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

Aiken, South Carolina

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

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

Table 3 provides a summary of the LUC objectives for the OUs with groundwater remedies.

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.

Remedial actions which result in any hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure are reviewed every five years to ensure protection of human health and the environment. The specific contaminants and remedial actions for each OU in this five-year remedy review

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. RGs are defined for individual OUs, but in general, remedial action objectives (RAOs) at SRS are:

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

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 are:

- 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 OU, LUCs are ongoing at all OUs discussed in this five-year remedy review report. Because the remedy for the C-Area Groundwater (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 removal 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, or abandoned.

Groundwater monitoring is an important component of operation and maintenance (O&M) at SRS. Groundwater monitoring includes installing monitoring wells, collecting water samples, analysis of samples at laboratories, data management, data interpretation, and document production. Groundwater monitoring reports are produced and submitted to USEPA and SCDHEC for individual OUs where monitoring and reporting are required. 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) 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) 2015 to FY2019 to the estimated costs from the remedy decision documents over the same period. The review for the actual costs incurred (i.e., FY2015 to FY2019) is based on the time-period since the last review five-year remedy review. 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 Fifth Five-Year Remedy Review Report (SRNS 2017a) concluded that all OUs were found to be protective (Table 5).

The recommendation from the Fifth Five-Year Remedy Review Report that impact the OUs with groundwater remedies evaluated in this report are as follows (Table 6):

- SRS recommended continued monitoring of 1,4-dioxane for two OUs and reporting of the results in the OU-specific groundwater reports. Based on the monitoring results, the USEPA, SCDHEC, and USDOE will determine whether or not 1,4-dioxane should be permanently added to the list of monitored constituents. For this report, this recommendation pertains to the D-Area Oil Seepage Basin (631-G) (DOSB) OU and R-Area Operable Unit (RAOU). Based on comprehensive sampling, 1,4-dioxane was added to the annual groundwater monitoring at the DOSB. ~~, but monitoring~~ Monitoring is no longer required at RAOU as agreed to by the approved *R-Area Groundwater (NBN) Effectiveness Monitoring Report in Support of the R-Area Operable Unit (U)*

January 2015 through December 2015 (SRNS 2016) and subsequent comment responses.

The *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 2017b) included data and a recommendation to discontinue monitoring and reporting at the LBRP OU (SEMS #56). As stated in the report, the LBRP OU ROD (WSRC 2002) selected Groundwater Mixing Zone with institutional controls (i.e., LUCs) as the remedial action until the maximum contaminant level for carbon tetrachloride is no longer exceeded for groundwater. The USEPA and SCDHEC agreed with the recommendation to discontinue monitoring and reporting at the LBRP OU in letters dated October 3, 2017 and October 25, 2017, respectively. Since monitoring and reporting have been discontinued at the LBRP OU, the institutional controls (i.e., LUCs) are no longer required because remedial goals for unrestricted land use have been achieved. The LBRP unit has been identified as a No Action site in Appendix A.

Groundwater monitoring at the RAOU will focus on the most mobile constituents (carbon-14, chlorine-36, iodine-129, and tritium) every five years at ten in situ decommissioning wells based on regulatory approved recommendations in the *Addendum to the Effectiveness Monitoring Plan (EMP) for the R-Area Operable Unit*. In addition, carbon-14 was detected in on sample in 2017. Monitoring for 1,4-dioxane is no longer required at RAOU based on monitoring results and regulatory agreement. Starting in 2018, the reporting requirements for RAOU were revised from annually to biennially.

IV. FIVE-YEAR REMEDY REVIEW PROCESS

USDOE has implemented the Sixth 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 Fifth Five-Year Remedy Review for this category:

- Submitted a scoping summary to USDOE, USEPA, and SCDHEC on August 15, 2019. The USDOE, USEPA, and SCDHEC agreed to the scope and schedule of the remedy review report, which is discussed in the scoping summary;

- Published an announcement on October 10, 2019 that the USDOE is conducting the Sixth 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, and through notices in the *Aiken Standard* (Aiken, SC), *The Augusta Chronicle* (Augusta, GA), *The People Sentinel* (Allendale and Barnwell, SC), and *The State* (Columbia, SC) newspapers. The Environmental Bulletin and newspaper affidavits of publication are available in the Administrative Record File;

- Reviewed appropriate data, documentation (i.e., including RODs, Early Action RODs [EARODs], Interim RODs [IRODs], Explanation of Significant Differences [ESDs], ROD Amendments), 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; and

- Submitted draft Fact Sheet to USEPA and SCDHEC for review with Revision 0 of the Sixth Five-Year Remedy Review Report for SRS OUs with Groundwater Remedies.

Community Notification and Involvement

USDOE will address any comments received from USEPA and SCDHEC and provide a Revision 1 report, if necessary, for USEPA and SCDHEC approval. After the USEPA and SCDHEC approve this report and USDOE, USEPA, and SCDHEC sign this report, a notice of its availability will be published in the *Aiken Standard* (Aiken, SC), *The Augusta Chronicle* (Augusta, GA), *The People Sentinel* (Allendale and Barnwell, SC), and *The State* (Columbia, SC) newspapers. Additionally, the availability of the report will be announced in *The Savannah River Site Environmental Bulletin*, which will be sent to the SRS mailing list. The report will be made available to the public at four information repositories. A briefing to the Citizens Advisory Board will be conducted prior to finalizing the report.

Data Review, Site Inspections, and Interviews

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

USEPA and SCDHEC are expected to perform site inspections of OUs with groundwater remedies with issued decision documents prior to submittal of the Revision 1 report. The Revision 0 report will be submitted on or before December 20, 2019.

V. TECHNICAL ASSESSMENT

The technical assessment of the environmental cleanup program at SRS in general and each of the OU-specific remedies evaluated in this report (Appendices C through 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 Monitored Natural Attenuation (MNA) remedy plumes indicates that groundwater concentrations are generally decreasing, and plumes are not expanding.~~
- Groundwater data at Monitored Natural Attenuation (MNA) remedy plumes indicates that groundwater concentrations are generally decreasing, and plumes are not expanding.
- None of the expected timeframes to achieve RGs 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 ~~and for~~ 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.

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 of the OUs included in this report. An evaluation of changes in 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 2015 to the current 2019 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. There were no changes in action-specific or location-specific requirements that would impact any remedy. This evaluation is included in Appendix B and described in the OU-specific appendices.

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

Answer: No other information that could call into question the protectiveness of the selected remedies and no outstanding issues have been identified in this Sixth Five-Year Remedy Review.

For all OUs, 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 for SRS remain protective of human health and the environment and are functioning as intended. No issues were identified for the remedies evaluated (Table 7).

There are no recommendations or follow-up actions (Table 8).

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 9). The ERH with SVE interim remedy for the CAGW OU was determined to be protective of human health and the environment in the short-term. However, in order for the remedy to be protective in the long-term, additional remedial actions, including LUCs (if needed), will need to be implemented. SRS facility security and administrative controls that restrict unauthorized access to the CAGW OU are not part of the interim remedy and therefore not recognized as long-term protective. SRS will include the CAGW OU in the FFA Annual Progress Report to demonstrate long-term protectiveness through the SRS facility security and administrative controls. The report is required by the FFA and includes an annual certification by the USDOE SRS Manager that the listed OUs are in compliance with land use requirements.

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 for the remedies in this report 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 January 21, 2029.

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

SRNS, 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

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

Operable Unit	Main Remedy	Remedy Decision Document Year[a]	FY2015-FY2019 O&M Estimated Cost	FY2015-FY2019 O&M Actual Cost	% of Estimate	Comments
C-Area Groundwater	Electrical Resistance Heating (ERH) with Soil Vapor Extraction (SVE)[a],	2004[b]	$0	$65,652	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, Monitored Natural Attenuation (MNA), LUCs	2005	$234,793	$760,~~231~~23~~2~~	324%	Actual costs were higher than expected because the current number of monitoring wells and surface water sampling locations (76) is much larger than the ROD estimate (12) requiring increased maintenance activities.
D-Area Oil Seepage Basin (631-G)	Removal Action (Excavation), Groundwater Mixing Zone (GWMZ), LUCs	1999	$16,666	$269,817	1,619%	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	$269,560	$135,043	50%	Actual costs are lower than expected because well redevelopment costs are significantly lower than estimated.
R-Area Operable Unit	Removal Actions (ISD of R-Reactor Building [105-R], Excavation, Cover), MNA, LUCs	2011	$286,500	$1,023,392	357%	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	$2,652,242 ~~$503,459~~	$503,459~~$2,652,242~~	19%	Actual costs are less than expected due to optimization of the groundwater monitoring.

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 Fifth 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 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. However, in order to establish long-term protectiveness, additional remedial actions may need to be evaluated and selected, as necessary, based on the results of groundwater modeling and continued groundwater and surface water monitoring.
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.

C-AREA GROUNDWATER OPERABLE UNIT

I. Introduction

This is the fourth five-year review for the C-Area Groundwater (CAGW) Operable Unit (OU). The review was conducted from August 2019 through November 2019. 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 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 2014a). ~~TCE does not exceed the MCL in surface water in either Castor Creek or Fourmile Branch, but TCE does exceed the MCL in an unnamed tributary to Castor Creek.~~

CAGW OU is currently monitored by the following:

- Fifty-six 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.

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 260 µg/L in 2015 and to 203 µg/L in 2019 (Figure C-7). The groundwater monitoring network is functioning properly.

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

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)~~Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for the CAGW OU (SRNS 2018a)~~, the removal action objective is to protect human health and the environment ~~is to reduce~~by reducing the mass of ~~discharge of groundwater contaminated with~~ TCE present in the groundwater ~~above MCLs to surface water, so that the MCL (5 µg/L) is no longer exceeded in the unnamed tributary to Castor Creek~~. 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 and will continue for five years per the *Removal Action Design Plan with Effectiveness Monitoring Plan for C-Area Groundwater Operable Unit* (SRNS 2018~~b~~).

VI. Five-Year Review Process

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

- Reviewed the documents listed in Section XII, Documents Reviewed;
- Confirmed implementation and completion of the interim remedial action;
- Reviewed all process and performance monitoring data provided by the 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 2015 to 2019 indicate the concentration of the CAGW OU TCE plume has significantly decreased relative to the original 1998 to 2002 characterization. In 2019, the TCE plume has also decreased in extent relative to the original 1998 to 2002 characterization. Groundwater monitoring wells (CRW 20D and CRW021DR) 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-7).

X. Protectiveness Statement(s)

The interim action remedy at the CAGW OU is currently protective of human health and the environment because access is controlled by SRS facility security and administrative controls. However, in order for the remedy to be protective in the long-term, additional remedial actions, including LUCs (if needed), will need to be implemented. The final ROD for CAGW OU is scheduled for issuance in April 2027.

The exposure pathways that could result in unacceptable risks are being restricted through SRS land use controls. 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, use restrictions via the SRS Site Use/Site Clearance Program. Protectiveness of the interim remedial action will be verified by continued groundwater monitoring.

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

XI. Next Review

As shown in Appendix A, Table A-1, the next five-year review for SRS OUs with Groundwater is scheduled for January 2026.

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, 2014a. *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, 2014b. *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, Savannah River Site, Aiken, SC

~~SRNS, 2018a. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) for C-Area Groundwater Operable Unit (U)*, SRNS-RP-2017-00365, Revision 1, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC~~

SRNS, ~~2018b~~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

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

USDOE, 2018. *Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the C-Area Groundwater Operable Unit (U)*, SEMS Number: 82, IACD-18-150, U.S. Department of Energy, Savannah River Operations Office, Savannah River Site, Aiken, SC

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

WSRC, 2004a. *Interim Record of Decision Remedial Alternative Selection for the Remediation of the Trichloroethylene Vadose Zone Source Unit at the C-Reactor*

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 fifth five-year review for the Chemicals, Metals, and Pesticides (CMP) Pits 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 August 2019 through November 2019. 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~~; h~~. However, the stream has ~~never seen contaminant concentrations above MCLs~~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.

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-2).

System Operations/Operation and Maintenance

Operations at the CMP Pits OU are now complete.

- ERH and SVE have been completed in Field A. The ERH equipment and associated SVE wells 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 $234,793 for Fiscal Year (FY) 2015 through FY2019. The actual O&M cost for FY2015 until FY2019 is $760,~~231~~232. 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 FY2015 through FY2019, 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 fifth 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.

- Groundwater results around the actual CMP Pits source area have shown a general decreasing trend with time, but there was a maximum PCE concentration of 1,150 µg/L in 2018 (Table D-4). Well CMP 35D has shown increases in recent years. The increase in VOCs and lindane at well CMP 35D 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 35D location (Figures D-3 and D-7). DCM groundwater results have been below the MCL (5 µg/L) since the ERH/SVE shutdown. The 2018 DCM maximum result was 2.37 µg/L. Table D-4 compares the pre-ERH/SVE groundwater concentrations with current (2018) concentrations.

- 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. However, samples were analyzed for lindane in the fourth quarter of 2017 and all results were non-detect. The number of groundwater wells exceeding the lindane MCL has decreased from seven monitoring wells in 2008 to five monitoring wells in 2018.

- The Field A cover system is effective in preventing residential exposure to surface soils above RGs. 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. ~~With one exception, RCOC concentrations of surface water are generally below MCLs.~~ Most surface water results are non-detect. ~~Overall, RCOC concentrations have been reduced in the groundwater and the plumes overall footprints are not expanding. There has only been one MCL exceedance in surface water. This occurred in fourth quarter of 2015 at surface water station CMP-SW-08 with a PCE concentration of 8.49 µg/L. All subsequent results have been non-detect at all surface~~

~~water stations.~~Out of 150 Pen Branch surface water samples and 1,649 analytical results collected since 2002, there have been six non-estimated results for the VOCs monitored at CMP Pits. This number includes detections of PCE, TCE, and cis-1,2-dichloroethylene.

- 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 2018 in groundwater at a maximum of 1.5 µg/L, which is below the 70 µg/L MCL. It was not detected in surface water. Vinyl chloride was detected in groundwater during 2018 at a maximum of 0.74 µg/L, which is below the 2 µg/L MCL. Vinyl chloride was not detected in surface water.

The remedial activities are meeting the RGs established for the CMP Pits OU, as discussed in Section IV, by eliminating or controlling all routes of exposure to human health and ecological receptors.

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

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

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

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

VIII. Issues

No issues have been identified for the CMP Pits OU.

IX. Recommendations and Follow-up Actions

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

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

	FY2015	FY2016	FY2017	FY2018	FY2019	Five-Year Total
Total Actual O&M Costs ($)	334,400	~~416~~146,004	101,852	88,299	89,677	760,~~231~~232
Total ROD Estimated Direct O&M Costs ($)	44,297	44,297	57,605[a]	44,297	44,297	234,793

a - FY2017 estimated costs include costs associated with the fifth five-year remedy review. Actual costs were accrued in FY2016.

Table D-4. Comparison of RGs and Groundwater and Surface Water Monitoring Data from 2018

	RGs	Groundwater		Surface Water
RCOC	MCL (µg/L)*	2007 (Pre-ERH/SVE) Maximum Concentration (µg/L)	2018 Maximum Concentration (µg/L)	2018 Maximum Concentration (µg/L)
PCE	5.0	1.35E+03	1.15E+03	Non Detect
TCE	5.0	8.51E+02	6.85E+02	Non Detect
Lindane	0.2	3.05E00	7.07E00	Not Analyzed[1]
Carbon Tetrachloride	5.0	2.46E+01	2.45E+01	Non Detect
Dichloromethane	5.0	2.09E00	2.37E00	Non Detect
Bromodichloromethane	80	1.6E+01	9.4E00	Non Detect
Chloroform	80	3.04E+01	2.7E+01	Non Detect

* MCL values are based on USEPA values available May 2019.
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
Dichlorodiphenyldichloro ethane (DDD)	2.87E+02	1.94E+02
Dichlorodiphenyldichloro ethylene (DDE)	5.54E+02	4.96E+01
Dichlorodiphenyldichloro trichloroethylene (DDT)	1.62E+03	3.22E+02

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 ~~and surface water~~ 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 remedial goals (RGs) 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