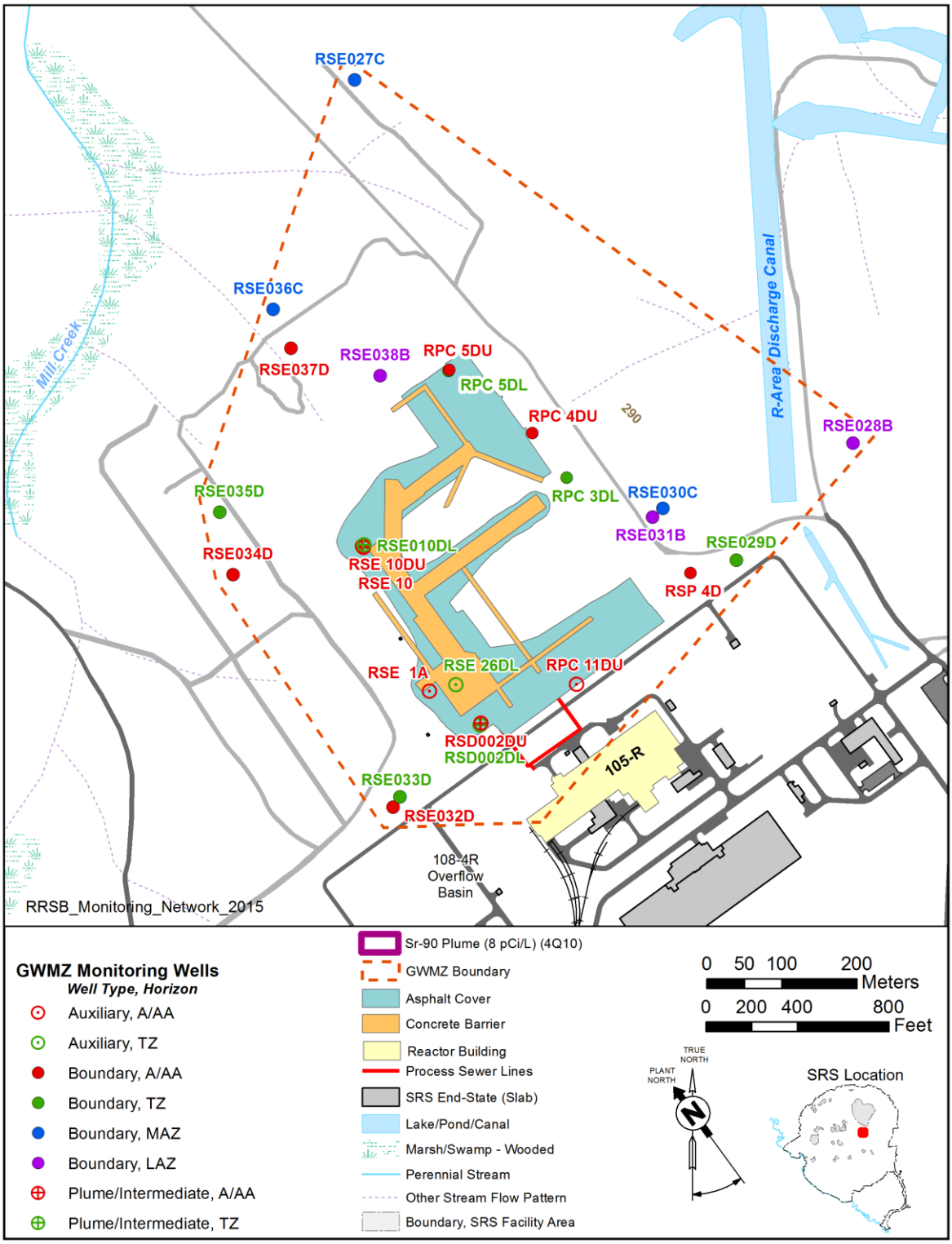


Figure H-2. Current Layout of the RRSB OU with Monitoring Well Network



Figure H-3. Photograph of the R-Reactor Seepage Basins Prior to ROD Approved Remedial Action (exact date unknown)

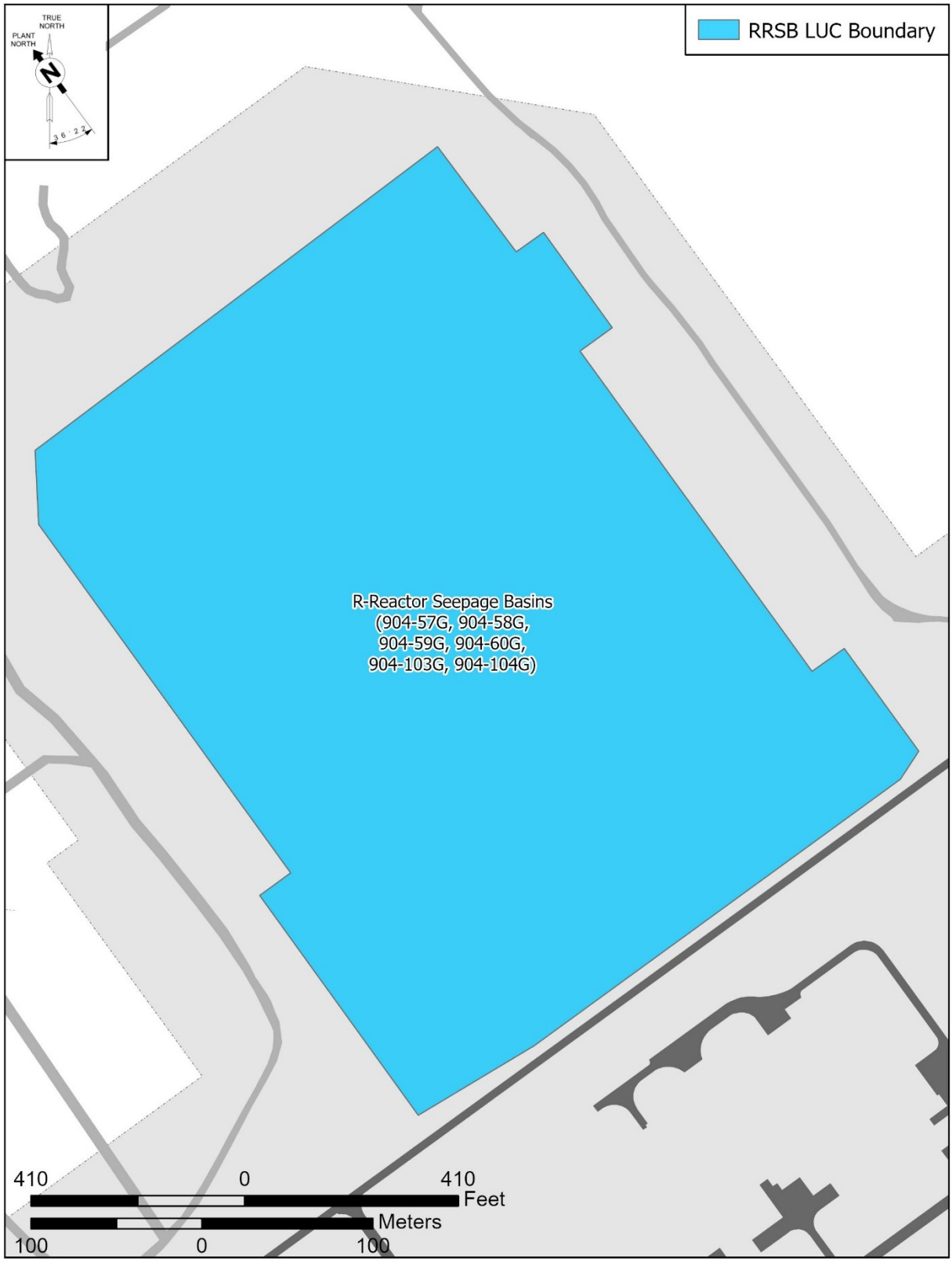


Figure H-4. Land Use Control Boundary for the R-Reactor Seepage Basins OU





Figure H-5. Current Photos of the R-Reactor Seepage Basins OU (2024)

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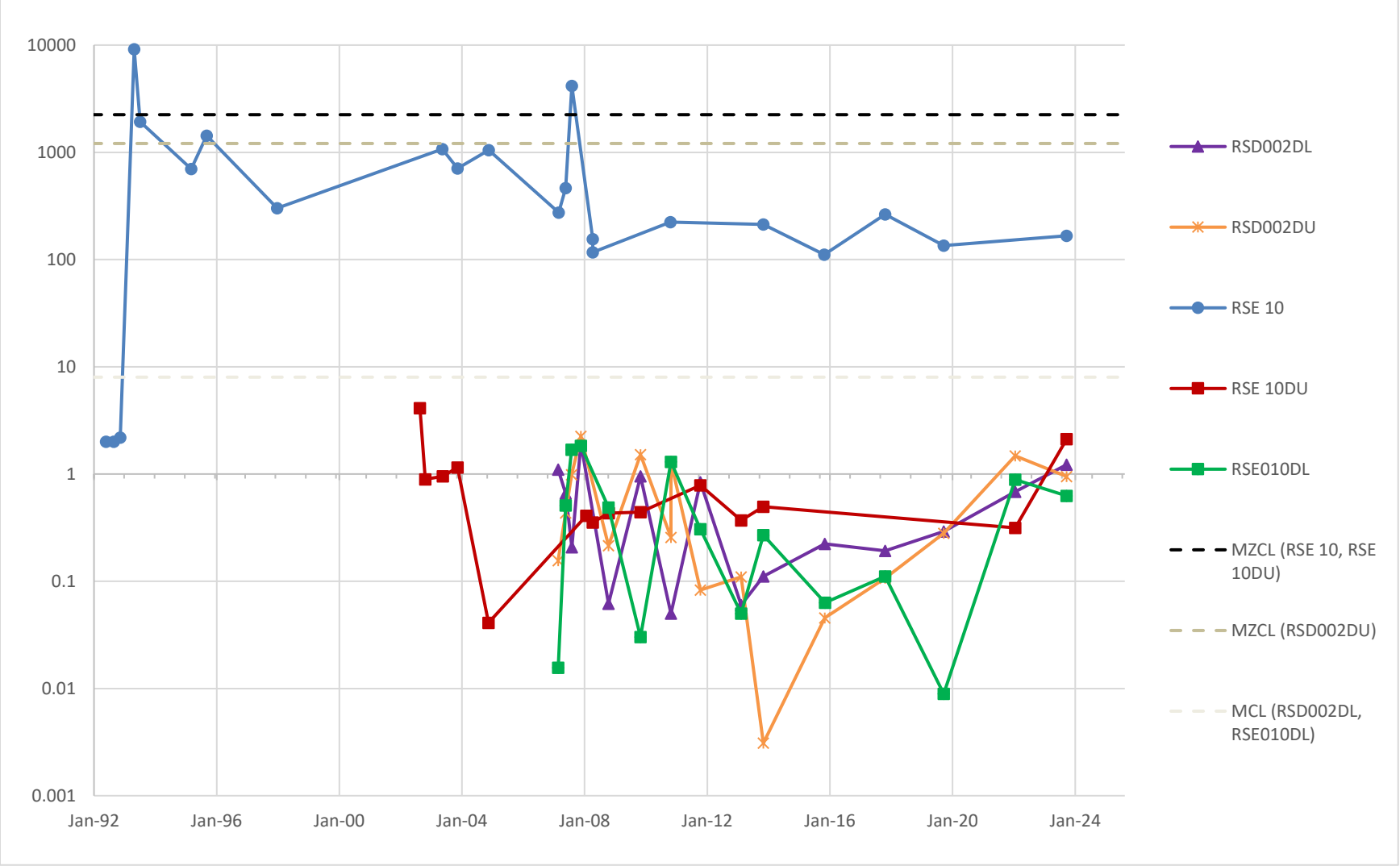


Figure H-6. Strontium-90 Time Trend Data for RRSB Plume/Intermediate Wells

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Table H-1. Chronology of OU Events

Event	Date
RFI/RI Field Start / Complete	1995 / 2000
Removal Action and Asphalt Cover Completed	1996
Corrective Measures Study /Feasibility Study Rev 1 Submittal	January 30, 2003
ROD Issuance	March 18, 2004
Remedial Action Start / Complete	March 4, 2005 / January 30, 2008
Previous Five-Year Remedy Review	January 28, 2009 / February 4, 2014 / February 2, 2017 / December 9, 2020

Table H-2. RCOCs and Cleanup Levels for 1E-06 Risk to Industrial Worker at RRSB OU

Medium	RCOC	CM Cleanup Level	HH Cleanup Level	ECO Cleanup Level (Earthworm)
Surface Soil	Cesium-137	none	1.05E-01 ρCi/g	none
Subsurface Soil	Americium-241	none	7.75E00 ρCi/g	3.32E00 ρCi/g
	Cesium -137	none	1.05E-01 ρCi/g	2.22E+03 ρCi/g
	Cobalt-60	none	2.25E-02 ρCi/g	none
	Plutonium-238	none	1.04E+01 ρCi/g	none
	Plutonium -239/240	none	9.69E00 ρCi/g	none
	Strontium-90	none	5.65E+01 ρCi/g	2.42E+03 ρCi/g
Total Soil Profile	Americium-241	5.32E-02 ρCi/g	none	none
	Carbon-14	4.08E00 ρCi/g	none	none
	Plutonium -239/240	1.38E-02ρCi/g	none	none
	Strontium-90	5.32E-02 ρCi/g	none	none
Groundwater	Americium-241	none	4.88E-01 ρCi/L	none
	Strontium-90	none	2.86E00 ρCi/L	none

Notes: CM – Contaminant Migration
HH – Human Health
ECO - Ecological

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

	FY2020	FY2021	FY2022	FY2023	FY2024	Five-Year Total
Total Actual O&M Costs ($)	258,873	398,044	57,705	339,449	316,972	1,371,042
Total ROD Estimated Direct O&M Costs ($)	320,024	320,024	320,024	320,024	333,336[a]	1,613,432

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

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Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit

I. SITE INFORMATION			
Site Name:	**R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit**	**Date of Inspection:**	**7/31/24**
Location and Region	**SRS, USEPA Region 4**	**EPA ID:**	**SEMS #25**
Agency, Office, or Company leading the Five-Year Review	**USDOE**	**Weather/ Temperature**	**90°F and partly cloudy**

Remedy Includes: ***(Click all that apply)***

- ☒ Landfill Cover/Containment
- ☒ Access Controls
- ☒ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Pump and Treatment
- ☒ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barriers
- ☒ Other Mixing Zone (groundwater); Excavation/Consolidation of process and sanitary sewer lines

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

II. INTERVIEWS (CLICK ALL THAT APPLY)

1. **O&M Site Manager:** Brian Hanshew (Name) | EC&ACP Post Closure Waste Site O&M Site Manager (Title) | 10/22/2024 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-4949
   Problems/Suggestions: ☐ Report Attached

2. **O&M Staff:** Eric Barron (Name) | EC&ACP Post Closure Waste Site Inspector/Maintenance Coord. (Title) | 10/22/2024 (Date)
   Interviewed: ☐ At Site ☒ At Office ☐ By Phone Phone No.: 803-952-3395
   Problems/Suggestions: ☐ Report Attached

Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit *(continued)*

II. INTERVIEWS (CLICK ALL THAT APPLY) (CONTINUED)

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

Agency: _____

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

Problems/Suggestions: ☐ Report Attached _____

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

On 10/22/2024, the EC&ACP Post Closure Waste Site Inspector/Maintenance Coordinators, Harold Rodgers (803-953-3363) and Donald Sahm (803-952-4145), were also interviewed.

III.ONSITE DOCUMENTS & RECORDS VERIFIED *(CLICK ALL THAT APPLY)*

1. O&M Documents:

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

Remarks: Annual site inspections are performed per SRS procedure ER-SOP-019, *Waste Unit Inspection and Maintenance*, and ER-IDS-019-048, *Field Inspection Checklist for the RRSB*.

2. Health and Safety Plans (HASPs):

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

Remarks: Routine O&M activities do not require a Site-Specific Health and Safety Plan (SSHASP) under 29 CFR 1910.120, Hazardous Waste Operations. A SSHASP is prepared if needed.

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

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

4. Permits and Service Agreements:

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

Remarks: _____

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

Remarks: _____

Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit *(continued)*

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

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

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

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

9. Discharge Compliance Records:
☐ Air ☐ Readily Available ☐ Up to Date ☒ N/A
☐ Water (Effluent) ☐ Readily Available ☐ Up to Date ☒ N/A
Remarks:

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

IV. O&M COSTS

1. O&M Organization:
☐ State In-House ☐ Contractor for State
☐ PRP In-House ☐ Contractor for PRP
☒ Other: SRS

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

3. Unanticipated or Unusually High O&M Costs During Review Period
Describe costs and reasons: N/A

Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ **APPLICABLE** ☐ **N/A**

A. Fencing

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

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

B. Signs

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

Remarks: Signs at this site are in good condition.

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*

C. Institutional Controls

1. Implementation and Enforcement

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

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

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

Frequency: Once every five years

Responsible Party/Agent: USDOE Savannah River Field Office

Contact: Phil Prater (Name) | Operable Unit Manager (Title) | 12/03/24 (Date) | 803-952-9333 (Phone No.)

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

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

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

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

Problems/Suggestions: ☐ Report Attached

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

Remarks: The ICs are adequately maintaining the RRSB protective systems. When maintenance activities are identified during inspections (e.g., repairing holes and concrete spalling, vegetation removal from the cover system), repairs are scheduled and performed.

Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit *(continued)*

V. ACCESS AND INSTITUTIONAL CONTROLS *(Continued)*
D. General
1. Vandalism/Trespassing: ☐ Location shown on site map ☒ No vandalism is evident Remarks:
2. Land use changes onsite: ☒ N/A Remarks:
3. Land use changes offsite: ☒ N/A Remarks:
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: Annual site inspections conducted from 2015 and 2018 identified the presence of overgrown vegetation, dead tree on fence, depression in asphalt near pipe to sediment basin, gap at bottom of perimeter fence, and ant mounds. These findings were documented on the field inspection checklist and resolved soon after discovery.
Remarks: Site vegetation is mowed routinely.

Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENT ☒ APPLICABLE ☐ N/A

A. Landfill Surface

1. Settlement (Low spots): ☐ Location shown on site map ☒ Settlement not evident
Areal extent_____ Depth_____
Remarks:_____

2. Cracks: ☐ Location shown on site map ☒ Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks: No cracking evident in the low-permeable barrier. Cracking evident in the bioturbation (asphalt) and intruder (concrete) barrier does not impact the protectiveness of the remedy.

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

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

5. Vegetative Cover: ☐ Grass ☐ Cover properly established ☐ No signs of stress
Areal extent_____ Depth_____
Remarks: NA._____

6. Alternative Cover (armored rock, concrete, etc.): ☐ N/A
Remarks: The cover system includes a concrete intruder barrier, an asphalt bioturbation barrier, and the original asphalt cover installed in 1996.

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

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

Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENTS *(Continued)*

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

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

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

D. Cover Penetrations ☒ **Applicable** ☐ **N/A**

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

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

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

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

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

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

F. Cover Drainage Layer ☐ **Applicable** ☒ **N/A**

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

Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin Operable Unit *(continued)*

VII. LANDFILL COVER/CONTAINMENTS *(Continued)*	
H. Retaining Walls	☐ **Applicable** ☒ **N/A**
I. Perimeter Ditches/Offsite Discharge	☒ **Applicable** ☐ **N/A**
1. Siltation:	☐ Location shown on site map ☒ Siltation not evident Areal extent_____ Depth_____ Remarks:_____
2. Vegetative Growth:	☐ Location shown on site map ☐ N/A ☒ Vegetation does not impede flow Areal extent_____ Type_____ Remarks:_____
3. Erosion:	☐ Location shown on site map ☒ Erosion not evident Areal extent_____ Depth_____ Remarks:_____
4. Discharge Structure:	☐ Location shown on site map ☒ N/A Remarks:_____
VIII. VERTICAL BARRIER WALLS	☐ **APPLICABLE** ☒ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES	☒ **APPLICABLE** ☐ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ **Applicable** ☒ **N/A**
B. Surface Water Collection Structures, Pumps, and Pipelines	☐ **Applicable** ☒ **N/A**
C. Treatment System	☐ **Applicable** ☒ **N/A**
D. Monitoring Data	☒ **Applicable** ☐ **N/A**
1. Monitoring Data:	☒ Is routinely submitted on time ☒ Is of acceptable quality
2. Monitoring Data Suggests:	☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining
E. Monitored Natural Attenuation	☒ **Applicable** ☐ **N/A**
1. Monitoring Wells (natural attenuation remedy):	☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs maintenance ☐ N/A Remarks:_____
X. OTHER REMEDIES	
If there are remedies applied at the site, which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.	
A. Soil Vapor Extraction System	☐ **Applicable** ☒ **N/A**

Attachment H-1. Five-Year Review Site Inspection Checklist – R-Area Reactor Seepage Basins (904-57G, 904-58G, 904-59G, 904-60G, 904-103G, 904-104G) and 108-4R Overflow Basin 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.). The remedial action for RRSB OU is installation of a reinforced concrete intruder barrier system over PTSM with granite monuments, installation of an asphalt bioturbation barrier over contaminated vegetation areas, excavation and consolidation on-unit of PTSM outside boundary fence, monitored natural attenuation (MNA) by radioactive decay with mixing zone for groundwater, and institutional controls (i.e., LUCs). The remedy is effective and functioning as designed.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. The O&M procedures consisting of annual site inspections (FY2020 through FY2024) and site maintenance (repair of erosion damage, cover system, fencing and warning signs) and land use controls (SRS Site Use and Site Clearance Programs, which restrict invasive and permanent installation activities at the waste unit) have been implemented. The O&M procedures are adequately maintaining the RRSB OU and the condition of the fencing and warning signs is good. When maintenance activities are identified during inspections (e.g., repairing holes, concrete spalling, asphalt cracking, vegetation removal from the cover system), repairs are scheduled and performed. There are no issues that impact the protectiveness of the remedy that require corrective actions. 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. The well sampling schedules were not impacted.
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A

End of Checklist

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