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FY2021 Performance Assessment Annual Review for the E-Area Low- Level Waste Facility

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March 2022

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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), Slit Trenches (STs), Engineered Trenches (ETs), Component-in-Grout (CIG) Trenches, and Naval Reactor Component Disposal Areas (NRCDAs). The ELLWF is a part of the Solid Waste Management Facility (SWMF). SWMF is managed and operated by the SRS Management and Operations prime 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 agency responsible for preparing and maintaining the PA. SWMF operations have been performed at SRS for over 60 years. 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 Those portions of that DAS applicable to the ELLWF were superseded by Revision 1 of the DAS on July 15, 2008 (DOE 2008a). 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) 2021 Annual Review.

Approximately 6,600 cubic meters of low-level waste were disposed in ELLWF disposal units during FY2021. All disposal units remain in conformance with their disposal limits (McGill, 2021). Special Analysis (SA) SRNL-STI-2018-00624 (Hamm et al., 2018) was added to the FY2021 Radioactive Waste Management Basis (RWMB) (McGill, 2021).

The majority of action-level (AL) lysimeter locations, approximately 87%, remained below administrative limits in FY2021. A majority of the AL lysimeters would need to reach, with some exceeding, their administrative limit in order to exceed a groundwater performance objective (PO) or measure. Because administrative limits are set at 1/4th the concentration predicted to result in an exceedance in the groundwater, the remaining twelve AL lysimeters spread over seven trenches are not expected to result in an exceedance at the 100-m point of assessment (POA). Trench cover monitoring in FY2021 revealed minor defects (cover – depressions, erosion areas, fasteners) not affecting the expected performance of these interim barriers. Finally, sump water samples were all 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. Therefore, a revision to the PA is in preparation and is scheduled to be reviewed by the DOE Low-Level Waste Disposal Facility Federal Review Group (LFRG) in FY2022. Operational restrictions remain in place from an SA (Hamm et al., 2018) that evaluated new groundwater flow predictions. These measures ensure that performance objectives will continue to be met (Wohlwend et al., 2020) until the ongoing PA revision is completed and approved.

The FY2021 PA Annual Review 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 2008a), RWMB (McGill, 2021), and ELLWF Low-Level Waste Acceptance Criteria (SRS-1S, 2021). This annual review affirms that the supporting studies performed in FY2021 do not alter the conclusions of the ELLWF PA (WSRC, 2008) and that there is a reasonable expectation that the ELLWF will meet the performance objectives delineated in DOE Manual 435.1-1 (DOE 2021).

TABLE OF CONTENTS

LIST OF TABLES	viii
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS.....	ix
1.0 Facility Background/History.....	1
2.0 Changes Potentially Affecting the PA, CA, DAS OR RWMB.....	1
3.0 Cumulative Effects of Changes.....	2
4.0 Waste Receipts.....	2
5.0 Monitoring	4
5.1 Vadose Zone Monitoring.....	4
5.1.1 Engineered Trench 1.....	7
5.1.2 Engineered Trench 2.....	8
5.1.3 Slit Trench 1	8
5.1.4 Slit Trench 4	9
5.1.5 Slit Trench 7	9
5.1.6 Slit Trench 8	9
5.1.7 Slit Trench 14	9
5.2 Trench Cover Monitoring.....	10
5.3 Vault Concrete Monitoring	10
5.4 Sump Water Monitoring.....	10
5.5 Surface Water Compliance Monitoring.....	10
5.6 Monitoring Conclusions	17
6.0 Research and Development.....	17
7.0 Planned or Contemplated Changes	24
8.0 Status of DAS Conditions, Key and Secondary Issues	27
9.0 Certification of the Continued Adequacy of the PA, CA, DAS and RWMB	29
10.0 References.....	30

LIST OF TABLES

Table 4-1. Waste Receipts.	3
Table 5-1. Current PA Monitoring Summary.	11
Table 5-2. Performance Monitoring.....	12
Table 5-3 Summary FY2021 Tritium Data (pCi/mL) for Action-Level Lysimeters.	16
Table 5-4. Compliance Monitoring.....	17
Table 7-1. Planned or Contemplated Changes.....	26
Table 7-1. Planned or Contemplated Changes.....	27
Table 8-1. Status of DAS Conditions, Key and Secondary Issues.....	28

LIST OF FIGURES

Figure 5-1. Layout showing disposal units, current action-level lysimeters, locations of administrative limit exceedances, and stormwater runoff covers.	6
Figure 5-2. Layout showing lysimeters with administrative limit exceedances.	6
Figure 7-1. Layout of New Water Table Monitoring Wells (red symbols).	25

LIST OF ABBREVIATIONS

AL	Action Level
AP	All-Pathways
CA	Composite Analysis
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIG	Components-in-Grout
CWTS	Consolidated Waste Tracking System
DAS	Disposal Authorization Statement
DOE	Department of Energy
DOE-HQ	Department of Energy – Headquarters
DOE-SR	Department of Energy – Savannah River
dpm	disintegrations per minute
DRF	Dose Release Factor
DU	Disposal Unit
ELLWF	E-Area Low-Level Waste Facility
ET	Engineered Trench
FEPs	Features, Events and Processes
FY	Fiscal Year
GSA	General Separations Area
HELP	Hydrologic Evaluation of Landfill Performance
K _d	Distribution Coefficient
K _s	Apparent Solubility Value
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
MOP	Member of the Public
MWMF	Mixed Waste Management Facility
N/A	Not Applicable
NRCDA	Naval Reactor Component Disposal Area
PA	Performance Assessment
PARC	Performance Assessment Review Committee

pCi	picocuries
PEST	Parameter ESTimation software
PO	Performance Objective
POA	Point of Assessment
QA	Quality Assurance
R&D	Research & Development
RWMB	Radioactive Waste Management Basis
SA	Special Analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SOF	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
TPBAR	Tritium Producing Burnable Absorber Rod
UCAQE	Unreviewed Composite Analysis Question Evaluation
UDQE	Unreviewed Disposal Question Evaluation
WAC	Waste Acceptance Criteria
1D	One-Dimensional
3D	Three-Dimensional

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 annual review 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 2008a), and the ELLWF Waste Acceptance Criteria (SRS-1S). The review also verifies that the Fiscal Year (FY) 2021 low-level waste (LLW) disposal operations were conducted within the bounds of the PA/SA baseline and the DAS. Important factors considered in this review include waste receipts, results from monitoring, research and development (R&D) programs, and the adequacy of controls derived from the PA/SA baseline.

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 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 (SDF). Those portions of that DAS applicable to the ELLWF were superseded by Revision 1 of the DAS on July 15, 2008 (DOE 2008a). The 2008 ELLWF PA and 2008 DAS were officially implemented by the facility on October 31, 2008 and are the authorization documents for this FY2021 Annual Review.

The ELLWF is a part of the Solid Waste Management Facility (SWMF). SWMF is managed and operated by the SRS Management and Operating prime 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 agency responsible for preparing and maintaining the PA. SWMF operations have been performed at SRS for over 60 years. The mission of the SWMF is to provide storage, processing, and shipment of radioactive, hazardous, and mixed waste. 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 (i.e., containing both hazardous and radioactive constituents). The SWMF consists of E-Area and a portion of H-Area within SRS. The majority of the 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

Many of the R&D tasks summarized in recent Annual Reviews (Hiergesell et al., 2016; Crapse et al., 2017; Hang et al., 2018; Kubilius et al., 2019; Wohlwend et al., 2020; LaBone et al., 2021) as well as in this report (see Section 6.0), have been in preparation for the revision of the 2008 ELLWF PA (WSRC, 2008). The DOE requires that the PA demonstrate a reasonable expectation that LLW disposal will meet the radiological performance objectives/measures established in DOE Manual 435.1-1 (DOE 2021). A revision to the ELLWF PA was started in January 2019.

PA/CA. There were no Unreviewed Disposal Question Evaluations (UDQE) or SAs completed in FY2021. The interim measures implemented in FY2021 by SWM in response to SRNS-TR-2020-00005 (Simmons, 2020) and described in 2019's ASR (Wohlwend et al. 2020) remain in place until the ongoing PA revision is completed and approved.

DAS. SRS continued to conduct ELLWF disposals in accordance with requirements, conditions and limitations set out in the DAS. No baseline document listed in the DAS required revisions in FY2021. LLW

disposal facility designs and operational practices continue to conform to the conceptual models used in the PA. Secondary issues identified in the Low-Level Waste Disposal Facility Federal Review Group (LFRG) review team report (DOE, 2008b) have been closed and improvements are to be addressed in the upcoming PA revision. Thus, this annual review affirms the continued adequacy of the DAS in FY2021.

RWMB. The Radioactive Waste Management Basis (RWMB), as updated and approved by Department of Energy-Savannah River (DOE-SR), is adequate for providing the waste controls, processes, and procedures to define the conditions under which the facility may operate with respect to low-level radioactive waste. The RWMB was updated in FY2021 (McGill, 2021) to ensure that it is consistent with facility operations and the radioactive waste management order.

3.0 Cumulative Effects of Changes

Based on the information described in Section 2.0, there will have been no impacts on the current ELLWF operations or disposal limits.

4.0 Waste Receipts

Waste acceptance criteria for disposal of LLW at the ELLWF are found in Chapter 5 of the 1S SRS Radioactive Waste Requirements Manual. 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 as necessary (SRS-1S, 2021).

As required by the WAC (SRS-1S, 2021), 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. Currently, there are over 2,400 approved waste streams in CWTS with approximately 132 approved waste streams active as of the end of FY2021. All waste types received in the E-Area disposal units were included and analyzed in the PA or supporting SAs.

In FY2021 there was one deviation to the WAC, with the disposal of 2 large Pump Cans with void space being allowed due to ALARA concerns. This deviation was approved in April 2021.

The disposed radionuclide and volumetric inventories in FY2021 (between 10/1/20 and 9/30/21) were compared against the applicable PA/SA-limits for each of the LLW disposal units in ELLWF and met performance objectives (POs) as illustrated by Table 4-1. These disposal units included the E-Area Vaults (LAWV, ILV), disposal trenches (STs, ETs, and CIG trenches), and the 643-26E 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 LLW facilities with a 0.95 sum of fractions (SOF) administrative limit. The SOFs for disposed radionuclide inventories for all disposal units are less than one as shown in Table 4-1.

The analysis of one of the closed slit trenches (i.e., ST05) had an SOF that was greater than the targeted administrative limit of 0.95 at the 100-meter POA. This SOF resulted from a prior year reanalysis of the waste in this closed disposal unit (Collard, 2008). However, in all cases the final SOFs for these closed disposal units were below the performance objective of a SOF of less than 1.00 (or 100%) for each DU. The targeted administrative limit of 0.95 is set to ensure the distribution of radionuclides in a disposal unit is always at or below a SOF of 1.00.

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 27 years of LAWV operation, approximately 33% of the available volume is filled with waste that contains approximately 14% of the allowable radionuclide inventory. After 27 years of ILV operation, approximately 59% of the available volume in the nine cells is filled with waste that contains approximately 10% of the allowable radionuclide inventory.

Table 4-1 provides the volume disposed of in FY2021, PA-estimated disposal capacity, percent filled, limiting SOFs for the selected performance measures, and the PA/Composite Analysis (CA) impact as of 9/30/21 for each disposal unit (DU). This data was retrieved from the waste tracking database. Plume overlap among units has been taken into account in calculating final limits. 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	Volume Disposed During FY2021 (m³)	PA-Estimated Disposal Capacity (m³)	Percent Filled FY2021 (%)	Sum of Fractions	PA/CA Impact (mrem/yr)
LAWV	180	30,600	33	0.15	0.60 of 4
ILV	21	4,284	59	0.10	0.36 of 4
ST1 (closed)	0	14,264	100	0.85	3.40 of 4
ST2 (closed)	0	15,560	100	0.87	3.48 of 4
ST3 (closed)	0	16,953	100	0.94	3.76 of 4
ST4 (closed)	0	19,193	100	0.95	3.80 of 4
ST5 (closed)	0	28,125	100	0.99	3.96 of 4
ST6	0	23,000	91	0.82	3.28 of 4
ST7	0	15,900	66	0.55	2.20 of 4
ST8	0	16,275	95	0.89	3.56 of 4
ST9	360	21,000	95	0.86	3.36 of 4
ST14	1,829	19,500	92	0.95	3.60 of 4
ET1 (closed)	0	35,660	100	0.87	3.48 of 4
ET2	181	35,500	79	0.81	3.12 of 4
ET3	4,039	30,000	90	0.85	3.24 of 4
NRCDA (643-7E) (closed)	0	701	100	0.03	0.12 of 4
NRCDA (643-26E)	0	6,000	12	0.03	0.12 of 4
CIG 1	0	6,500	28	0.44	1.76 of 4

5.0 Monitoring

The E-Area Performance Monitoring Program ensures that the monitoring results from the vadose zone, sump water, soil cover, stormwater runoff covers, and vaults are evaluated and that they meet the ELLWF POs. The monitoring program is implemented in accordance with DOE Manual 435.1 (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) and a revision is planned following the issuance of the revised PA. The PA Monitoring Plan revision will establish new administrative limits for the various waste disposal units based on results from the revised PA. The revised PA Monitoring Plan will also implement an updated approach to the overall performance monitoring strategy that adds a saturated zone (water table) monitoring component to the existing vadose zone monitoring program. Beginning in FY2022, groundwater in the water table aquifer beneath ELLWF will be monitored for tritium as part of the PA monitoring program. Section 7.0 provides a brief overview of the updated approach to monitoring that will be implemented in FY2022.

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 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 occurred beneath the entire areal footprint of the trench, would cause groundwater tritium concentrations at the 100-meter boundary to reach the maximum concentration limit (20 pCi/ml). These conservative limits are used as indicators for whether further investigation is necessary. Due to the conservative 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.

In the fall of FY21, three new lysimeter stations (2 lysimeters per station) were installed on the north rim of ET3 using a sonic drill rig (Dixon, 2020a). These stations were designated as ET3-VL-3, ET3-VL-4, and ET3-VL-5 as shown in Figure 5-1. The stations were installed in a line with the two existing stations (ET3 VL 1 and ET3 VL 2) and spaced approximately 100 ft apart. Lysimeter placement was based on borehole lithology and was comparable to the existing lysimeter stations. The deepest lysimeter at each of the three new lysimeter stations was designated as the Action--Level (AL) lysimeter.

With the addition of the new ET3 lysimeters, the vadose zone monitoring program now consists of 307 suction lysimeters at 102 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 93 of 102 lysimeter stations, a deep lysimeter is designated as an 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.

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.

In FY2021, samples were collected at 92 of the 93 AL lysimeters. One lysimeter station (VL-20) was inaccessible in FY2021 due to ongoing waste disposal activities. All other AL lysimeters were successfully sampled in either the fall or spring sampling event.

Analytical results in FY2021 were at or below administrative limits at 80 of the 92 sampled AL lysimeters. Table 5-2 provides a summary of FY2021 tritium data for each of the AL lysimeters above administrative limits (where the PA Expected Behavior is the administrative limit for that DU). Table 5-3 provides summary data for all AL lysimeters. Tritium concentrations in twelve AL lysimeters exceeded administrative limits: three at ET1, three at ET2, two at ST1, and one each at ST4, ST7, ST8, and ST14 (locations shown in Figure 5-2).

An analytical result that is greater than the administrative limit does not indicate that groundwater concentrations will exceed the Environmental Protection Agency drinking water standard (SRS groundwater protection requirement) at the compliance point. The administrative limit would have to be simultaneously exceeded by a factor of four over a significant portion of the trench in several of the deepest lysimeters (closest to the aquifer) before there would be a risk of exceeding drinking water standards. This is because the administrative limits are set to $1/4^{\text{th}}$ the concentration that would result in an exceedance of the drinking water standard at the 100-m compliance point as predicted by the PA model (Millings, 2012). Of the 93 AL lysimeters, only six exceeded the administrative limit by greater than a factor of four. No individual disposal unit had more than two AL lysimeters that exceeded the administrative limit by a factor of four. When an action-level is exceeded, data are 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. All AL lysimeters which exceeded their administrative limits in FY2021 or earlier are discussed individually below.

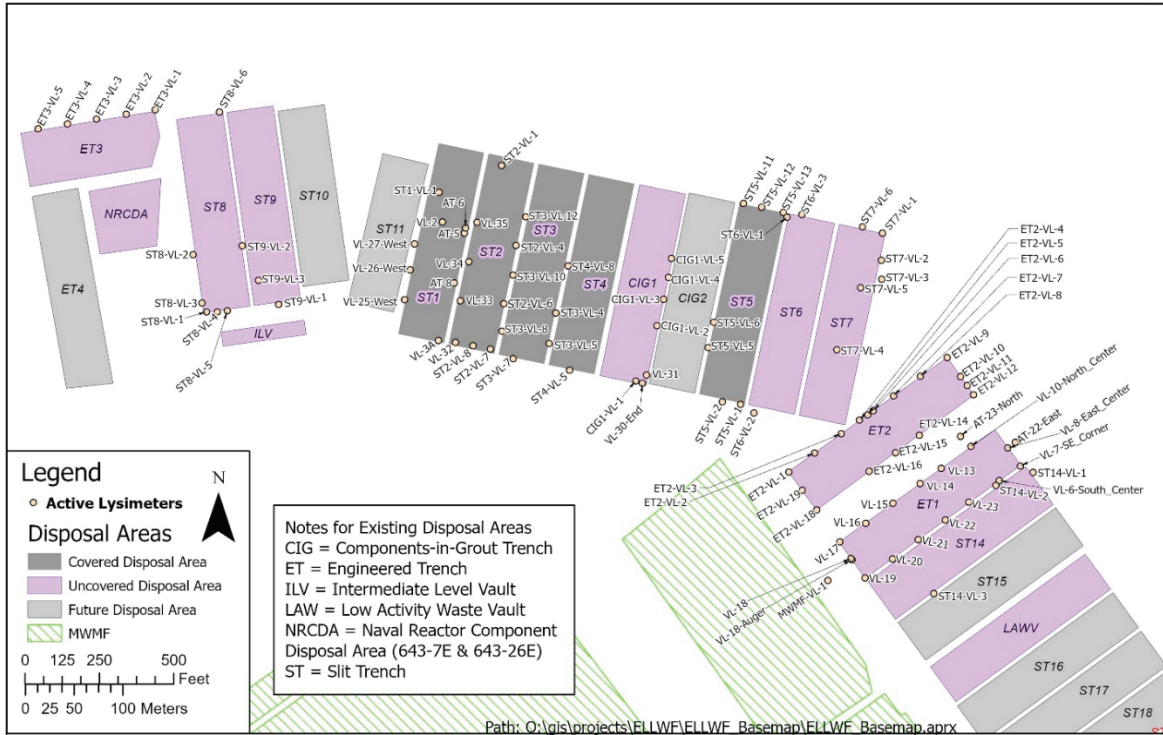


Figure 5-1. Layout showing disposal units and active lysimeters.

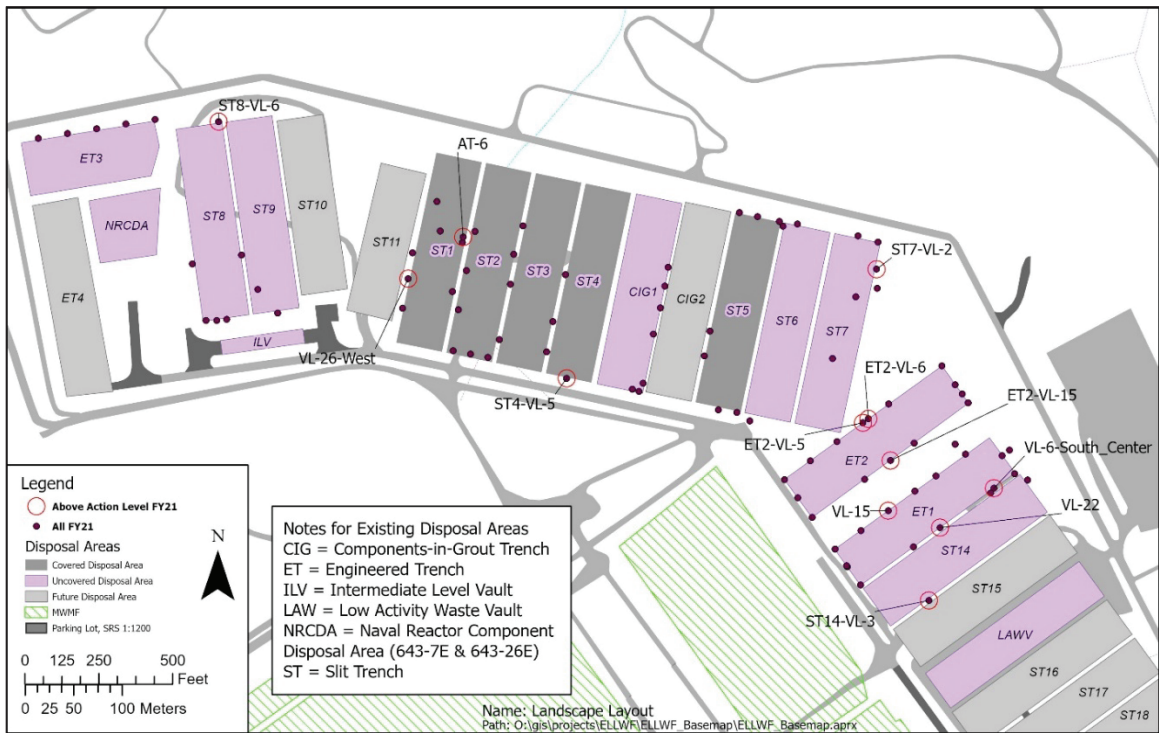


Figure 5-2. Layout showing action-level lysimeters with administrative limit exceedances.

5.1.1 Engineered Trench 1

There are 17 AL lysimeters associated with Engineered Trench 1. Of these 17 lysimeters, samples were collected from 16 AL lysimeters during either or both FY2021 sampling events. One AL lysimeter, VL-20, was inaccessible due to ongoing waste disposal operations at ST14. Three of the 16 AL lysimeters sampled in FY2021 exceeded the tritium concentration administrative limit of 101 pCi/mL: those in clusters VL-6-South Center (VL-6-SC), VL-15, and VL-22. VL-17 exceeded the administrative limit in FY2020 but was below the limit in FY2021.

VL-6-SC. 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 increased for both FY2020 sampling events reaching a peak of 786 pCi/mL in the spring sampling event. For the fall FY2021 sampling event, the concentration decreased to 500 pCi/mL. VL-6-SC was dry during the spring FY2021 sampling event. The tritium concentration in the shallow lysimeter reached a peak of 1026 pCi/mL in fall 2018 but has declined substantially since that time. In FY2021, the tritium concentration in the shallow lysimeter was 65 pCi/mL. This suggests the tritium concentration in the AL lysimeter may decrease in the future. 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 upwards for several sampling events, the tritium concentration in the AL lysimeter at ST14-VL-2 is trending downwards (23 pCi/mL) and is below the action-level for both ET 1 (101.3 pCi/mL) and ST 14 (63.8 pCi/mL).

VL-15. The AL lysimeter was successfully sampled for the first time since FY2019. The tritium concentration in FY2021 was 1040 pCi/mL which is down slightly from FY2019 (1113 pCi/mL). This AL lysimeter had its first exceedance in FY2012, with its concentration increasing from 40 to 158 pCi/mL. It has exceeded the administrative limit in every successful sampling event since then. The tritium concentration rose to a maximum of 1163 pCi/mL in fall 2015. After a period of decline, the tritium concentration rose to 1113 pCi/mL in spring 2019. A similar trend was observed in the shallower lysimeter where tritium concentrations initially increased, declined, and subsequently increased again. The most recent data shows that tritium concentrations in the shallower lysimeter continue to increase. It appears that tritium concentrations in the AL lysimeter follow the same pattern as the shallower lysimeter but are lagged and slightly reduced.

VL-17. The AL lysimeter exceeded the action level for the first time in the fall sampling event for FY20 when the tritium concentration peaked at 199 pCi/mL. For the spring FY2020 sampling event, the concentration had declined to 60 pCi/mL. For both the fall and spring FY2021 sampling events, the measured tritium concentrations were comparable (66 and 63 pCi/mL). Recent concentrations in this lysimeter have been trending upward but remain below the administrative limit. Concentrations in the upper lysimeter peaked in 2014 and declined through 2017 when they began to increase again. This suggests this lysimeter may continue to increase in the future.

VL-22. The tritium concentration measured in the AL lysimeter was 238 pCi/mL compared to 300 pCi/mL in FY2020. Shallow lysimeters at VL-22 are elevated but are on a decreasing trend. This suggest that the tritium concentration in the AL lysimeter may decrease 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 FY2021. Three of the 15 AL lysimeters, ET2-VL-5, ET2-VL-6, and ET2-VL-15, exceeded the tritium concentration administrative limit of 101 pCi/mL.

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. Although the spring 2021 concentration is higher than measured in fall 2020 (1370 vs. 1250 pCi/ml), the concentration in this lysimeter has generally been decreasing. The shallow lysimeter at ET2-VL-5 reached a peak concentration in fall 2016 and then declined through spring 2018. 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.

ET2-VL-6. This lysimeter exceeded the administrative limit for the first time in fall 2020 reaching a concentration of 124 pCi/ml. The concentration in this lysimeter has been increasing since fall 2018 and spiked to a concentration of 924 pCi/ml in spring 2021. ET2-VL-6 is the closest lysimeter to ET2-VL-5 (7 meters), which is also elevated as previously discussed. The shallow lysimeters at this location remain at or near background. As with ET2-VL-5, the expansion of the operational soil cover beyond this location should reduce infiltration and funneling of water. This location will be monitored closely 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 steadily declining. The tritium concentration in this lysimeter was 173 pCi/ml in fall 2020 and 160 pCi/ml in spring 2021. The shallow lysimeters in this cluster are elevated but have generally 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 FY2021, two of the eight AL lysimeters in Slit Trench 1, AT-6 and VL-26-West, exceeded the tritium concentration administrative limit of 61 pCi/mL.

AT-6. The tritium concentration in the AL lysimeter at AT-6 rose gradually from about 2011, and it exceeded the administrative limit in fall 2016 with a concentration of 76 pCi/mL. Since fall 2016, tritium concentrations have hovered around the administrative limit of 61 pCi/mL but had not exceeded the limit again until spring 2021 with a concentration of 62.1 pCi/ml. Although the tritium concentration measured in AT-6 increased slightly compared to fall 2020 (58.1 pCi/ml), it appears to have plateaued and is hovering around the administrative limit. The tritium concentrations in the shallow lysimeters at AT-6 are generally

trending downward but have stabilized in recent sampling events. This suggests the tritium concentration in the AL lysimeter is likely to continue to hover around the administrative limit.

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 515 pCi/mL. Since 2017, the concentration has been relatively steady. The spring 2021 concentration (474 pCi/ml) is below the peak measured in fall 2017. The lysimeter above the AL lysimeter is also elevated, but tritium concentrations there have been declining since 2013. 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 in Slit Trench 4, ST4-VL-5, exceeded its tritium concentration administrative limit (61 pCi/mL) in FY2021. 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 spring 2021, the concentration was 122 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 7

ST7-VL-2. One of the six AL lysimeters in Slit Trench 7, ST7-VL-2, exceeded its tritium concentration administrative limit (61 pCi/mL) in FY2021. 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 sampling event and reached a peak of 425.6 pCi/mL in fall 2017. The tritium concentration in this lysimeter had been decreasing since fall 2017; however, in FY2020 the concentration increased reaching 440 pCi/mL in the spring sampling event. The increasing trend continued in FY2021 with a concentration of 667 pCi/ml measured in spring 2021. Shallow lysimeters in the cluster are at background levels (~5-10 pCi/mL).

5.1.6 Slit Trench 8

ST8-VL-6. One of the five AL lysimeters in Slit Trench 8, ST8-VL-6, exceeded its tritium concentration administrative limit (46.9 pCi/mL) in FY2021, with a concentration of 64.5 pCi/mL (fall 2020). The concentration in spring 2021 decreased to 61.6 pCi/ml. This lysimeter first exceeded the administrative limit in FY2018. The shallow lysimeter at this cluster is elevated but the tritium concentration is decreasing. Therefore, the concentration in the AL lysimeter may decrease in the future.

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 (64 pCi/mL) in FY2021 with a concentration of 209 pCi/mL (fall 2020). In spring 2021, the tritium concentration decreased slightly (203 pCi/ml). This lysimeter was installed in 2016, and it has exceeded the limit since 2017. The lysimeter immediately above the AL lysimeter is near background but the shallowest lysimeter in the cluster has been trending upwards.

5.2 Trench Cover Monitoring

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, 2021). 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, 2021). Four inspections were conducted in FY2021. In August 2020, during the quarterly inspection, a defective tear was found. The cover was repaired under the cover warranty in FY2021.

Inspections of the Slit Trench water barriers are performed quarterly (SWM, 2021). 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 FY2021 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 2020 (FY2021) by procedure 724-EAV-50 (SWM, 2020a) 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 vaults (LAWV and ILV) and engineered trench sumps. SWM monitors the vault sumps through procedure SW15.1-SOP-LLS-01 (SWM, 2020b) and the ET2 sump through procedure SW15.1-SOP-ESUMP-02 (SWM, 2017). These procedures provide instructions for sampling and pumping the vaults and ET 2 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, 2017; 2020b) and dispositioned accordingly. All FY2021 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 (Stagich and Butcher, 2020). 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 2020 Annual Environmental Report (SRNS, 2021) and shown in Table 5-4. This value is 0.35 mrem/yr, which is far below the DOE 458.1 dose limit of 100 mrem/yr.

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 a 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.

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results¹	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Engineered Trench 1 VL-6-SC	Radionuclide Transport	<ul style="list-style-type: none"> • 500 pCi/mL • Concentrations in the action-level lysimeter decreased in FY21 from a peak of 786 pCi/ml in FY20. The lysimeter above the action level shows a decreasing trend. This suggests the concentration in the action level lysimeter may decrease in the future. See Section 5.1.1. • 1040 pCi/ml 	101.3 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect PO's to be met
ELLWF Engineered Trench 1 VL-15	Radionuclide Transport	<ul style="list-style-type: none"> • VL-15 was successfully sampled for the first time since FY19. For FY21, the concentration decreased compared to 1113 pCi/ml measured in spring 2019. Concentrations in the shallower lysimeters are elevated and generally increasing. This suggests that VL-15 may increase in the future. See Section 5.1.1. • 66 pCi/mL 	101.3 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect PO's to be met
ELLWF Engineered Trench 1 VL-17	Radionuclide Transport	<ul style="list-style-type: none"> • VL-17 exceeded the action level for the first time in the fall sampling event for FY20. However, for the FY20 spring event, the concentration had declined to 60 pCi/mL. For FY21, concentrations remained below the administrative limit. However, concentrations in this lysimeter have been trending upward. Concentrations in the upper lysimeter peaked in 2014 and declined through 2017 when they began to increase again. This suggests this lysimeter 	101.3 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect PO's to be met

Table 5-2. Performance Monitoring.

<p>ELLWF Engineered Trench 1 VL-22</p>	<p>Radionuclide Transport</p>	<p>may continue to increase in the future. See Section 5.1.1.</p> <ul style="list-style-type: none"> • 238 pCi/mL <p>• VL-22 reached a peak of 300 pCi/ml in FY20. In FY21, concentrations exhibited a decreasing trend. Concentrations in the shallow lysimeter have been trending downward and suggest this lysimeter may continue to decline in the future. See Section 5.1.1.</p>	<p>101.3 pCi/mL</p>	<p>Will continue to monitor this location as part of vadose zone monitoring program.</p>	<p>Expect PO's to be met</p>
<p>ELLWF Engineered Trench 2 ET2-VL-5</p>	<p>Radionuclide Transport</p>	<ul style="list-style-type: none"> • 1370 pCi/mL <p>• Although elevated, concentrations in this lysimeter are trending downward. Concentrations in the shallow lysimeter had also been trending downward but increased in FY21. This suggests that ET2-VL-15 may increase in the future. See Section 5.1.2.</p>	<p>101.3 pCi/mL</p>	<p>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.</p>	<p>Expect PO's to be met</p>
<p>ELLWF Engineered Trench 2 ET2-VL-6</p>	<p>Radionuclide Transport</p>	<ul style="list-style-type: none"> • 924 pCi/mL <p>• ET2-VL-6 exceeded the administrative limit for the first time in FY21. Concentrations in this lysimeter started increasing in 2018 but remained below the limit. For the fall 2021 sampling event, the concentration was 124 pCi/mL. In spring 2021, the tritium concentration spiked to 924 pCi/mL. The shallow lysimeters at this location are at background levels. See Section 5.1.2.</p>	<p>101.3 pCi/mL</p>	<p>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</p>	<p>Expect PO's to be met</p>

Table 5-2. Performance Monitoring.

				vadose zone monitoring program.	
ELLWF Engineered Trench 2 ET2-VL-15	Radionuclide Transport	<ul style="list-style-type: none"> • 173 pCi/mL • Concentrations in the action-level lysimeter show a decreasing trend. Concentrations in the upper lysimeter have generally trended downward in recent events. 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 PO's to be met
ELLWF Slit Trench 1 AT-6	Radionuclide Transport	<ul style="list-style-type: none"> • 62.1 pCi/mL • AT-6 first exceeded the administrative limit in fall 2016. Since that time, concentrations have hovered just below the administrative limit until spring 2021. The shallow lysimeters at this location show a decreasing trend but have stabilized in recent sampling events. This suggests that the tritium concentration in AT-6 is likely to continue hovering around the administrative limit. See Section 5.1.3. 	61.2 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect PO's to be met
ELLWF Slit Trench 1 VL-26-West	Radionuclide Transport	<ul style="list-style-type: none"> • 474 pCi/mL • Concentrations in the action-level lysimeter appear to have plateaued. The tritium concentration in the lysimeter above the action-level lysimeter has been trending downward. This suggests the concentration in the 	61.2 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect PO's to be met

Table 5-2. Performance Monitoring.

<p>ELLWF Slit Trench 4 ST4- VL-5</p>	<p>Radionuclide Transport</p>	<p>action-level lysimeter may begin to decline in the future. See Section 5.1.3</p> <ul style="list-style-type: none"> • 122 pCi/mL • Concentrations in the action-level lysimeter have been slowly trending upward. 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 	<p>61.2 pCi/mL</p>	<p>Will continue to monitor this location as part of vadose zone monitoring program.</p>	<p>Expect PO's to be met</p>
<p>ELLWF Slit Trench 7 ST7- VL-2</p>	<p>Radionuclide Transport</p>	<ul style="list-style-type: none"> • 667 pCi/mL • Concentrations in the action-level lysimeter continue to increase. Concentrations in the upper lysimeters are at background. See Section 5.1.5 	<p>61.2 pCi/mL</p>	<p>Will continue to monitor this location as part of vadose zone monitoring program.</p>	<p>Expect PO's to be met</p>
<p>ELLWF Slit Trench 8 ST8- VL-6</p>	<p>Radionuclide Transport</p>	<ul style="list-style-type: none"> • 64.5 pCi/mL • Concentrations in the action-level lysimeter appear to have reached a plateau. Although elevated, the tritium concentration in the shallow lysimeter is on a decreasing trend. See Section 5.1.6 	<p>46.9 pCi/mL</p>	<p>Will continue to monitor this location as part of vadose zone monitoring program.</p>	<p>Expect PO's to be met</p>
<p>ELLWF Slit Trench 14 ST14-VL-3</p>	<p>Radionuclide Transport</p>	<ul style="list-style-type: none"> • 209 pCi/mL • Concentrations in the action-level lysimeter are trending upward but the lysimeter above is at background. See Section 5.1.7 	<p>63.8 pCi/mL</p>	<p>Will continue to monitor this location as part of vadose zone monitoring program.</p>	<p>Expect PO's to be met</p>

¹Trends discussed in more depth within the text. Concentrations shown are maximum values for FY2021.

Table 5-3 Summary FY2021 Tritium Data (pCi/mL) for Action-Level Lysimeters.

Well ID (Elevation in ft msl)	FY2021 Sampling Events	
	Fall ⁺	Spring ⁺
CIG Trench (Administrative Limit = 29.6 pCi/mL)		
CIG1-VL-1 (236)	13	9
CIG1-VL-2 (237)	3	3
CIG1-VL-3 (233)	5	7
CIG1-VL-4 (232)	15	17
CIG1-VL-5 (238)	4	3
VL-30-End (240)	4	*
VL-31 (241)	4	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)	500	*
VL-7-SE_Corner (235.7)	10	11
VL-8-East_Center (234.9)	47	49
VL-10-North_Center (233)	*	8
VL-13 (237)	8	10
VL-14 (239)	27	26
VL-15 (235)	*	1040
VL-16 (235)	4	4
VL-17 (238)	66	63
VL-18 (234)	5	*
VL-18-Auger (234)	4	3
VL-19 (238)	4	4
VL-20 (243)	*	*
VL-21 (239)	12	12
VL-22 (241)	238	226
Engineered Trench 2 (Administrative Limit = 101.3 pCi/mL)		
ET2-VL-1 (242)	4	3
ET2-VL-2 (242)	4	4
ET2-VL-3 (245)	5	4
ET2-VL-5 (247)	1250	1370
ET2-VL-6 (244)	124	924
ET2-VL-7 (245)	15	13
ET2-VL-9 (242)	3	2
ET2-VL-10 (242)	2	3
ET2-VL-11 (246)	2	3
ET2-VL-12 (240)	6	5
ET2-VL-14 (240)	13	16
ET2-VL-15 (247)	173	160
ET2-VL-16 (242)	2	2
ET2-VL-18 (242)	5	5
ET2-VL-19 (248)	14	25
Engineered Trench 3 (Administrative Limit = 43.7 pCi/mL)		
ET3-VL-1 (221)	3	4
ET3-VL-2 (226)	3	2
ET3-VL-3 (222)	2	3
ET3-VL-4 (224)	1	1
ET3-VL-5 (222)	28	32
Silt Trench 1 (Administrative Limit = 61.2 pCi/mL)		
AT-5 (226)	53	*
AT-6 (227)	58	62
AT-8 (232)	4	3
ST1-VL-1 (245)	3	3
VL-2 (225)	7	7
VL-25-West (246)	2	2
VL-26-West (245)	464	474
VL-27-West (245)	5	5

Well ID (Elevation in ft msl)	FY2021 Sampling Events	
	Fall ⁺	Spring ⁺
Silt Trench 2 (Administrative Limit = 61.2 pCi/mL)		
ST2-VL-4 (232)	3	3
ST2-VL-7 (231)	12	10
ST2-VL-8 (240)	3	3
VL-32 (231)	3	4
VL-33 (229)	4	4
VL-34 (227)	5	4
VL-35 (227)	3	3
Silt Trench 3 (Administrative Limit = 61.2 pCi/mL)		
ST3-VL-4 (234)	21	21
ST3-VL-5 (236)	*	21
ST3-VL-8 (238)	3	3
ST3-VL-10 (240)	3	3
ST3-VL-12 (243)	*	3
Silt Trench 4 (Administrative Limit = 61.2 pCi/mL)		
ST4-VL-5 (238)	122	122
ST4-VL-8 (239)	3	3
Silt Trench 5 (Administrative Limit = 61.2 pCi/mL)		
ST5-VL-1 (237)	13	17
ST5-VL-2 (252)	3	3
ST5-VL-5 (239)	3	3
ST5-VL-6 (244)	3	3
ST5-VL-11 (237)	2	2
ST5-VL-12 (231)	2	2
ST5-VL-13 (236)	3	3
Silt Trench 6 (Administrative Limit = 61.2 pCi/mL)		
ST6-VL-1 (233)	2	1
ST6-VL-2 (241)	3	3
ST6-VL-3 (235)	2	2
Silt Trench 7 (Administrative Limit = 61.2 pCi/mL)		
ST7-VL-1 (233.5)	2	2
ST7-VL-2 (231.7)	578	667
ST7-VL-3 (232)	2	3
ST7-VL-4 (232)	4	4
ST7-VL-5 (229)	1	1
ST7-VL-6 (229)	2	2
Silt Trench 8 (Administrative Limit = 46.9 pCi/mL)		
ST8-VL-1 (235.5)	6	9
ST8-VL-2 (227)	1	2
ST8-VL-4 (230)	2	2
ST8-VL-5 (229)	2	2
ST8-VL-6 (238)	65	62
Silt Trench 9 (Administrative Limit = 46.9 pCi/mL)		
ST9-VL-1 (239)	2	2
ST9-VL-2 (229)	3	3
ST9-VL-3 (240)	4	4
Silt Trench 14 (Administrative Limit = 63.8 pCi/mL)		
ST14-VL-1 (240)	4	4
ST14-VL-2 (239)	23	18
ST14-VL-3 (237)	209	203

+ All data in pCi/mL

* No sample collected

Pink shading = Exceeds Administrative Limit

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	0.35 mrem	<100 mrem	NA	None	None

5.6 Monitoring Conclusions

The majority of AL lysimeter locations, approximately 87%, remained below administrative limits in FY2021. A majority of the AL lysimeters would need to reach, with some exceeding, their administrative limit in order to exceed a groundwater performance objective or measure. Because administrative limits are set at 1/4th the concentration predicted to result in an exceedance in the groundwater, the remaining twelve AL lysimeters spread over 7 trenches are not expected to result in an exceedance at the 100-m POA. The source of these exceedances in the overlying waste zone and potential impacts have been previously evaluated (Halverson and Millings, 2017; Hang et al., 2018; Kubilius et al., 2019) and trends in these lysimeters continue to be monitored.

Trench cover inspections during FY2021 revealed minor defects (i.e., cover depressions, erosion areas, broken fasteners) not affecting the expected performance of these barriers. In some cases, repairs have been 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 FY2021, SRNL produced a number of technical reports and memoranda supporting ELLWF annual PA maintenance, SWM Operations & Engineering, PA Test & Research, and PA Revision Development. Table 6-1 lists a summary of this work where the designation “To Be Determined” or “TBD” indicates the PA impact will be evaluated in the in-progress PA.

Table 6-1. Research and Development Activities.

Document Number	Results	PA/CA Impact
SRNL-L2200-2020-00024 Rev.1	<p>Annual Meteorological Averages for the Savannah River Site 2014-2018 Dataset</p> <p>This report provides the annual meteorological average data for the SRS for 2014-2018. The Atmospheric Technologies Group at the SRS has calculated the annual average for the following meteorological data parameters: wind speed, absolute humidity, relative humidity, mixing height, precipitation rate, and temperature. These parameters are used to create input files for the modeling software U.S. EPA CAP88, which is used in the PA analyses, to demonstrate compliance with regulatory guidelines from state and federal agencies. The updated parameters for wind speed, absolute humidity, and temperature are calculated using the 2014-2018 meteorological dataset.</p>	TBD
SRNL-STI-2016-00512, Rev. 3	<p>Air Pathway Dose Modeling for the E-Area Low-Level Waste Facility</p> <p>This report describes the dose-release factors (DRFs) that were calculated for potential atmospheric releases of several radionuclides from the E-Area Low-Level Waste Facility (ELLWF). These factors represent the maximum dose a receptor would receive if standing at either 100 m or 11,408 m (Site Boundary) from the edge of an ELLWF disposal unit which are points of assessment for DOE Order 435.1 performance assessments. The DRFs were calculated for 1 Ci of the specified radionuclide being released from the ground surface to the atmosphere (mrem per curie released). The calculation conservatively represented the ELLWF as a point source, and conservatively assumed the receptor was positioned at the center of the contaminant plume and continuously exposed for a period of one year. These DRFs can be refined to take into consideration disposal unit size, proximity, and timing of peak dose to establish less conservative radionuclide specific disposal limits.</p>	TBD
SRNL-STI-2020-00346, Rev. 0	<p>GoldSim E-Area Low-Level Waste Facility Aquifer Zone Model Calibration Methodology</p> <p>This report documents the development and calibration of the E-Area Low-Level Waste Facility GoldSim aquifer model. It provides a methodology on how a GoldSim aquifer model can be calibrated to specific PORFLOW-based aquifer predictions. The calibration activity presented within this report focuses on the Slit Trench #06 location that resides within the center set of Slit Trenches. This GoldSim-based aquifer model is a generic model capable of being calibrated to any of the other trench locations within E-Area. In addition, subsequent activities (beyond the scope of this effort) will couple this GoldSim-based aquifer model to various GoldSim-based trench</p>	TBD

Table 6-1. Research and Development Activities.

	<p>models, with the intent of performing stochastic analyses that couple all pertinent fate and transport processes from the ground surface up to the 100-m point of assessment.</p>	
<p>SRNL-STI-2020-00372, Rev. 0</p>	<p>GoldSim E-Area Low-Level Waste Facility Vadose Zone Model Benchmarking</p> <p>This report documents the development and benchmarking of the E-Area Low-Level Waste Facility GoldSim Engineered and Slit Trench vadose zone models. Subsequent activities (beyond the scope of this effort) will couple the GoldSim-based vadose zone models to the GoldSim aquifer model, with the intent of performing stochastic analyses that couple all pertinent fate and transport processes from the ground surface up to the 100-m Point of Assessment. The benchmarking presented within this report focuses on the Slit Trench 06 hydrostratigraphic location that resides within the center set of slit trenches. These GoldSim-based vadose zone models are generic models capable of being benchmarked to any of the other trench locations within E-Area.</p>	<p>TBD</p>
<p>SRNL-STI-2020-00410, Rev. 1</p>	<p>PORFLOW Modeling of Vadose Zone Flow and Transport for the E-Area Intermediate Level Vault</p> <p>In support of the E-Area Performance Assessment, a two-dimensional model of water flow and radionuclide transport through the E-Area Intermediate Level Vault (ILV) and local vadose zone has been developed using the PORFLOW™ software. The purpose of the model is to calculate flux to the water table for radionuclides eluted from the ILV during its operational life, the period of institutional control, and times following site closure. Results of model calculations will be used by a three-dimensional PORFLOW model of transport through the aquifer to determine radionuclide concentrations at a hypothetical 100 meter well and at the site boundary where contaminated groundwater is accessible to members of the public following site closure.</p>	<p>TBD</p>
<p>SRNL-STI-2020-00566, Rev. 0</p>	<p>E-Area Low-Level Waste Facility Multitiered Groundwater and Intruder Radionuclide Screening</p> <p>An earlier screening effort had identified that an additional screening tier (i.e., Tier-2) was necessary to further reduce those parent radionuclides that would require explicit inventory tracking within the E-Area Low-Level Waste Facility (ELLWF). This report accomplishes this along with other additional upgrades made to the Tier-1 analyses, including the option to have trigger-value radionuclides. The parent radionuclide listings presented in this report supersede all prior screening efforts associated with the ELLWF and will be employed directly in the upcoming PA.</p>	<p>TBD</p>
<p>SRNL-STI-2020-00588, Rev. 0</p>	<p>FY2020 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility</p>	<p>None</p>

Table 6-1. Research and Development Activities.

<p>SRNL-STI-2021-00029, Rev. 0</p>	<p>This annual review for the E-Area Low-Level Waste Facility (ELLWF) affirms that the disposal facility continued to operate within the bounds of the current PA and Composite Analysis baseline and the subsequent SA's and satisfied all the requirements, conditions, and limitations identified in the 2008 DAS, RWMB, and ELLWF Low-Level Waste Acceptance Criteria. This report affirms that the supporting studies performed in FY2020 do not alter the conclusions of the 2008 ELLWF PA and that there is a reasonable expectation that the ELLWF will meet the performance objectives delineated in DOE Manual 435.1-1.</p>	
<p>SRNL-STI-2021-00029, Rev. 0</p>	<p>FY2020 Savannah River Site Composite Analysis Annual Summary Review</p> <p>This document provides DOE Order 435.1 and its manual, Radioactive Waste Management required Annual Review for the SRS CA. Progress made to-date toward addressing the secondary issue from the LFRG review of the 2010 SRS CA has focused primarily upon inventory estimate improvements. Inventory impacts dose in a linear fashion and reduces the uncertainty with the CA conclusions. Maintenance items are addressed, as funding allows, based on the relative risk associated with meeting the performance objectives. Currently, there is minimal risk in exceeding the DOE 100 mrem/yr CA primary dose limit or the DOE 30 mrem/yr dose constraint (administrative limit). Based on the assessment presented within this annual review and collective engineering judgement, the conclusions of the 2010 SRS CA remain valid and there is reasonable assurance that SRS will meet the performance objectives delineated in DOE Manual 435.1-1. The 2010 SRS CA should be updated to incorporate PA changes, proposed changes to inventories and sources and model improvements accumulated since the 2010 CA. The timing will be dependent on the completion of the ongoing E-Area PA revision.</p>	<p>None</p>
<p>SRNL-STI-2021-00017, Rev. 0</p>	<p>Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site</p> <p>The Savannah River Site (SRS) disposes of low-level radioactive waste and stabilizes high-level radioactive waste tanks in the subsurface environment. Calculations used to establish the radiological limits of these facilities are referred to as Performance Assessments (PAs), Special Analyses, and Composite Analyses. The purpose of this document is to revise the existing geochemical data package used for these calculations. This work builds on earlier compilations of geochemical data, referred to a geochemical data packages. This work is being conducted as part of the on-going maintenance program of the SRS PA programs that periodically updates calculations and data packages when new information becomes available. This document also provides the geochemical conceptual model, the approach used for selecting the values, the justification for selecting data, and the assumptions made to</p>	<p>TBD</p>

Table 6-1. Research and Development Activities.

	<p>assure that the conceptual and numerical geochemical models are reasonably conservative (i.e., bias recommended input values to reflect conditions that will predict maximum risk to the hypothetical recipient). This document provides 1,232 input parameters for geochemical parameters describing transport processes for 64 elements (>740 radioisotopes) potentially occurring within eight subsurface disposal or tank closure areas: Slit Trenches, Engineered Trenches, Low Activity Waste Vault, Intermediate Level Vaults, Naval Reactor Component Disposal Areas, Components-in-Grout Trenches, Saltstone Disposal Facility, and Closed Liquid Waste Tanks. The geochemical parameters described here are the distribution coefficient, Kd value, apparent solubility value, Ks value, and the cementitious leachate impact factor. For the vast majority of the dataset, the new information supported use of the original recommended input values, thereby reaffirming the pedigree of these values. As part of the PA maintenance plan, future geochemical data-needs were identified, including: (1) develop cementitious leachate impact factors (used to factor the influence of cementitious leachate on constituent of concern sorption to sediments), (2) develop a reactive transport code for certain aspects of the PA, (3) conduct studies to understand 14C and radioiodine geochemistry in cementitious environments, and (4) develop solubility limits and paired Kd values (for lower constituent of concern concentration conditions) for Ba, Cr, Np, Pa, Pb, Pu, Sr, and U under reducing and/or oxidized cementitious conditions.</p>	
<p>SRNL-STI-2021-00063, Rev. 0</p>	<p>PORFLOW Modeling of Vadose Zone Flow and Transport for the E-Area Low Activity Waste Vault</p> <p>In support of the E-Area Performance Assessment, a two-dimensional model of water flow and radionuclide transport through the E-Area Low Activity Waste Vault (LAWV) and local vadose zone has been developed using the PORFLOWTM software. The purpose of the model is to calculate flux to the water table for radionuclides eluted from the LAWV during its operational life, the period of institutional control, and times following site closure. Results of model calculations will be used by a three-dimensional PORFLOW model of transport through the aquifer to determine radionuclide concentrations at a hypothetical 100 meter well and at the site boundary where contaminated groundwater could be accessed by members of the public following site closure. Results from these initial trial runs are compared to calculations that were made for the 2008 PA LAWV analysis. In brief, a new PORFLOW model of flow and transport through the LAWV vadose zone has been developed and tested.</p>	<p>TBD</p>
<p>SRNL-STI-2021-00284, Rev. 0</p>	<p>Radiological Impact of 2020 Operations at the Savannah River Site</p> <p>This report presents the environmental dose assessment methods and the estimated potential doses to the public from 2020 SRS air and liquid radioactive releases. Also documented are potential doses</p>	<p>TBD</p>

Table 6-1. Research and Development Activities.

	<p>from special-case exposure scenarios, such as the consumption of wildlife or goat milk. The 2020 dose to the offsite representative person from SRS liquid releases was 0.35 mrem and from SRS air releases it was 0.012 mrem. To show compliance with the DOE all-pathway dose standard of 100 mrem/yr, SRS conservatively adds these two doses for a total representative person dose of 0.36 mrem which is 0.36% of the DOE standard. The estimated dose from consuming hunter harvested deer or wild pig meat is determined for every onsite hunter. During 2020, the maximum potential dose an onsite hunter received was 10.6 mrem, or 10.6% of DOE's 100 mrem/yr all-pathway dose standard. SRS estimated the maximum potential dose from fish consumption at 0.53 mrem from bass collected at the mouth of Steel Creek. This dose is 0.53% of the DOE standard. SRS bases this hypothetical dose on the low probability scenario that, during 2020, a fisherman consumed 24 kg (53 lbs) of bass caught exclusively from the mouth of Steel Creek. SRS conducts screening evaluations of plant and animal doses for aquatic and terrestrial ecosystems. For 2020, all SRS aquatic system locations passed the Level 1 and Level 2 screenings and no further assessments were required at those locations. For the land-based systems evaluation, SRS performed initial screenings using concentration data from the five onsite radiological soil sampling locations. Typically, SRS collects and analyzes only one soil sample per year from each location. For 2020, all land-based locations passed their initial (Level 1) pathway screenings.</p>	
<p>SRNL-TR-2020-00298, Rev. 0</p>	<p>Updated Estimate of Tritium Permeation from TPBAR Disposal Containers in ILV (U) A tritium source term analysis was performed for TPBAR disposal in the E-Area Intermediate Level Vaults for the E-Area Low-Level Waste Facility PA. This analysis is based on an earlier source term analysis which treated the bulk of the tritium residual as tightly bound by the TPBAR getter material, with only a small fraction existing as tritiated moisture in the lithium aluminate ceramic pellets. Together with atmospheric moisture trapped in the free volume, the tritiated water vapor is assumed to corrode steel surfaces inside the disposal container, covering them with a magnetite film while generating hydrogen. The carbon steel walls of the disposal container are permeable to hydrogen, providing a pathway for tritium to escape containment. The rate of hydrogen generation is assumed to be limited by the rate of corrosion, which is assumed to be governed by parabolic reaction kinetics obtained from the literature. This relies on the further assumption that the water vapor consumed by the corrosion reaction is continually replaced by moisture from the lithium aluminate pellets until all of that moisture is gone. In addition to tritium permeation, the analysis also includes a slow leak through the disposal container walls at the maximum allowable leak rate, 1×10^{-4} standard cm^3/s. Results were obtained for four different combinations of internal and container wall temperatures, established in an</p>	<p>TBD</p>

Table 6-1. Research and Development Activities.

	earlier thermal analysis that considered two different vault loadings and two different TPBAR activity levels.	
SRNL-L3220-2021-00082, Rev. 0	<p>Re: Fall 2020 Lysimeter Tritium Data</p> <p>The purpose of this memo was to provide the Fall 2020 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 2020 were at or below the administrative limits at 78 out of 88 sampled locations. There were 10 AL lysimeters above the administrative limits. There were 5 dry AL lysimeters in Fall 2020</p>	None
SRNL-L3220-2021-00004, Rev. 0	<p>Re: Spring 2021 Lysimeter Tritium Data</p> <p>The purpose of this memo was to provide the Spring 2021 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 2021 were at or below the administrative limits at 77 out of 88 sampled locations. There were 11 AL lysimeters above the administrative limits. There were 5 dry AL lysimeters in Spring 2021.</p>	None
SRNL-STI-2020-00555, Rev. 0	<p>Installation of Lysimeters Near Engineered Trench 3</p> <p>This report documents the installation of three new vadose zone lysimeter stations at ET3. It also designates the deepest lysimeter at each station as the Action-Level lysimeter and provides initial analytical results for tritium.</p>	None
SRNL-STI-2020-00433, Rev. 0	<p>Selection of Well Locations for Saturated Zone Monitoring at the E-Area Low Level Waste Facility</p> <p>This report documents the field activities and analytical results from the characterization effort conducted to select the well locations south of ST1. This report also provides the locations and construction details for all eight water table wells to be installed at ELLWF to support the revised approach to performance monitoring.</p>	None
SRNL-STI-2021-00290, Rev. 0	<p>Installation of Lysimeters and Monitoring Wells in Support of the Revised Approach to E-Area Performance Monitoring</p> <p>This report provides the final construction details and layout for the new vadose zone lysimeters at ET3 and the water table monitoring wells installed as part of the new saturated zone component of the revised performance monitoring program.</p>	None

7.0 Planned or Contemplated Changes

A PA revision is currently ongoing to update the ELLWF PA technical baseline and is scheduled to be submitted to LFRG in FY2022. 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 GW limits.

The revision to the PA will lead to a revision of the ELLWF PA monitoring plan. As part of the revised PA monitoring plan, tritium administrative limits for the AL lysimeters that comprise the vadose zone monitoring system (VZMS) will be re-calculated. The administrative limits for tritium are calculated using the inventory limit for each disposal unit, the peak activity concentration to the groundwater determined by PA modeling, disposal unit geometry, and estimated infiltration rates (Millings, 2012). The new administrative limits will be documented in the updated PA Monitoring Plan.

Optimization of the PA groundwater monitoring program is also underway and will be documented in the revised ELLWF PA monitoring plan. Since 1999, the VZMS has been used to successfully demonstrate that the ELLWF performance meets the requirements and predictions of the approved PA. However, AL lysimeters at the ELLWF are experiencing an increasing number of administrative limit exceedances for tritium concentrations in vadose zone groundwater. Therefore, saturated zone (SZ) monitoring will be included in the revised PA Monitoring Plan.

For a SZ monitoring program to be effective, it is necessary to distinguish tritium originating from the Mixed Waste Management Facility (MWMF) from that of the ELLWF. The MWMF is in an older part of the disposal facility upgradient of ELLWF. Depth-discrete SZ sampling performed in a FY2018 E-Area SZ characterization program (Kubilius and Joyce, 2018) demonstrated that MWMF-derived tritium occurs at greater depths than ELLWF-derived groundwater in some areas of the facility. In these areas, discriminating between the two contaminant sources is possible based on the presence of chlorinated solvent "fingerprints" associated with groundwater contamination originating from the MWMF.

In FY2021, eight water table monitoring wells were installed at various locations around ELLWF (Figure 7-1). Four wells were installed in the area down gradient of ET1 and ET2 where 8 of 12 administrative limit exceedances for AL lysimeters occurred in FY2021. These wells were all screened within the uppermost portion of the water table aquifer which is presumed free of MWMF contamination (Kubilius and Joyce, 2018). Depth discrete sediment cores were collected during well installation and analyzed for volatile organic compounds (VOCs). All samples were free of VOC contamination which indicates the wells were successfully screened above any MWMF contamination, if present, in these locations. These wells will be sampled on an annual basis using passive methods (i.e., hydrasleeve) beginning in FY2022. Samples will be analyzed for tritium, VOCs, technetium-99, and iodine-129 (sample volume permitting).

Water table wells were also installed near ST1 in response to administrative limit exceedances in this area of the facility. The groundwater in this portion of ELLWF is impacted by MWMF contamination. Consequently, wells were placed both upgradient (two wells) and downgradient (two wells) of the disposal area as shown in Figure 7-1. These wells will be sampled on an annual basis using dedicated bladder pumps beginning in FY2022. Samples will be analyzed for tritium, VOCs, technetium-99, and iodine-129 (sample volume permitting). Due to the MWMF contamination in this area, tritium concentrations in these wells

are expected to be above the maximum contaminant level (MCL). Therefore, interpretation of the analytical data will rely on time trending and will most likely require several years of monitoring before ELLWF contamination, if any, will be apparent.

The eight-water table monitoring wells installed in FY2021, along with existing water table monitoring wells located around the perimeter of the facility, will comprise the new saturated zone monitoring program intended to complement the existing vadose zone monitoring program. The initial POs for these wells will be established in the revised PA Monitoring Plan and may be revised following the subsequent review of the monitoring data.

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

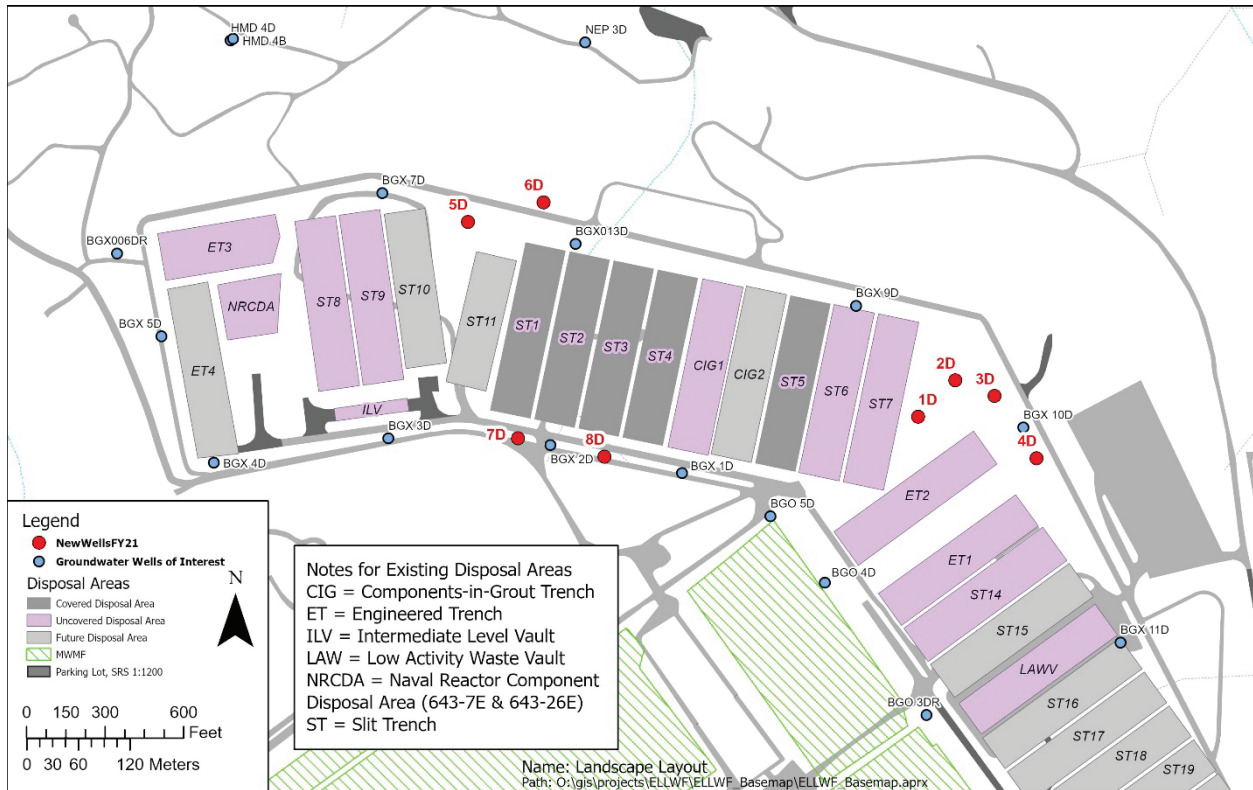


Figure 7-1. Layout of New Water Table Monitoring Wells (red symbols).

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 PA revision currently underway. 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	FY21-FY22
Revision to Administrative Limits for Action Level Lysimeters	Administrative limits are calculated based on PA modeling. Specifically, these conservative limits are based on disposal unit inventory limits, peak activity concentrations to groundwater for tritium, disposal unit geometry, and estimated infiltration rates. These input parameters will change with the PA revision. Therefore, new administrative limits will be calculated based on the revised PA due to be completed in FY2022.	New administrative limits for AL lysimeters.	FY22

Table 7-2. Planned or Contemplated Changes.

Planned or contemplated change	Change Basis	PA/CA Impact	Schedule
<p>Optimization of Groundwater Monitoring Program at the E-Area Low-Level Waste Facility</p>	<p>A FY2019 report describes results of a SZ characterization campaign which was conducted in 2017, and proposes changes to the ELLWF PA Monitoring Plan, including: 1) reducing the frequency of vadose zone lysimeter sampling from semi-annually to annually; 2) omitting sampling of about 40 (of 300) lysimeters that are deemed unnecessary due to either being historically dry or because they are one of several lysimeters at a station; 3) installing up to eight new performance monitoring wells in the saturated zone downgradient of ET 1 and 2 and ST 1; and 4) considering future compliance monitoring at surface water stations in Upper Three Runs or Crouch Branch. (Kubilius and Joyce, 2018)</p>	<p>Will be included in the update to the monitoring plan</p>	<p>FY22</p>

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 Review. Three issues were closed by committing to address the issues in the next PA and are listed in Table 8-1. This annual review 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	7.2.3.2	Insufficient documentation of all components of the site model for the vadose and saturated zone (five specific items to be addressed)	Closed per DOE approval of FY2011 Annual Review	Items 1, 3, 4 and 5: <i>PORFLOW Qualification for use in E-Area Low-Level Waste Facility Performance Assessment, (McDowell-Boyer and Flach, 2011)*</i> , July 2011; Item 2: Information was included in App. G of the PA *GSA Model Improvements will be incorporated into the next revision of the PA.	Complete Pending PA Revision
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 Review.	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
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 Review.	This item was downgraded from a key issue to a secondary issue based on additional sensitivity analyses performed and documented in the final 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, <i>Benchmarking Exercises to Validate the Updated ELLWF GoldSim Trench Models</i> , 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, <i>Update to the Uncertainty Analysis for the E-Area Low-Level Waste Facility Trenches</i> , 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

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

This annual review 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 2008a), RWMB (McGill, 2021), and ELLWF Waste Acceptance Criteria (SRS-1S, 2021). This annual review affirms that the supporting studies performed in FY2021 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. A revised PA is in preparation and anticipated SRS (i.e., including SRNS, BSRA, DOE-SR) review and approval is scheduled to occur in FY2022. Following submittal of the final draft to the LFRG for review, their approval is not anticipated until sometime in FY2023.

10.0 References

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- Dixon and Jannik 2021. K. L. Dixon and G. T. Jannik, "*Air Pathway Dose Modeling for the E-Area Low-Level Waste Facility.*" SRNL-STI-2016-00512, Rev. 3. Savannah River National Laboratory, Aiken, SC. August 2021.
- Dixon and Joyce, 2021. K. L. Dixon and W. D. Joyce, "Installation of Lysimeters and Monitoring Wells in Support of the Revised Approach to E-Area Performance Monitoring." SRNL-STI-2021-00290. Savannah River National Laboratory, Aiken, SC.
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