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FY2024 Performance Assessment Annual Summary Report for the E-Area Low-Level Waste Facility

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EXECUTIVE SUMMARY

The Savannah River Site (SRS) E-Area Low-Level Waste Facility (ELLWF) consists of six types of disposal units described in the Performance Assessment (PA) (WSRC, 2008): Low-Activity Waste Vault (LAWV), Intermediate-Level Vault (ILV), Trenches [Slit Trenches (STs), Engineered Trenches (ETs), and Component-in-Grout (CIG) Trenches], and Naval Reactor Component Disposal Areas (NRCDAs). The ELLWF is a part of the Solid Waste Management Facility (SWMF). The SWMF is managed and operated by the SRS Environmental Management contractor, Savannah River Nuclear Solutions (SRNS). The Solid Waste Management (SWM) organization within SRNS is responsible for operating the SWMF and the Savannah River National Laboratory (SRNL) is the technical agent that SRNS has contracted for preparing and maintaining the PA. SWMF operations have been performed at SRS since 1952. The mission of the SWMF is to provide storage, processing, disposal, and shipment of radioactive, hazardous, and mixed waste. The SWMF is committed to treat, store, and dispose of these waste products in a manner that protects the environment and the health and safety of the facility worker, the co-located worker, and the offsite general public. Wastes handled in the SWMF include low level waste, transuranic waste, hazardous waste, Toxic Substances Control Act waste, and mixed waste (i.e., containing both hazardous and radioactive constituents).

SRS low-level waste management at ELLWF is regulated under Department of Energy (DOE) Manual 435.1-1 (DOE, 2021) and is authorized under a Disposal Authorization Statement (DAS) as a federal permit. The original DAS was issued by Department of Energy-Headquarters (DOE-HQ) on September 28, 1999 (DOE, 1999) for the operation of the ELLWF and the Saltstone Disposal Facility. Those portions of that DAS applicable to the ELLWF were superseded by Revision 1 of the DAS on July 15, 2008 (DOE, 2008). The 2008 PA and 2008 DAS were officially implemented by the facility on October 31, 2008, and are the authorization documents for this Fiscal Year (FY) 2024 Annual Summary Report (ASR).

In FY2024, an unreviewed disposal question evaluation (UDQE) was prepared to assess the need for repair/replacement of the LAWV engineered roof system (i.e. membrane and fiberboard covering) that was damaged in a storm event. The conclusions of this UDQE determined that there was no immediate need to repair/replace the membrane and fiberboard covering, that the credibility of the PA models was not impacted, and a Special Analysis (SA) was not required. The UDQE also specified that routine inspections and maintenance of the LAWV drainage system must be performed, and the repair/replacement of LAWV membrane and fiberboard covering must occur by the end of facility operations.

Disposed volume to date of low-level waste placed in ELLWF disposal units is 303,642 cubic meters. In FY2024, 6,480 cubic meters were disposed in ELLWF. All disposal units remain in conformance with their disposal limits (McGill, 2024).

Tritium Action level (AL) concentration is calculated using the inventory limit for each group of disposal units (e.g., East ST, Center ST, West ST and CIG Trenches and ET) and the peak activity to the ground water from the PA modeling. Administrative limits are 25% of the tritium AL concentrations (Millings, 2012). If, the tritium concentration that enters the groundwater from the vadose zone is greater than the AL concentration for any of the group of disposal units, the result will be a tritium activity that exceeds the Environmental Protection Agency drinking water standard for tritium of 20 pCi/ml in groundwater at the 100-m compliance point. This assumes that the tritium concentration is distributed uniformly in a disposal group and that all points beneath the trenches in this group are adding the greater than AL concentrations to the water table at the same time. Of the 101 AL lysimeters that were sampled, only 4 spread over four trenches (Table 5-2) exceeded the tritium AL concentrations. Therefore, the EPA drinking water standard for tritium of 20 pCi/ml in the groundwater at the 100-m compliance point will not be exceeded. Exceeding the tritium AL in a single lysimeter is considered a conservative trigger compared with PA modeling results

for the group of disposal units. When an AL lysimeter is first exceeded, the data is reviewed to establish temporal trends and to evaluate depth and geographic occurrence (Millings, 2012). A graded hierarchal approach is used to evaluate the collected data versus projected results from the PA. The graded approach may consist of continued monitoring, additional sampling, testing, and research studies implemented through the PA/CA maintenance program.

The CIG storm water runoff cover was damaged due to a storm in May 2024. SWM is assessing the need to repair/replace the cover. In FY2024, the other defects observed during monitoring were minor (e.g., cover depressions, erosion areas, and fasteners) and are not expected to affect the performance of these interim barriers. Inspection of the LAWV walls performed in FY2024 showed no significant cracking or degradation. Finally, all sump water samples were found to be below administrative limits before being discharged. Impacts to surface waters downstream from the ELLWF (i.e., Upper Three Runs, Savannah River) continue to fall well below DOE public dose limits based on annual compliance monitoring.

The number of proposed changes to data, models and operational plans for the ELLWF since the 2008 PA are enough to warrant a revision. A draft revision to the PA is currently being prepared and upon completion will be submitted to the DOE LFRG for review. Operational restrictions remain in place from a SA (Hamm et al., 2018) that evaluated new groundwater flow predictions. These measures ensure that POs will continue to be met (Mayer et al., 2024) and will be incorporated in the next PA revision.

The FY2024 PA ASR for the ELLWF affirms that the disposal facility continued to operate within the bounds of the current PA and Composite Analysis (CA) baseline and the subsequent SA's and satisfied all the requirements, conditions, and limitations identified in the 2008 DAS (DOE, 2008), RWMB (McGill, 2024), and ELLWF Low-Level Waste Acceptance Criteria (SRS-1S, 2023). This ASR affirms that the supporting studies performed in FY2024 do not alter the conclusions of the ELLWF PA (WSRC, 2008) and that there is a reasonable expectation that the ELLWF will meet the POs delineated in DOE Manual 435.1-1 (DOE, 2021).

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LIST OF ABBREVIATIONS

AL	Action-Level
CA	Composite Analysis
CIG	Components-in-Grout
CWTS	Consolidated Waste Tracking System
DAS	Disposal Authorization Statement
DOE	Department of Energy
DOE-HQ	Department of Energy – Headquarters
dpm	disintegrations per minute
DU	Disposal Unit
ELLWF	E-Area Low-Level Waste Facility
ET	Engineered Trench
FY	Fiscal Year
GSA	General Separations Area
ILV	Intermediate-Level (Waste) Vault
L	liter
LAWV	Low-Activity Waste Vault
LFRG	Low-Level Waste Disposal Facility Federal Review Group
LLW	Low-Level Waste
m^3	cubic meters
mL	milliliter
MWMF	Mixed Waste Management Facility
N/A	Not Applicable
NRCDA	Naval Reactor Component Disposal Area
PA	Performance Assessment
pCi	picocuries
PIF	Plume Interaction Factor
PO	Performance Objective
POA	Point of Assessment
R&D	Research & Development
RWMB	Radioactive Waste Management Basis
SA	Special Analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SOFs	Sum-of-Fractions
SRNL	Savannah River National Laboratory

SRNS	Savannah River Nuclear Solutions
SRS	Savannah River Site
ST	Slit Trench
SWM	Solid Waste Management
SWMF	Solid Waste Management Facility
SZ	Saturated Zone
UCAQE	Unreviewed Composite Analysis Question Evaluation
UDQE	Unreviewed Disposal Question Evaluation
UDQS	Unreviewed Disposal Question Screen
VOCs	Volatile Organic Compounds
VZMS	Vadose Zone Monitoring System
WAC	Waste Acceptance Criteria
WSRC	Westinghouse Savannah River Company

1.0 Facility Background/History

The Savannah River Site (SRS) E-Area Low-Level Waste Facility (ELLWF) consists of six types of disposal units described in the Performance Assessment (PA) (WSRC, 2008): Low-Activity Waste Vault (LAWV), Intermediate-Level Vault (ILV), Slit Trenches (STs), Engineered Trenches (ETs), Component-in-Grout (CIG) Trenches, and Naval Reactor Component Disposal Areas (NRCDAs). This ASR evaluates the adequacy of the approved 2008 ELLWF PA, along with the Special Analyses (SAs) approved since the 2008 ELLWF PA was issued, the 2008 Disposal Authorization Statement (DAS) (DOE, 2008), and the ELLWF Waste Acceptance Criteria (SRS-1S, 2023). The report also verifies that the Fiscal Year (FY) 2024 low-level waste (LLW) disposal operations were conducted within the bounds of the PA/SA baseline and the DAS. Important factors considered in this report include waste receipts, results from monitoring, research and development (R&D) programs, and the adequacy of controls derived from the PA/SA baseline.

SRS LLW management at ELLWF is regulated under Department of Energy (DOE) Manual 435.1-1 (DOE, 2021) and is authorized under a DAS as a federal permit. The original DAS was issued by Department of Energy-Headquarters (DOE-HQ) on September 28, 1999 (DOE, 1999) for the operation of the ELLWF and the Saltstone Disposal Facility. Those portions of that DAS applicable to the ELLWF were superseded by Revision 1 of the DAS on July 15, 2008 (DOE, 2008). The 2008 ELLWF PA and 2008 DAS were officially implemented by the facility on October 31, 2008, and are the authorization documents for this FY2024 ASR.

The ELLWF is a part of the Solid Waste Management Facility (SWMF). SWMF is managed and operated by the SRS Environmental Management contractor, Savannah River Nuclear Solutions (SRNS). The Solid Waste Management (SWM) organization within SRNS is responsible for operating the SWMF and the Savannah River National Laboratory (SRNL) is the technical agent that SRNS has contracted for preparing and maintaining the PA. The SWMF operations have been performed at SRS for 72 years. The mission of the SWMF is to variously provide for the storage, processing, disposal, and shipment of radioactive, hazardous, and mixed waste as appropriate. The SWMF is committed to treat, store, and dispose of these waste products in such a manner that the health and safety of the facility worker, the co-located worker, the offsite general public, and the environment are protected. Wastes handled in the SWMF include low level waste, transuranic waste, hazardous waste, Toxic Substances Control Act waste, and mixed waste (containing both hazardous and radioactive constituents). The SWMF consists of E-Area and a portion of H-Area within SRS. Most SWMF processes, including ELLWF, are located in the E-Area near the center of SRS.

2.0 Changes Potentially Affecting the PA, CA, DAS OR RWMB

One unreviewed disposal question evaluation (UDQE) was prepared and approved in FY2024 (Table 2-1). On January 9, 2024, severe inclement weather resulted in damage to the LAWV engineered roof system (i.e. membrane and fiberboard covering). This damage was discovered during a subsequent walkdown of the facility. Initial reports of damage were minor, but closer inspection revealed significant damage to the engineered roof system over LAWV Cells 2 and 3. Initial reviews of SWMF safety basis and PA documentation confirmed that immediate repair/replacement was not necessary. An unreviewed disposal question screen (UDQS) was then performed further assess the need for repair/replacement of the LAWV engineered roof system. The UDQE evaluated the PA documentation that describes the LAWV construction and intended purposes of its design with respect to requirements that are inputs and uphold the PA models. The conclusion of this evaluation confirms the initial assessment that there are no explicit requirements to uphold the integrity of the LAWV engineered roof system to protect the credibility of the PA models, and that no SA is required to address the impacts of the damage. In fact, the current PA (WSRC, 2008) states that “the LAWV model does not include a HDPE layer directly over the vault”. While the PA documents do include explanations of the intended function performed by the LAWV engineered roof system, they do so with respect to the entire LAWV drainage system. Ultimately, as long as the LAWV drainage system can minimize water infiltration into the vault and remove infiltrated water during the operational and institutional control periods, the LAWV model remains credible. As it stands currently, the LAWV drainage system in its entirety continues to provide adequate drainage of rainwater to minimize infiltration and meet PA objectives. The conclusions of the UDQE propose delaying the repair until funding is available to complete replacement of the roof system over the entire LAWV. Further, routine inspections and maintenance of other facets of the LAWV drainage system must be performed in the meantime to ensure that the basis for delaying repair/replacement remains valid. The repair/replacement must take place by 2065 or the end of facility operations, whichever comes first.

Table 2-1. Potential Changes Affecting the PA, CA, DAS or RWMB.

Disposal Facility/Unit	UDQE/UCAQE or Change control process identification number	Change, Discovery, Proposed Action, New Information description	Evaluation Results	Special Analysis number (if applicable)	PA, CA, DAS or RWMB Impacts
ELLWF: LAWV	SRNS-TR-2024-00401 (Simmons, 2024)	Delayed repair of the Low Activity Waste Vault (LAWV) engineered roof system (i.e. membrane and fiberboard covering) damage following inclement weather.	Delaying repair/replacement is deemed appropriate so long as the LAWV drainage system is functioning properly during the Operational and IC periods. Routine inspections and maintenance of other facets of the LAWV drainage system must be performed to ensure that the basis for delaying repair/replacement remains valid during the Operational Period.	N/A	None due to negative UDQE; the results of this UDQE conclude that the credibility of the PA models remain valid

3.0 Cumulative Effects of Changes

Based on the information described in Section 2.0 and Table 2-1, there were no changes potentially affecting the PA, CA, DAS or RWMB during FY2024.

4.0 Waste Receipts

Waste acceptance criteria for disposal of LLW at the ELLWF are found in Manual1S SRS Radioactive Waste Requirements, Chapter 5 Low-Level Waste procedure. Chapter 5 identifies the specific Waste

Acceptance Criteria (WAC) by waste form, general Consolidated Waste Tracking System (CWTS) limits, and a LLW disposal unit decision tree. This LLW WAC procedure is periodically reviewed and updated (SRS-1S, 2023).

As required by the WAC (SRS-1S, 2023), waste generators must fill out a waste stream characterization form for each waste stream and forward it to SWM for approval prior to shipping. This characterization form includes the waste type and description. SWM reviews the characterization form for compliance with the WAC. Each request for disposal is evaluated and decision on disposal unit is made that helps to balance curie limits/ sum of fractions (SOF) vs. volume capacity of the ELLWF. Currently, there are over 2,400 approved waste streams in CWTS with approximately 132 approved waste streams active as of the end of FY2024. All waste types received in the E-Area disposal units were included and analyzed in the PA or supporting SAs.

The disposed radionuclide and volumetric inventories in FY2024 (between 10/1/23 and 9/30/24) were compared against the applicable PA/SA-limits for each of the LLW disposal units in ELLWF and were the basis for the analysis that demonstrates POs can be met. These disposal units included the E-Area Vaults (LAWV, ILV), the disposal trenches (STs and ETs), and the NRCDA.

The radionuclide inventory limits calculated in the PA/SA are implemented in the WAC. Disposed inventory is tracked as fractions of the individual radionuclide limits in the ELLWF waste tracking system. The sum of these fractions for each disposal unit is controlled to less than or equal to one to ensure compliance with each PA performance measure’s limit. SWM typically operates most low-level waste facilities with a 0.95 SOF administrative limit. In FY2024, the SOFs for disposed radionuclide inventories for all disposal units were less than one.

Because of waste minimization and volume reduction programs at SRS, future inventory estimates indicate that only a single LAWV and a single ILV will be needed for low-level radioactive waste disposal over the operational period (i.e., no new vaults need to be constructed). After 30 years of LAWV operation, approximately 35% of the available volume is filled with waste that contains approximately 16% of the allowable radionuclide inventory. After 30 years of ILV operation, approximately 61% of the available volume in the nine cells is filled with waste that contains approximately 10% of the allowable radionuclide inventory.

In FY2024, 6,480 cubic meters were disposed in ELLWF. Table 4-1 provides the actual volume disposed to date, PA-estimated disposal capacity, percent filled, limiting SOFs for the selected performance measures, and the PA/Composite Analysis (CA) impact as of 9/30/24 for each disposal unit (DU). Final DU inventory limits are established by taking their preliminary inventory limits (i.e., computed in isolation from other neighboring DUs) and factoring in a plume interaction factor (PIF) that explicitly addresses for each DU its plume overlap from neighboring DUs. SOF calculations are based on these final inventory limits and as such implicitly account for all possible plume overlap contributions. The PIF method is constructed to be an estimator of plume overlap. Thus, if individual DU’s are compliant, the overall facility is as well. For all ELLWF units, the groundwater beta-gamma performance measure is the controlling pathway at various time intervals depending on the disposal unit. Dose impact was calculated using the most limiting SOF and the corresponding PO. The dose associated with each disposal unit is below the PO limit.

Table 4-1. Waste Receipts

Disposal Unit	Disposed Volume (m^3) to date	PA-Estimated Disposal Capacity (m^3)	Percent Filled (%) Volume	Sum of Fractions*	PA/CA Impact (mrem/yr)
LAWV	10,545	30,600	35	0.15	0.60 of 4
ILV	2,613	4,284	61	0.09	0.36 of 4
ST1 (closed)	14,264	14,264	100	0.85	3.40 of 4
ST2 (closed)	15,560	15,560	100	0.88	3.52 of 4
ST3 (closed)	16,953	16,953	100	0.94	3.76 of 4
ST4 (closed)	19,193	19,193	100	0.95	3.80 of 4
ST5 (closed)	28,125	28,125	100	0.99	3.96 of 4
ST6	20,849	23,000	91	0.82	3.28 of 4
ST7	10,555	15,900	66	0.55	2.20 of 4
ST8	15,461	16,275	95	0.89	3.56 of 4
ST9	21,378	23,000	93	0.95	3.80 of 4
ST10**	1,116	20,000	6	0.17	0.68 of 4
ST14 (closed)***	19,420	19,420	100	0.95	3.80 of 4
ET1 (closed)	35,660	35,660	100	0.87	3.48 of 4
ET2	29,238	35,500	82	0.92	3.68 of 4
ET3 (closed)	29,654	29,654	100	0.81	3.24 of 4
ET4	9,990	35,000	29	0.57	2.28 of 4
NRCDA (643-7E) (closed)	701	701	100	0.03	0.12 of 4
NRCDA (643-26E)	533	6,000	9	0.03	0.12 of 4
CIG 1	1,834	6,500	28	0.44	1.76 of 4

*Sum of Fractions is compared to the PA limit of 1.00.
**ST10 opened in FY2024
***ST14 closed in FY2024

5.0 Monitoring

The E-Area Performance Monitoring Program is implemented in accordance with DOE Manual 435.1-1 (DOE, 2021) and its objectives are to: 1) monitor trends in performance, 2) evaluate whether a facility is operating and behaving as expected and predicted by the PA, 3) evaluate the conservativeness of the PA conclusions, 4) provide input for refining the PA and building integrity in the PA analyses, and 5) provide a means to evaluate the potential for future regulatory exceedances. A summary of the monitoring performed for the ELLWF is provided in Table 5-1, and the performance modeling results that differ from expected behavior are given in Table 5-2.

The PA Monitoring Plan was last revised in 2012 (Millings, 2012). The monitoring plan will be revised in FY25 to incorporate administrative limits for ET3 (Hamm et al., 2013) and ET4 (Butcher, 2017) per their respective UDQEs.

The PA Expected Behavior in Table 5-2 indicates the administrative limit for the disposal unit. Table 5-2 also indicates lysimeters that exceeded administrative limits in FY2024 and current trends. Additionally, Table 5-2 includes lysimeters that exceeded limits in FY2023 but were below limits in FY2024.

Tritium Action level (AL) concentration is calculated using the inventory limit for each group of disposal units (e.g., East ST, Center ST, West ST and CIG Trenches and ET) and the peak activity to the ground water from the PA modeling. Administrative limits are 25% of the tritium AL concentrations (Millings, 2012). If, the tritium concentration that enters the groundwater from the vadose zone is greater than the AL concentration for any of the group of disposal units, the result will be a tritium activity that exceeds the Environmental Protection Agency drinking water standard for tritium of 20 pCi/ml in groundwater at the 100-m compliance point. This assumes that the tritium concentration is distributed uniformly in a disposal group and that all points beneath the trenches in this group are adding the greater than AL concentrations to the water table at the same time. Of the 101 AL lysimeters that were sampled, only 4 spread over four trenches (Table 5-2) exceeded the tritium AL concentrations. Therefore, the EPA drinking water standard for tritium of 20 pCi/ml in the groundwater at the 100-m compliance point will not be exceeded. Exceeding the tritium AL in a single lysimeter is considered a conservative trigger compared with PA modeling results for the group of disposal units. When an AL lysimeter is first exceeded, the data is reviewed to establish temporal trends and to evaluate depth and geographic occurrence (Millings, 2012). A graded hierarchal approach is used to evaluate the collected data versus projected results from the PA. The graded approach may consist of continued monitoring, additional sampling, testing, and research studies implemented through the PA/CA maintenance program.

To enhance future ASRs, the LFRG Co-Chairs recommended a discussion about the groundwater monitoring that is currently being collected under a Resource Conservation and Recovery Act permit and an explanation of why groundwater well data is not expected to be included in future revisions of the monitoring plan. This discussion follows below.

Results of Action Level lysimeters installed in the vadose zone around disposal facilities at ELLWF are used to demonstrate performance monitoring only. At SRS, DOE facilities comply with EPA/State regulations for water resource protection compliance. Groundwater monitoring for the plume underneath the ELLWF is performed under the Office of Environmental Quality Control Bureau of Land and Waste Management Hazardous and Mixed Waste Permit (SC1 890 008 989). In accordance with the Permit, an annual corrective action report is submitted on or before August 31 of each year and will document the effectiveness of the Corrective Action Program. An extensive monitoring well network monitors groundwater quality and remedial effectiveness associated with the MWMF (which includes the plume under ELLWF). Natural attenuation was the agreed upon remedy for the plume underneath the ELLWF and has proven to be the most effective. For tritium, the primary mechanism is radioactive decay. The tritium concentration is reducing and will continue to be monitored under the RCRA permit until closure.

Data from the eight groundwater wells installed by SWM around ELLWF are not used to demonstrate compliance with EPA/State regulations governing the waters of South Carolina. As discussed in the paragraph above compliance is demonstrated by a RCRA permit. Therefore, the data will not be included in this or future revisions of the ASR. However, the wells will be discussed in the PA monitoring plan for the purpose of identifying location and annual sampling of the wells. Due to the MWMF plume underneath the ELLWF several years of monitoring will be required along with time trending comparison to upgradient wells before it is determined whether ELLWF contribution to the tritium plume can be quantified. These wells will be assessed using time trending with performance criteria to be developed after a sufficient history is available.

Table 5-1. Current PA Monitoring Summary.

Area	Monitoring Location	Sampling Frequency	Radionuclide / Other Substance	Administrative Limits
Vadose Zone	Beneath and adjacent to the trenches	Twice per year	Tritium	East ST – 63.8 pCi/mL Center ST – 61.2 pCi/mL West ST – 46.9 pCi/mL ET 1 & 2 – 101.3 pCi/mL ET3 – 43.7 pCi/mL[1] CIG – 29.6 pCi/mL
Sump Water	Vault Sumps	Prior to pumping when threshold liquid levels are exceeded	Gross Alpha	1.35E+3 pCi/L (or ≥ 3.0 dpm/mL)
			Nonvolatile Beta	7.20E+3 pCi/L (or ≥ 16.0 dpm/mL)
			Tritium	8.0E+8 pCi/L (or ≥ 1.78E+6 dpm/mL)
	Engineered Trench 2 Sump	Prior to pumping when threshold liquid levels are exceeded	Gross Alpha	1.35E+3 pCi/L (or ≥ 3.0 dpm/mL)
			Nonvolatile Beta	7.20E+3 pCi/L (or ≥ 16.0 dpm/mL)
Groundwater	Not monitored by ELLWF because there is an existing tritium plume beneath parts of ELLWF that is from a different facility which monitors and reports on the groundwater per a RCRA permit. [2]			
Vault Concrete	Inspections of vaults; subsidence inspections	Every two years	N/A	N/A
Trench Cover Monitoring	Inspections of trench covers	Four times per year	N/A	N/A

[1] Calculated using peak fraction flux of 0.125 Ci/yr per Ci disposed (Hamm et al., 2013) and inventory limit of 4.2 Ci for the disposal unit (Butcher, 2017).
[2] Monitored and reported in accordance with the Office of Environmental Quality Control Bureau of Land and Waste Management Hazardous and Mixed Waste Permit SC1 890 008 989 (SCDHEC, 2014).

Table 5-2. Performance Monitoring Results that Differ from the Expected Results.

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results & Trends[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Engineered Trench 1 VL-6-SC	Radionuclide Transport	• 78.7 pCi/mL • Concentrations in the action-level lysimeter have been on a decreasing trend and were below the administrative limit in FY2024. The tritium concentration in the shallow lysimeter had been decreasing since reaching a peak in FY2020. However, in spring 2023, the concentration in the shallow lysimeter began increasing. Therefore, VL-6-SC may begin increasing again in the future. See Section 5.1.1.	101.3 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met
ELLWF Engineered Trench 1 VL-15*	Radionuclide Transport	• 1240 pCi/mL • VL-15 had been on an increasing trend since FY2011 reaching a maximum concentration of 1330 pCi/ml mL in FY2023. Concentrations declined in FY2024 and concentrations in the shallow lysimeters also show the start of what may be a declining trend. This suggests that VL-15 may have reached its maximum and concentrations could be starting to decrease. See Section 5.1.1.	101.3 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results & Trends[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Engineered Trench 1 VL-22	Radionuclide Transport	• 82.1 pCi/mL • VL-22 reached a peak of 300 pCi/mL in FY2020. In FY2021, concentrations began a decreasing trend which continued in FY2024 as this lysimeter was below the administrative limit for the first time since FY2011. Concentrations in the shallow lysimeter have been trending downward since FY2021. See Section 5.1.1.	101.3 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met
ELLWF Engineered Trench 2 ET2-VL-5*	Radionuclide Transport	• 956 pCi/mL • Although elevated, concentrations in this lysimeter have trended downward since the peak of 2822 pCi/mL in FY2018. This trend continued in FY2024. Concentrations in the shallow lysimeter have also been trending downward. This suggests that ET2-VL-5 may continue to decrease in the future. See Section 5.1.2.	101.3 pCi/mL	Operational soil cover was extended past ET2-VL-5, ET2-VL-6, and ET2-VL-15 during FY2019. This should reduce infiltration and eliminate funneling of rainwater near the lysimeters. Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results & Trends[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Engineered Trench 2 ET2-VL-15	Radionuclide Transport	• 129 pCi/mL • Concentrations in the action-level lysimeter have shown a decreasing trend since FY2020. This trend continued in FY2024. Concentrations in the upper lysimeter are trending downward. This suggests that concentrations at ET2-VL-15 may continue to decline in the future. See Section 5.1.2.	101.3 pCi/mL	Operational soil cover was extended past ET2-VL-5, ET2-VL-6, and ET2-VL-15 during FY2019. This should reduce infiltration and eliminate funneling of rainwater near the lysimeters. Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met
ELLWF Slit Trench 1 AT-5	Radionuclide Transport	• 67.0 pCi/mL • AT-5 exceeded the administrative limit for the first time in FY2023. This lysimeter has been slowly trending upwards for several years. In FY2024, concentrations continued to hover slightly above the administrative limit. Sampling of the shallower lysimeters has been unsuccessful in recent years. See Section 5.1.3.	61.2 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results & Trends[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Slit Trench 1 VL-26-West*	Radionuclide Transport	• 328 pCi/mL • Concentrations in the action-level lysimeter are decreasing. The tritium concentration in the lysimeter above the action level lysimeter has also been trending downward. This suggests the concentration in the action-level lysimeter may continue to decline in the future. See Section 5.1.3.	61.2 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met
ELLWF Slit Trench 4 ST4-VL-5	Radionuclide Transport	• 158 pCi/mL • Concentrations in the action-level lysimeter have been slowly trending upward. This trend continued in FY2024. The tritium concentration in the shallow lysimeter is also elevated. After peaking in fall 2009, concentrations in the shallow lysimeter declined through fall 2012. Since fall 2020, the concentration has been increasing. This suggests that tritium concentrations in ST4-VL-5 may continue to slowly increase. See Section 5.1.4.	61.2 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results & Trends[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Slit Trench 5 ST5-VL-1	Radionuclide Transport	• 67.8 pCi/mL • Concentrations in the action-level lysimeter exceeded the administrative limit for the first time in FY2024. Concentrations in this lysimeter have been trending upwards since FY2020. The shallow lysimeters at this location have also been trending upwards. This suggests that tritium concentrations in ST5-VL-1 may continue to increase. See Section 5.1.5.	61.2 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met
ELLWF Slit Trench 7 ST7-VL-2*	Radionuclide Transport	• 258 pCi/mL • Concentrations in the action-level lysimeter reached a peak of 706 pCi/mL in FY2022 and started to decline in FY2023. This trend continued in FY2024. In FY2024, the fall 2023 concentration was the maximum (258 pCi/ml) with the spring 2024 concentration declining to 210 pCi/ml. Concentrations in the upper lysimeters are at background. See Section 5.1.6.	61.2 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results & Trends[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Slit Trench 14 ST14-VL-3	Radionuclide Transport	• 136 pCi/mL • Concentrations in the action-level lysimeter reached a peak concentration of 209 pCi/mL in fall 2020. Since that time, concentrations have started declining. This trend continued in FY2024. The shallow lysimeter is trending upward. See Section 5.1.7.	63.8 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect POs to be met

[1] Trends discussed in more depth within Section 5.1. Concentrations shown are maximum values for FY2024.
* Monitoring Results for this lysimeter exceeded 4 times the tritium action level concentration

5.1 Vadose Zone Monitoring

Groundwater in the vadose zone beneath the ELLWF undergoes semiannual performance monitoring to verify that tritium concentrations are not high enough to cause saturated zone groundwater to exceed the tritium maximum concentration limit at or beyond the facility point of assessment (POA). Measured vadose zone tritium concentrations are compared to administrative limits, which were established in the ELLWF Monitoring Plan (Millings, 2012) and amended by Kubilius (2019). The administrative limits are based on PA predictions (WSRC, 2008). The administrative limit for a given trench is 25% of the tritium concentration in the vadose zone which, if it occurs beneath all trenches in the group of disposal units, would cause groundwater tritium concentrations at the 100-meter boundary to reach the maximum concentration limit (20 pCi/mL). These limits are used as indicators for whether further investigation is necessary. Due to the assumptions used to calculate the administrative limits, it is important to note that reaching or exceeding the limit does not mean that the drinking water standard will be exceeded at the compliance point.

Historical lysimeter data are examined to determine whether sampling of some could be discontinued. In FY2024, changes were made that removed 50 shallow lysimeters from the lysimeter sampling program (Dixon, 2023). Of these, 15 were removed due to being dry, and 35 were removed to lower the number of lysimeters to three per lysimeter station. Many of the older stations had five to seven lysimeters per station. No action-level lysimeters were affected. With these changes, the vadose zone monitoring program now consists of 276 suction lysimeters at 111 stations surrounding 14 waste trenches (Figure 5-1). Vadose zone moisture is collected from the lysimeters on a semi-annual basis and analyzed for tritium. At 102 of 111 lysimeter stations, a deep lysimeter is designated as an action-level (AL) lysimeter (Halverson and Millings, 2017). This is usually the deepest (i.e., closest to the water table) active lysimeter in the cluster. Tritium concentrations in AL lysimeters are those that are compared to the administrative limits (Millings, 2012; Kubilius, 2019).

Nine lysimeter clusters do not have an AL lysimeter; one cluster (MWMF-VL-1) is a “background” cluster not associated with a trench, and eight clusters have no active lysimeter at an appropriate elevation: one at ET1 (VL-23), two at ET2 (ET2-VL-4, ET2-VL-8), one at ST1 (VL-3A), two at ST2 (ST2-VL-1, ST2-VL-6), one at ST3 (ST3-VL-7) and one at ST8 (ST8-VL-3). These nine clusters are still sampled, and the results are reviewed for notable changes.

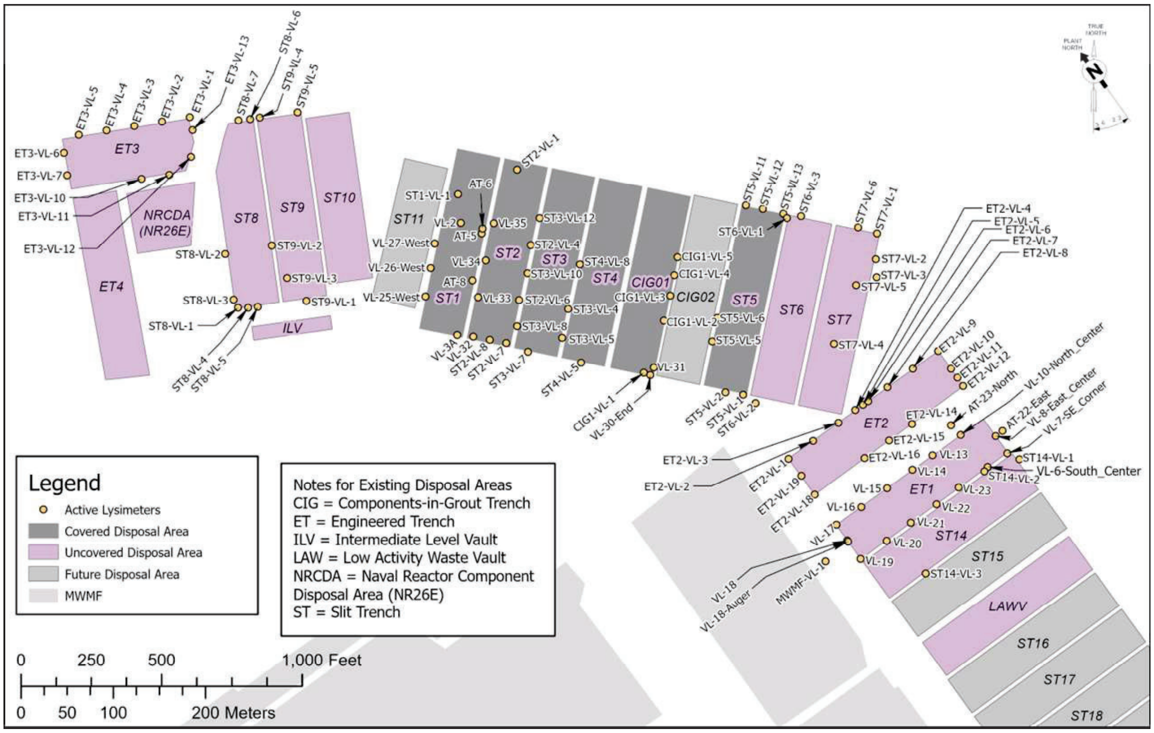

Figure 5-1. Layout showing disposal units, active lysimeters, and stormwater runoff covers.

In FY2024, samples were collected from 101 of 102 AL lysimeters. Analytical results in FY2024 were at or below administrative limits at 92 of the 101 sampled AL lysimeters. Table 5-3 provides a summary of FY2024 tritium data for each of the 9 AL lysimeters above administrative limits (where the PA Expected Behavior is the administrative limit for that DU). Table 5-3 also provides summary data for all AL lysimeters. Tritium concentrations in nine AL lysimeters exceeded administrative limits: one at ET1, two at ET2, two at ST1, and one each at ST4, ST5, ST7, and ST14 (locations shown in Figure 5-2). Eight of nine lysimeters above the administrative limit have been above the limit at least once in previous sampling events. Lysimeter ST5-VL-1 (237), located at ST5, slightly exceeded its administrative limit for the first time in FY2024.

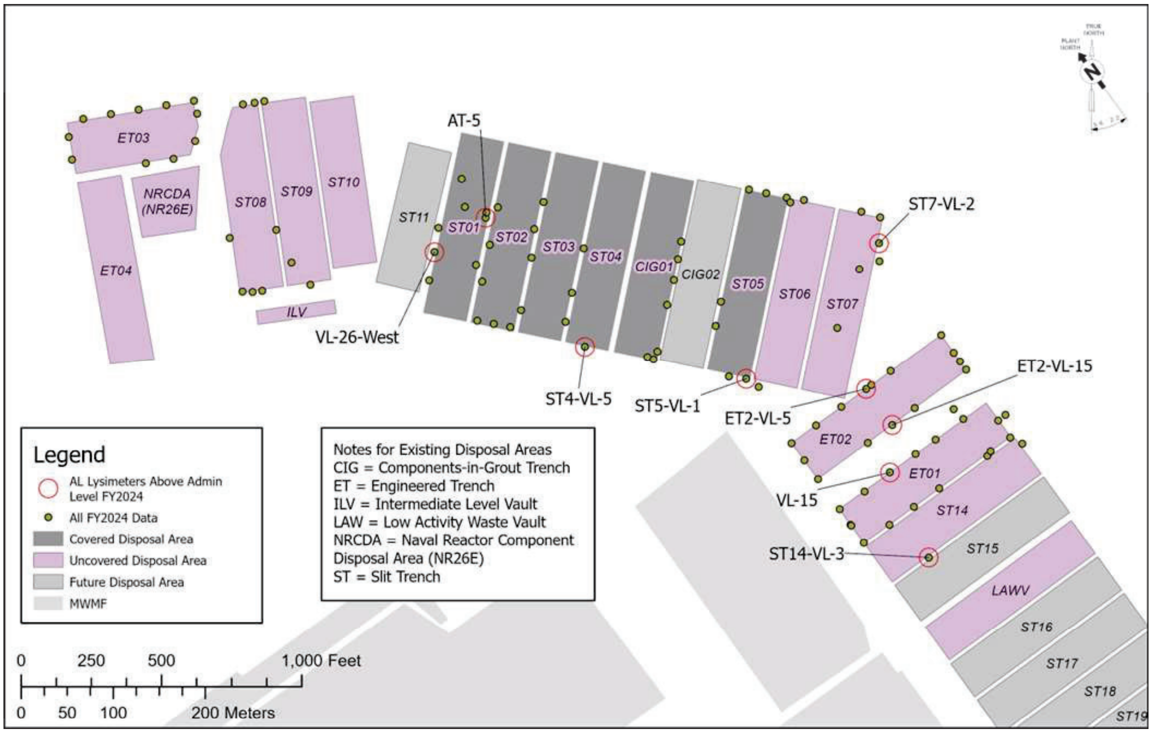

Figure 5-2. Layout showing action-level lysimeters with administrative limit exceedances.

Table 5-3. Summary FY2024 Tritium Data (pCi/mL) for Action-Level Lysimeters.

	FY2024 Sampling Events	
Well ID (Elevation in ft msl)	Fall +	Spring +
CIG Trench (Administrative Limit = 29.6 pCi/mL)		
CIG1-VL-1 (236)	15	14
CIG1-VL-2 (237)	3	2
CIG1-VL-3 (233)	5	5
CIG1-VL-4 (232)	27	24
CIG1-VL-5 (238)	3	2
VL-30-End (240)	4	3
VL-31 (241)	3	3
Engineered Trench 1 (Administrative Limit = 101.3 pCi/mL)		
AT-22-East (233)	3	3
AT-23-North (237)	2	2
VL-6-South_Center (233)	*	79
VL-7-SE_Corner (235.7)	8	7
VL-8-East_Center (234.9)	44	45
VL-10-North_Center (233)	7	5
VL-13 (237)	8	6
VL-14 (239)	18	16
VL-15 (235)	1240	1150
VL-16 (235)	2	2
VL-17 (238)	65	68
VL-18 (234)	4	4
VL-18-Auger (234)	4	3
VL-19 (238)	3	4
VL-20 (243)	5	5
VL-21 (239)	11	12
VL-22 (241)	*	82
Engineered Trench 2 (Administrative Limit = 101.3 pCi/mL)		
ET2-VL-1 (242)	3	3
ET2-VL-2 (242)	3	3
ET2-VL-3 (245)	6	6
ET2-VL-5 (247)	956	645
ET2-VL-6 (244)	11	12
ET2-VL-7 (245)	10	13
ET2-VL-9 (242)	1	4
ET2-VL-10 (242)	1	2
ET2-VL-11 (246)	2	5
ET2-VL-12 (240)	4	3
ET2-VL-14 (240)	12	18
ET2-VL-15 (247)	129	104
ET2-VL-16 (242)	2	2
ET2-VL-18 (242)	4	4
ET2-VL-19 (248)	30	26
Engineered Trench 3 (Administrative Limit = 43.7 pCi/mL)		
ET3-VL-1 (221)	2	2
ET3-VL-2 (226)	4	3
ET3-VL-3 (222)	3	3
ET3-VL-4 (224)	1	2
ET3-VL-5 (222)	27	23
ET3-VL-6 (219)	4	3
ET3-VL-7 (220)	7	9
ET3-VL-10 (222)	12	10
ET3-VL-11 (221)	5	5
ET3-VL-12 (223)	3	3
ET3-VL-13 (218)	3	2
Slit Trench 1 (Administrative Limit = 61.2 pCi/mL)		
AT-5 (226)	67	63
AT-6 (227)	61	55
AT-8 (232)	3	3
ST1-VL-1 (245)	3	3
VL-2 (225)	7	7
VL-25-West (246)	3	3
VL-26-West (245)	328	307
VL-27-West (245)	4	5

	FY2024 Sampling Events	
Well ID (Elevation in ft msl)	Fall +	Spring +
Slit Trench 2 (Administrative Limit = 61.2 pCi/mL)		
ST2-VL-4 (232)	3	2
ST2-VL-7 (231)	11	9
ST2-VL-8 (240)	4	4
VL-32 (231)	6	8
VL-33 (229)	4	*
VL-34 (227)	4	4
VL-35 (227)	3	2
Slit Trench 3 (Administrative Limit = 61.2 pCi/mL)		
ST3-VL-4 (234)	22	20
ST3-VL-5 (236)	23	20
ST3-VL-8 (238)	3	3
ST3-VL-10 (240)	3	3
ST3-VL-12 (243)	3	3
Slit Trench 4 (Administrative Limit = 61.2 pCi/mL)		
ST4-VL-5 (238)	158	152
ST4-VL-8 (239)	3	3
Slit Trench 5 (Administrative Limit = 61.2 pCi/mL)		
ST5-VL-1 (237)	53	68
ST5-VL-2 (252)	2	2
ST5-VL-5 (239)	3	3
ST5-VL-6 (244)	3	2
ST5-VL-11 (237)	1	2
ST5-VL-12 (231)	4	3
ST5-VL-13 (236)	2	2
Slit Trench 6 (Administrative Limit = 61.2 pCi/mL)		
ST6-VL-1 (233)	2	2
ST6-VL-2 (241)	2	3
ST6-VL-3 (235)	1	2
Slit Trench 7 (Administrative Limit = 61.2 pCi/mL)		
ST7-VL-1 (233.5)	2	2
ST7-VL-2 (231.7)	258	210
ST7-VL-3 (232)	2	2
ST7-VL-4 (232)	3	3
ST7-VL-5 (229)	2	1
ST7-VL-6 (229)	2	2
Slit Trench 8 (Administrative Limit = 46.9 pCi/mL)		
ST8-VL-1 (235.5)	23	26
ST8-VL-2 (227)	2	2
ST8-VL-4 (230)	3	3
ST8-VL-5 (229)	3	3
ST8-VL-6 (238)	16	17
ST8-VL-7 (220)	7	8
Slit Trench 9 (Administrative Limit = 46.9 pCi/mL)		
ST9-VL-1 (239)	3	3
ST9-VL-2 (229)	3	3
ST9-VL-3 (240)	6	7
ST9-VL-4 (216)	3	3
ST9-VL-5 (220)	*	*
Slit Trench 14 (Administrative Limit = 63.8 pCi/mL)		
ST14-VL-1 (240)	3	3
ST14-VL-2 (239)	10	13
ST14-VL-3 (237)	136	122

+ All data in pCi/mL
* No sample collected
Pink shading = Exceeds Adminstrative Limit

All AL lysimeters which exceeded their administrative limits in FY2024 are discussed individually below. Additionally, AL lysimeters that exceeded their administrative limits in FY2023 but were below the limit in FY2024 are also discussed.

5.1.1 Engineered Trench 1

There are 17 AL lysimeters associated with Engineered Trench 1 and all were successfully sampled in FY2024. VL-15 was the only ET1 AL lysimeter that exceeded the tritium concentration administrative limit of 101.3 pCi/mL in FY2024. In FY2023, AL lysimeters VL-6-SC and VL-22 also exceeded the administrative limit and are discussed below along with VL-15.

VL-6-SC. This AL lysimeter was below the administrative limit in FY2024 for the first time since FY2013 with a concentration of 78.7 pCi/ml. This AL lysimeter first exceeded the tritium administrative limit in FY2014, with a result of 502 pCi/mL, representing a substantial increase from 58 pCi/mL obtained in the previous sampling event. This prompted a detailed data review for VL-6-SC including disposal records, local hydrogeology, and rainfall data (Millings et al., 2014). Nothing remarkable was found in these data that could definitively explain the elevated tritium concentrations in VL-6-SC. From 2014 through 2019, concentrations in the AL lysimeter were generally decreasing, reaching 312 pCi/mL in spring 2019. However, the tritium concentration spiked in FY2020 to a peak of 786 pCi/mL. Since FY2020, concentrations have been trending downwards and in FY2024 were below the administrative limit. The tritium concentration in the shallow lysimeter had been decreasing since reaching a peak in FY2019 (1026 pCi/mL). However, in spring 2024, the concentration in the shallow lysimeter increased (389 pCi/mL). Concentrations in adjacent lysimeters remain below the action level (VL-7 and VL-23). ST14-VL-2 is the closest lysimeter station to VL-6-SC (less than 10 ft). After trending downwards for several sampling events, the tritium concentration in the AL lysimeter at ST14-VL-2 is trending upwards (12.6 pCi/mL) but remains below the administrative limit for both ET 1 (101.3 pCi/mL) and ST 14 (63.8 pCi/mL).

VL-15. Tritium concentrations in this AL lysimeter have been increasing since FY2008 with the first exceedance of the administrative limit occurring in FY2012. It has exceeded the administrative limit in every successful sampling event since FY2012. The tritium concentration measured in fall 2023 was 1240 pCi/mL and the spring 2024 concentration was 1150 pCi/mL. Although elevated, the tritium concentration in VL-15 appears to be declining. Likewise, the concentration in the shallow lysimeter also decreased in FY2024. It appears that tritium concentrations in the AL lysimeter follow the same pattern as the shallower lysimeter but are lagged and slightly reduced. Therefore, concentrations may have plateaued in the AL lysimeter. Concentrations in adjacent lysimeters VL-14 (18.2 pCi/mL) and VL-16 (2.4 pCi/mL) are well below the administrative limit (101.3 pCi/mL).

VL-22. The tritium concentration measured in the AL lysimeter was below the administrative limit for the first time since FY2010 with a concentration of 82.1 pCi/mL. Concentrations in this lysimeter have been declining since reaching a peak of 300 pCi/mL in FY2020. The shallow lysimeter at VL-22 reached a peak in FY2016 and declined steadily through FY2020 before increasing again in FY2021. The concentration in the shallow lysimeter has been decreasing since FY2021. The concentration trend of the AL lysimeter is comparable to the shallow lysimeter but is reduced and lagged. Therefore, the concentration in the AL lysimeter may begin to increase in the future.

As a result of the exceedances noted for the ET1 sampling locations, a study was undertaken to assess whether the elevated concentrations challenged the PA conclusions (Flach and Whiteside, 2016). Because ET1 and ET2 were analyzed together in the 2008 PA, they were evaluated together in this study. The 2008 PA model conservatively assumed hypothetical waste disposal timing and distribution based on both trenches opening and being filled simultaneously. However, the average disposal dates for ET1 and ET2 differ by more than eight years, which will result in some plume separation. Because the as-disposed-of waste conditions for ET1 and ET2 were different than assumed in the PA, the model was revised to reflect the actual disposal conditions. The results of the study showed that simulated and vadose zone plume concentrations are reasonably consistent and that the phased operation of ET1 and ET2 is likely to ensure that performance objectives are met. This conclusion was later confirmed by the SA of the impact of the updated GSA flow model on E-Area groundwater performance (Hamm et al. 2018).

5.1.2 Engineered Trench 2

There are 15 AL lysimeters associated with Engineered Trench 2 and all were successfully sampled in FY2024. Two of the 15 AL lysimeters, ET2-VL-5 and ET2-VL-15, exceeded the tritium concentration administrative limit of 101.3 pCi/mL. Both lysimeters also exceeded the limit in FY2023.

ET2-VL-5. This AL lysimeter first exceeded the tritium administrative limit in spring 2017, with a result of 178 pCi/mL. It increased again in both fall 2017 and spring 2018. The spring 2018 concentration of 2822 pCi/mL is the highest level of any AL lysimeter at ELLWF to date. The tritium concentration in this lysimeter was 956 pCi/mL in fall 2023 and 645 pCi/mL in spring 2024. These are the lowest concentrations measured in ET2-VL-5 since FY2018. The tritium concentration in the shallow lysimeter at ET2-VL-5 have been generally declining since fall 2020. As part of normal operations, the operational soil cover over the waste was extended beyond ET2-VL-5 in FY2019. This action will reduce infiltration and funneling of water in the vicinity of ET2-VL-5. Therefore, the tritium concentration in ET2-VL-5 may continue to decrease in the future.

ET2-VL-15. Tritium concentrations at this AL lysimeter began increasing in 2015 and reached a peak of 231 pCi/mL in the fall 2019 sampling event. Since fall 2019, the tritium concentration has been generally declining. The tritium concentration in this lysimeter was 129 pCi/mL in fall 2023 and 104 pCi/mL in spring 2024. The shallow lysimeters in this cluster are elevated but have been declining since 2016. This suggests the concentration in the AL lysimeter may continue to decrease. As with ET2-VL-5, the operational soil cover was extended beyond this lysimeter location during FY2019.

5.1.3 Slit Trench 1

In FY2024, two of the eight AL lysimeters in Slit Trench 1, AT-5 and VL-26-West, exceeded the tritium concentration administrative limit of 61.2 pCi/mL. AT-5 slightly exceeded the limit for the first time in FY2023 and remained slightly above the limit in FY2024.

AT-5. This AL lysimeter exceeded the administrative limit for the first time in fall 2022 with a concentration of 62.7 pCi/mL and was slightly over the limit again in fall 2023 (67 pCi/mL). The spring 2024 concentration was 63.4 pCi/mL. The tritium concentration in AT-5 (226) had been slowly trending upwards since FY2011 but may have reached a plateau. The lysimeter immediately above the AL lysimeter was last successfully sampled in FY2020 but has been dry since. Concentrations in this lysimeter were elevated but appeared to be trending downwards with the last successful sample.

VL-26-West. This AL lysimeter was the first at ELLWF to exceed its administrative limit. This lysimeter was installed in 2003 and the first action level exceedance was in spring 2008 with a result of 67 pCi/mL. The tritium concentration increased gradually through 2017 reaching 514 pCi/mL. Since 2017, the concentration has been on a slight downward trend. This downward trend continued in FY2024 with a concentration of 328 pCi/mL in the fall 2023 sampling event and 307 pCi/mL in the spring 2024 sampling event. The lysimeter above the AL lysimeter is also elevated, but tritium concentrations there have been declining since 2015. The decreasing trend in the shallower lysimeter suggests that concentrations in the AL lysimeter have plateaued and may decrease in the future. Previous investigations into VL-26-West have included additional sampling events, reviews of geology and disposal history (Millings, 2009), modeling (Smith, 2010), and a field study (Millings et al., 2010). Data from these studies indicate that the tritium emanating from ST1 near VL-26-West is localized and should have minimal effect on groundwater near the trench.

5.1.4 Slit Trench 4

ST4-VL-5. One of the two AL lysimeters at Slit Trench 4, ST4-VL-5, exceeded its tritium concentration administrative limit (61.2 pCi/mL) in FY2024. This AL lysimeter had elevated tritium levels when installed in 2008, and concentrations have increased since then. It has exceeded the administrative limit continuously since fall 2011. In FY2024, the concentration was 158 pCi/mL. Concentrations in the shallower lysimeters within the cluster are elevated but have been generally trending upward since fall 2020. This suggests the tritium concentration in the AL lysimeter may continue to slowly increase.

5.1.5 Slit Trench 5

ST5-VL-1. One of the seven AL lysimeters at Slit Trench 5, ST5-VL-1, exceeded its tritium concentration administrative limit (61.2 pCi/mL) in FY2024. This is the first time this lysimeter has exceeded the administrative limit. Concentrations in this AL lysimeter have been trending upwards since FY2020. The shallow lysimeters at this location have also been trending upwards. This indicates that concentrations in the AL lysimeter may continue to increase. This lysimeter station will be monitored closely in the future.

5.1.6 Slit Trench 7

ST7-VL-2. One of the six AL lysimeters in Slit Trench 7, ST7-VL-2, exceeded its tritium concentration administrative limit (61.2 pCi/mL) in FY2024. This AL lysimeter slightly exceeded the administrative limit in FY2010 and FY2011, then was below it for several years. Beginning in FY2017, it has been above the administrative limit for each subsequent sampling event. Concentrations in the AL lysimeter reached a maximum in fall 2021 of 706 pCi/mL before declining to 210 pCi/mL in spring 2024. Shallow lysimeters in the cluster are at background levels (~5-10 pCi/mL).

5.1.7 Slit Trench 14

ST14-VL-3. One of the three AL lysimeters in Slit Trench 14, ST14-VL-3, exceeded its tritium concentration administrative limit (63.8 pCi/mL) in FY2024 with a concentration of 136 pCi/mL (fall 2023). In spring 2024 the tritium concentration decreased slightly (122 pCi/mL). The FY2024 concentrations are down compared to FY2023 (164 and 141 pCi/mL, fall 2022 and spring 2023 respectively). This lysimeter was installed in 2016, and it has exceeded the limit since 2017. The tritium concentration has been decreasing since fall 2020. The lysimeter immediately above the AL lysimeter has been trending upwards.

5.2 <u>Trench Cover Monitoring</u>

Inspections of the soil cover over filled sections of operating STs and ETs are conducted on a quarterly basis per procedure SW15.6-INP-SWF-03 (SWM, 2024). A few localized depressions and erosion areas were noted in these inspections. SWM addressed each area of concern with grading equipment and soil fill.

Inspections of the CIG storm water runoff cover are performed on a quarterly basis (SWM, 2024). Four inspections were conducted in FY2024. In May 2024, a strong storm came through the area causing damage to the cover. A path forward for the repair/replacement is being developed.

Inspections of the Slit Trench water barriers are performed quarterly (SWM, 2024). Ongoing maintenance issues were addressed with concrete fasteners. A few concrete fasteners for the stainless-steel anchor strips had been found to be broken off at the head of the fasteners. These fasteners were replaced with more durable concrete anchors. In addition, SWM has continued to monitor two depressions that had formed underneath the covers due to subsidence of the waste in FY2012. One depression is approximately ten feet in diameter and the other depression is approximately five feet in diameter. Both are up to approximately eighteen inches deep. The FY2024 inspections determined that these two depressions had not changed in size or in depth. The covers were still intact with no fatigue issues above these two depression areas. SWM will continue to monitor these depressions for changes in conditions.

5.3 Vault Concrete Monitoring

Inspection of the LAWV walls was last performed in October 2022 (FY2023) by procedure 724-EAV-50 (SWM, 2020) which showed no significant cracking or degradation beyond what was assumed for the PA. This inspection is performed every two years.

5.4 Sump Water Monitoring

Water samples are taken from the vault (LAWV and ILV) and engineered trench sumps. SWM monitors the vault sump through procedure SW15.1-SOP-LLS-01 (SWM, 2023b) and the ET2 sump through procedure SW15.1-SOP-ESUMP-02 (SWM, 2023b). These procedures provide instructions for sampling and pumping the vaults and ET2 sumps. The sumps are checked for liquid levels and if liquid level thresholds are exceeded, then the contents are sampled for evaluation against the administrative limits (SWM, 2023b; SWM, 2023a) and dispositioned accordingly. All FY2024 samples were below administrative limits.

5.5 Surface Water Compliance Monitoring

SRS conducts scheduled compliance monitoring of surface water at several locations downstream of ELLWF, per DOE Order 458.1 (DOE, 2020) and the CA monitoring plan (Crapse et al., 2011). Results and projected radiation doses to the public are published in the SRS Annual Environmental Report and are compared to CA predictions in the CA annual reviews (Watkins, 2023). The most recent predicted maximum dose to a member of the public, via the liquid pathways (includes doses from drinking water, fish and invertebrate consumption, recreational activities, and irrigation) at locations below ELLWF, is published in the 2023 Annual Environmental Report (SRNS, 2024) and shown in Table 5-4. This value is 0.14 mrem/yr, which is far below the DOE 458.1 dose limit of 100 mrem/yr.

Table 5-4. Compliance Monitoring.

Disposal Facility/Unit	Monitoring Type	Monitoring Results & Trends	Performance Objective Measure or other Regulatory Limit	Action Level	Action Taken	PA/CA Impacts
ELLWF	Surface Water	0.14 mrem	<100 mrem	NA	None	None

5.6 Monitoring Conclusions

Administrative limits for each group of disposal units (e.g., East ST, Center ST, West ST and CIG Trenches and ET) are set to 25% of the action level concentration as predicted in the ELLWF PA model (Millings, 2012). If, the tritium concentration that enters the groundwater from the vadose zone is greater than administrative limits for any of the group of disposal units, the result will be a tritium activity that exceeds the Environmental Protection Agency drinking water standard for tritium of 20 pCi/ml in groundwater at the 100-m compliance point. This assumes that the tritium concentration is distributed uniformly in a disposal group and that all points beneath the trenches in this group are adding the greater than administrative limits concentration to the water table at the same time. Of the 101 AL lysimeters that were sampled, only 4 spread over four trenches (Table 5-2) exceeded the tritium AL concentrations. Therefore, the EPA drinking water standard for tritium of 20 pCi/ml in the groundwater at the 100-m compliance point will not be exceeded.

A strong storm in May 2024 caused damage to the CIG storm water runoff cover. A path forward for repairing or replacing the cover is being developed. Other observed defects were minor (i.e., cover depressions, erosion areas, broken fasteners) and not expected to affect performance of these barriers. In some cases, repairs were made (i.e., trench cover concrete fasteners). In other cases, conditions will continue to be monitored for progression of existing defects or new defects.

Finally, sump water samples were all found to be below administrative limits before being discharged. Impacts from surface waters downstream from the E-Area LLWF (Upper Three Runs, Savannah River) continue to fall well below DOE public dose limits based on annual compliance monitoring.

6.0 Research and Development

In FY2024, SRNL produced three technical reports and memoranda supporting ELLWF annual PA maintenance, SWM Operations & Engineering, and PA Test & Research. Table 6-1 lists a summary of this work. There is no impact to the PA or CA from these activities. All activities are PA Maintenance and were performed to verify PA/CA assumptions. The supporting studies performed in FY2024 do not alter the conclusions of the ELLWF PA (WSRC, 2008)

Table 6-1. Research and Development Activities.

Document Number	Results	PA/CA Impact
SRNL-L3220-2024-00006, Revision 0	**Recommended Lysimeter Locations and Depths for the FY2025 Lysimeter Installations** The purpose of this memo was to provide recommendations on the location and depths of 12 new lysimeter stations to be installed in FY2025. The planned FY2025 installations include 2 lysimeters stations at ET3, 5 stations at ET4, 2 stations at ST10 and 3 stations at ST14. The number and location of the lysimeter stations will be adjusted based on field conditions. Each station will consist of two lysimeters. Lysimeter placement will be based on stratigraphy with lysimeters typically located in sandy zones above silt/clay layers.	None
SRNL-L3200-2024-00001, Revision 0	**Technical Memorandum, "Re: Fall 2023 Lysimeter Tritium Data"** The purpose of this memo was to provide the Fall 2023 tritium data for the E-Area Vadose Zone Monitoring System and to summarize the tritium concentrations and trends in the Action Level lysimeters. Analytical results in Fall 2023 were at or below the administrative limits at 91 out of 99 sampled locations. There were 8 AL lysimeters above the administrative limits. There were 3 dry AL lysimeters in Fall 2023.	None
SRNL-L3220-2024-00010, Revision 0	**Technical Memorandum, "Re: Spring 2024 Lysimeter Tritium Data"** The purpose of this memo was to provide the Spring 2024 tritium data for the E-Area Vadose Zone Monitoring System and to summarize the tritium concentrations and trends in the Action Level lysimeters. Analytical results in Spring 2024 were at or below the administrative limits at 91 out of 100 sampled locations. There were 9 AL lysimeters above the administrative limits. There were 2 dry AL lysimeters in Spring 2024.	None

7.0 Planned or Contemplated Changes

The PA revision, which will update the ELLWF PA technical baseline is currently under development. This comprehensive update is warranted by the cumulative number of changes to the existing PA technical baseline as contained in 15 UDQE's and 10 SA's approved since the 2008 PA. A 2016 PA strategic planning document set out recommendations and a roadmap for the current revision. Numerous updates to models, assumptions, approaches and key PA datasets are being evaluated as part of this new baseline. SA SRNL-STI-2018-00624 (Hamm et. al., 2018) employed a version of these improvements existent at that time and demonstrated a sizeable amount of operating margin with respect to POs. This provides increased confidence that the ongoing PA revision will produce acceptable groundwater limits.

A planned revision to the PA monitoring plan will incorporate administrative limits for ET3 (Hamm et al., 2013) and ET4 (Butcher et al., 2017) per their respective UDQEs. The PA maintenance plan will also be revised to incorporate the monitoring plan revision and other planned or ongoing activities.

In FY2025, twelve new lysimeter stations will be installed on the perimeter of ET3, ET4, ST10, and ST14. Each station will consist of two lysimeters with the deeper lysimeter at each station being designated as the AL lysimeter. Lysimeter placement will be based on stratigraphy with lysimeters typically located in sandy zones above silt/clay layers. This strategy takes advantage of the possibility of perched water at this interface to improve the odds of collecting water samples. The action level lysimeter will be located such that it is outside the influence of the water table and capillary fringe.

A summary of these planned changes is provided in Table 7-1.

Table 7-1. Planned or Contemplated Changes.

Planned or contemplated change	Change Basis	PA/CA Impact	Schedule
Update of ELLWF PA technical baseline	A FY2016 PA planning document surveyed the 2008 PA as well as PA's across the DOE Complex, reviewed ELLWF operational plans and history, evaluated changes in the ongoing DOE O 435.1 update, and identified new PA data and model simulation techniques to develop a strategy and lay out recommendations for the current 2008 PA revision. Based on this roadmap, the E-Area PA revision is being developed to employ the following new models and updated key PA datasets in a new technical baseline: updated GSA flow model; new conceptual closure cap design; updated infiltration estimates; new trench, NRCDA, ILV and LAWV models; latest geochemical parameters; updated hydraulic parameters; new comprehensive radionuclide screening model, safety functions and relevant features-events-processes screening, and exposure pathway screening; and a new dose model based on updated radionuclide-dose parameters and dose methodology. (Butcher and Phifer, 2016)	New radionuclide disposal limits and operational constraints, and update to estimated dose impacts at facility closure	After 2008 PA Revision Approval a detailed schedule for PA Implementation will be developed
Addition of Lysimeters to Vadose Zone	Twelve new lysimeter stations will be installed around the perimeter of ET3, ET4, ST10, and ST14. Each station will consist of two lysimeters with the deepest	Update to the monitoring plan	FY2025

Planned or contemplated change	Change Basis	PA/CA Impact	Schedule
Monitoring System	lysimeter being designated as the AL lysimeter.		
Monitoring Plan Revision	Revise monitoring plan meet the requirements in DOE-STD-5002-2017 “Disposal Authorization Statement and Tank Closure Documentation”	None	FY2025
Maintenance Plan Revision	Revise monitoring plan meet the requirements in DOE-STD-5002-2017 “Disposal Authorization Statement and Tank Closure Documentation”	None	FY2025

8.0 Status of DAS Conditions, Key and Secondary Issues

All key and secondary issues from the LFRG review of the 2008 ELLWF PA have been resolved and are understood to be closed with final DOE-HQ approval of the FY2014 Annual Summary Report. Two issues were closed by committing to address the issues in the next PA and are listed in Table 8-1. This ASR report affirms that the ELLWF has satisfied all the requirements, conditions and limitations identified in the DAS and that a revision to the DAS is not needed at this time.

Table 8-1. Status of DAS Conditions, Key and Secondary Issues

Disposal Facility/ Unit	Key/ Secondary Issue or DAS Condition number	Issue Description	Issue Closure Method	Disposition Documentation & Date Completed	PA, CA, DAS Impact or Status
ELLWF	7.2.4	Greater consistency is needed in the level of detail of technical approaches and results for each facility in Ch. 1-5 (recommend including figures and diagrams of the general technical approaches and calculational steps that led to performance measures and disposal limits). Evaluate information within App. A of Part B for relevance.	Closed per DOE approval of the FY2014 Annual Summary Report.	All figures in the Appendices underwent a general review before the final PA was issued. The labeling on the specific figures referenced in the last paragraph of this issue was corrected in the final PA. These actions addressed the concerns about mislabeling. For the remaining details of this issue, re-examining and rewriting Chapters 1 through 5 of the PA in order to achieve greater consistency for all disposal units represent significant revision. As such, improvements will be incorporated into the next revision of the PA.	Complete Pending PA Revision Approval

Disposal Facility/ Unit	Key/ Secondary Issue or DAS Condition number	Issue Description	Issue Closure Method	Disposition Documentation & Date Completed	PA, CA, DAS Impact or Status
ELLWF	7.1.1	Additional sensitivity and uncertainty work required to increase confidence in the waste concentration limits and SOFs (through deterministic or probabilistic sensitivity and uncertainty analysis). In the near term, focus should be on components most likely to compromise Performance Objectives (the non-sorbing radionuclides disposed in STs and ETs).	Closed per DOE approval of FY2014 Annual Summary Report.	This item was downgraded from a key issue to a secondary issue based on additional sensitivity analyses performed and documented in the final 2008 PA during the factual accuracy review. Additional work to improve the 1-D GoldSim ELLWF trench models, benchmark to PORFLOW, and update the S/U analysis was completed in 2010 with subcontractor support. The initial benchmarking report was updated in FY2013, *Benchmarking Exercises to Validate the Updated ELLWF GoldSim Trench Models*, SRNL-STI-2010-0737, Rev. 1, November 2013. (Taylor and Hiergesell, 2013) In 2014 SRNL prepared a report that compiles and summarizes the collective GoldSim trench model improvements, benchmarking work, and S/U analysis update, *Update to the Uncertainty Analysis for the E-Area Low-Level Waste Facility Trenches*, SRNL-STI-2013-00660, Rev. 0, May 2014. (Hiergesell and Taylor, 2014) These improvements will be incorporated into the next revision of the PA.	Complete Pending PA Revision Approval

9.0 Certification of the Continued Adequacy of the PA, CA, DAS and RWMB

This Annual Summary Report affirms that the disposal facility continued to operate within the bounds of the current PA and CA baselines and satisfied all the requirements, conditions, and limitations identified in the 2008 DAS (DOE 2008), RWMB (McGill, 2024), and ELLWF Waste Acceptance Criteria (SRS-1S, 2023). This Annual Summary Report affirms that the supporting studies performed in FY2024 do not alter the conclusions of the 2008 ELLWF PA (WSRC, 2008) and that there is a reasonable expectation that the ELLWF will meet the POs delineated in DOE Order 435.1. The number of proposed changes to data, models and operational plans for the ELLWF since the 2008 ELLWF PA were deemed sufficient to warrant a revision. That PA revision is currently in development. The required FEM certification statement of continued adequacy of the PA, CA, DAS and RWMB is in the ASR transmittal letter.

10.0 References

Butcher, 2017. B. T. Butcher, *Revision of the ELLWF Disposal Limits Database Evaluating Use of Slit Trench 13 Limits for Engineered Trench #4 (Revision 2017-1)*, SRNL-L3200-2017-00154, Savannah River National Laboratory, Aiken SC, January 2018.

Butcher and Phifer, 2016. B. T. Butcher and M. A. Phifer, *Strategic Plan for Next E-Area Low-Level Waste Facility Performance Assessment*, SRNL-STI-2015-00620, Revision 0, Savannah River National Laboratory, Aiken, SC, February 2016.

Crapse et al., 2011. K.P. Crapse, M.A. Phifer, F.G. Smith, G.T. Jannik, and M.R. Millings, *Savannah River Site DOE 435.1 Composite Analysis Monitoring Plan,* SRNL-STI-2011-00458, Revision 0, Savannah River National Laboratory, Aiken SC, September 2011.

Dixon, 2023. Technical Memorandum, K. L. Dixon to V. Rigsby *"Recommended Changes to the Lysimeter Sampling Schedule"*, SRNL-L3220-2023-00019, Revision 0, August 31, 2023.

Dixon, 2024a. Technical Memorandum, K. L. Dixon to V. Rigsby *"Re: Fall 2023 Lysimeter Tritium Data"*, SRNL-L3200-2024-00001, Revision 0, May 30, 2024.

Dixon, 2024b. Technical Memorandum, K. L. Dixon to V. Rigsby "*Re: Spring 2024 Lysimeter Tritium Data"*, SRNL-L3220-2024-00010, Revision 0, January 12, 2025.

Dixon, 2024c. Technical Memorandum, K. L. Dixon to V. Rigsby *"Re: Recommended Lysimeter Locations and Depths for the FY2025 Lysimeter Installations"*, SRNL-L3200-2024-00006, Revision 0, August 26, 2024.

DOE, 1999. *Disposal Authorization Statement for the DOE Savannah River Site E-Area Vaults and Saltstone Disposal Facilities,* U.S. Department of Energy, Washington D.C., September 28, 1999.

DOE, 2008. *Disposal Authorization Statement for the Savannah River Site E-Area Low-Level Waste Facility*, Revision 1, U. S. Department of Energy, Washington D.C., July 15, 2008.

DOE, 2020. *Radiation Protection of the Public and the Environment*, DOE O 458.1, Chg. 4: U. S. Department of Energy, Washington, DC. September 15, 2020.

DOE, 2021. *Radioactive Waste Management Manual*, DOE M 435.1-1, Chg 3: U. S. Department of Energy, Washington, DC. January 11, 2021.

Flach and Whiteside, 2016. G. P. Flach and T. S. Whiteside, *Interpretation of Vadose Zone Monitoring System Data near Engineered Trench 1*, SRNL-STI-2016-00546, Revision 0, Savannah River National Laboratory, Aiken SC, December 2016.

Halverson and Millings, 2017. N. V. Halverson and M. R. Millings, *Vadose Zone Monitoring Report for the E-Area Low Level Waste Facility*, SRNS-TR-2016-00137, Revision 0, Savannah River National Laboratory, Aiken, SC, August 2017.

Hamm et al., 2013. L. L. Hamm, F. G. Smith, III, G. P. Flach, R.A. Hiergesell, B.T. Butcher, *Unreviewed Disposal Question Evaluation: Waste Disposal in Engineered Trench #3*, SRNL-STI-2013-00393, Revision 0, Savannah River National Laboratory, Aiken, SC, July 2013.

Hamm et al., 2018. L. L. Hamm, S. E. Aleman, T. L. Danielson, B. T. Butcher, *Special Analysis: Impact of Updated GSA Flow Model on E-Area Low-Level Waste Facility Groundwater Performance*, SRNL-STI-2018-00624, Revision 0, Savannah River National Laboratory, Aiken, SC, December 2018.

Hang et al., 2018. T. Hang, N.V. Halverson, I.J. Stewart, and G.K. Humphries, *FY2017 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility*, SRNL-STI-2017-00761, Revision 0, Savannah River National Laboratory, Aiken, SC, March 2018.

Hiergesell and Taylor, 2014. R. A. Hiergesell and G. A. Taylor, *Update to the Sensitivity/Uncertainty Analysis for the E-Area Low-Level Waste Facility Trenches*, SRNL-STI-2013-00660, Revision 0, Savannah River National Laboratory, Aiken, SC, May 2014.

Kubilius 2019. W. P. Kubilius, *Updated Approach to Performance Monitoring at the E-Area Low Level Waste Facility.* SRNL-RP-2019-00682, Revision 0, Savannah River National Laboratory, Aiken, SC. 2019.

Kubilius and Joyce, 2018. W.P. Kubilius and W.D. Joyce, *Optimization of the Groundwater Monitoring Program at the E-Area Low-Level Waste Facility (ELLWF)*, SRNS-RP-2018-01123, Revision 0, December 2018.

Kubilius et al., 2019. W. P. Kubilius, B. T. Butcher and I. J. Stewart, *FY2018 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility*, SRNS-RP-2019-00002, Revision 0, February 2019.

LaBone et al. 2022. E. D. LaBone, J. J. Mayer, K. L. Dixon and I. J. Stewart. *FY2021 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility*, SRNL-STI-2022-00018, Revision 0, March 2022.

Mayer, J. J., K. L. Dixon and I. J. Stewart. 2024. *FY2023 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility*. SRNS-RP-2024-00027/SRNL-RP-2024-00028, Revision 0, March 2024.

McGill 2024. S. P. McGill, *Savannah River Nuclear Solutions (SRNS) Solid Waste Management (SWM) Radioactive Waste Management Basis (RWMB) (U)*, Q-RWM-E-00001, Revision 12, January 2024.

Millings, 2009. M.R. Millings, *Review of Lysimeter Cluster VL-26 at Slit Trench 1*, SRNL-L6200-2009-00038, Revision 0, Savannah River National Laboratory, Aiken, SC, November 2009.

Millings, 2012. M. R. Millings, *Performance Assessment Monitoring Plan for the E-Area Low Level Waste Facility*, SRNL-RP-2009-00534, Revision 1, Savannah River National Laboratory, Aiken, SC, August 2012.

Millings et al., 2010. M. R. Millings, L. A. Bagwell, J. V. Noonkester and K. A. Roberts, *Summary Report for the VL-26 Lysimeter Field Characterization*, SRNL-STI-2010-00436, Revision 0, Savannah River National Laboratory, Aiken, SC, July 2010.

Millings et al., 2014. Technical Memorandum, *"Review of Lysimeter Cluster "VL-6-South Center"* at Engineered Trench 1", SRNL-L3200-2014-00004, Savannah River National Laboratory, Aiken, SC, July 24, 2014.

SCDHEC, 2014. *South Carolina Department of Health and Environmental Control Hazardous and Mixed Waste Permit, Permit Number SCI 890 008 989*, 2014 RCRA Permit Renewal for the Savannah River Site, issued on February 11, 2014, South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, Bureau of Land and Waste Management, Columbia, SC.

Simmons, 2024. J. Simmons, *UDQE to Assess LAWV Engineered Roof System Damage for Delayed Repair*, SRNS-TR-2024-00401, Revision 0, Solid Waste Management, Savannah River Nuclear Solutions, Aiken, SC, June 2024.

Smith, 2010. F. G. Smith III, *GoldSim Analysis of Slit Trench 1*, SRNL-L5200-2009-00085, Revision 1, Savannah River National Laboratory, Aiken, SC, June 2010.

SRNS, 2023. *Savannah River Site Environmental Report 2022*, SRNS-RP-2023-00273, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRS-1S, 2023. *SRS Radioactive Waste Requirements Manual*, Chapter 5, *Low Level Waste*, Revision 3 Savannah River Nuclear Solutions, Aiken, SC, April 13, 2023.

SWM, 2020. *E-Area Vaults Subsidence and Low Activity Waste Vault Concrete Degradation Inspection (U),* 724-EAV-50, Revision 8, Savannah River Nuclear Solutions, Aiken SC, June 17, 2020.

SWM, 2023a. *E-Area Low Level Sump Sampling and Pumping (U)*, SW15.1-SOP-LLS-01, Revision 18, Savannah River Nuclear Solutions, Aiken SC, August 23, 2023.

SWM, 2023b. Engineered Trench #2 Sump Sampling and Pumping (U), SW15.1-SOP-ESUMP-02, Revision 11, Savannah River Nuclear Solutions, Aiken SC, October 10, 2023.

SWM, 2024. *SWMF E-Area Inspections (U)*, SW15.6-INP-SWF-03, Revision 42, Savannah River Nuclear Solutions, Aiken SC, March 11, 2024.

Taylor and Hiergesell, 2013. G. A. Taylor and R. A. Hiergesell, *Benchmarking Exercises to Validate the Updated ELLWF GoldSim Trench Models*, SRNL-STI-2010-0737, Revision 1, November 2013.

Watkins, D. R. 2023. *FY2022 Savannah River Site Composite Analysis Annual Summary Review*, SRMC-CWDA-2023-00010, Revision 0, Savannah River Mission Completion, Aiken, SC, March 2023.

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