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FY2020 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility

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February 2021

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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). SWMF is managed and operated by the SRS Management and Operations prime contractor, Savannah River Nuclear Solutions (SRNS). Within SRNS, the Solid Waste Management (SWM) organization 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 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 (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 2011) 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 1999b) 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 Those portions of that DAS applicable to the ELLWF were superseded by Revision 1 of the DAS on July 15, 2008 (DOE 2008a).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) 2020 Annual Review.

Approximately 5,000 cubic meters of low-level waste was disposed in ELLWF disposal units during FY2020. All disposal units remain in conformance with their disposal limits. Special Analysis (SA) SRNL-STI-2018-00624 (Hamm et. al., 2018) was added to the FY2020 Radioactive Waste Management Basis (RWMB) (McGill, 2020).

The majority of action-level lysimeter locations, approximately 89%, remained below administrative limits in FY2020. A majority of the action-level (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 ten 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 FY2020 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 (Upper Three Runs Creek, 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 a Special Analysis (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 FY2020 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, 2020), and ELLWF Low-Level Waste Acceptance Criteria (SRS-1S, 2014). This annual review affirms that the supporting studies performed in FY2020 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 2011).

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LIST OF ABBREVIATIONS

AL	Action Level
AP	All-Pathways
CA	Composite Analysis
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIG	Components-in-Grout
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
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
WITS	Waste Information Tracking System
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), Trenches [Slit Trenches (STs), Engineered Trenches (ETs), and 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 ELLWF Waste Acceptance Criteria (SRS-1S). The review also verifies that the Fiscal Year (FY) 2020 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 2011) 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 1999b) 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 FY2020 Annual Review.

The ELLWF is a part of the Solid Waste Management Facility (SWMF). SWMF is managed and operated by the SRS Maintenance and Operations prime contractor, Savannah River Nuclear Solutions (SRNS). Within SRNS, the Solid Waste Management (SWM) organization 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 (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, which is near the center of SRS.

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

Many of the research and development tasks summarized in recent Annual Reviews (Hiergesell et al., 2016; Crapse et al., 2017; Hang et al., 2018; Kubilius et al., 2019a; Wohlwend et al., 2020) as well as in this report, 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 2011). A revision to the PA was started in January 2019.

PA/CA. There was one Unreviewed Disposal Question Evaluations (UDQE) and no Special Analyses (SA) completed in FY2020. This UDQE evaluated potential use of an out-of-spec Tritium Producing Burnable Absorber Rod (TPBAR) disposal container as described in Table 2-1. Interim measures implemented in FY2019 by SWM in response to SA SRNL-STI-2018-00624 (Hamm et. al., 2018) and described in last year'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 FY2020. 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 next PA. Thus, this annual review affirms the continued adequacy of the DAS in FY2020.

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 FY2020 (McGill, 2020) to ensure that it is consistent with facility operations and the radioactive waste management order and incorporate SA SRNL-STI-2018-00624 (Hamm et. al., 2018).

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	PA, CA, DAS, or RWMB Impacts
ILV	SRNS-TR-2020-00005 (Simmons, 2020)	TPBAR Disposal container #4 was found to have an out-of-spec weld leak rate impacting tritium release calculations in the 2008 ELLWF PA	• The 2008 ELLWF PA analysis of TPBAR containers only examined tritium release from diffusion through the disposal container walls, lid and welds. It did not examine tritium release from disposed disposal containers due to weld leaks. • The increase to tritium release rates provided by the weld leak on TPBAR Disposal Container #4 is insignificant relative to the diffusion-controlled release analyzed in the 2008 ELLWF PA. • The weld leak has no impact on disposal limits because the disposal limits are based on package inventory, and TPBAR Disposal Container #4 will have an inventory consistent with what is acceptable. • The ongoing PA revision will address TPBAR disposal cask weld leaks and specifically the acceptability of container #4. • A revision will be made to document CAR-SWE-2006-0006 to incorporate the approved Supplier Document Deviation request into the specification for TPBAR Disposal Container #4.	N/A	The weld leak has no impact on disposal limits because there is no impact on overall tritium release analyzed in the PA.

3.0 Cumulative Effects of Changes

The UDQE described in Section 2.0 will have no impact on current ILV operations or disposal limits for the TPBAR waste form.

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 Waste Information Tracking System (WITS) limits, and a LLW disposal unit decision tree. This LLW WAC procedure is periodically reviewed and updated (SRS-1S, 2014).

As required by the WAC (SRS-1S, 2014), 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 2,000 approved waste streams in WITS with approximately 126 approved waste streams active as of the end of FY2020. 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 FY2020 (between 10/1/19 and 9/30/20) were compared against the applicable PA/SA-limits for each of the LLW disposal units in ELLWF and met performance objectives. 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 low-level waste 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.

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 26 years of LAWV operation, approximately 32% of the available volume is filled with waste that contains approximately 14% of the allowable radionuclide inventory. After 26 years of ILV operation, approximately 58% 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 FY2020, PA-estimated disposal capacity, percent filled, limiting SOFs for the selected performance measures, and the PA/Composite Analysis (CA) impact as of 9/30/20 for each disposal unit (DU). 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 performance objective (PO). The dose associated with each disposal unit is below the performance objective limit.

Table 4-1. Waste Receipts.

Disposal Unit	Volume Disposed During FY2020 (m^3)	PA-Estimated Disposal Capacity (m^3)	Percent Filled FY2020 (%)	Sum of Fractions	PA/CA Impact (mrem/yr)
LAWV	120	30,600	32	0.13	0.52 of 4
ILV	10	4,284	58	0.09	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	175	21,000	94	0.84	3.36 of 4
ST14	1563	19,500	82	0.79	3.14 of 4
ET1 (closed)	0	35,660	100	0.87	3.48 of 4
ET2	180	35,500	79	0.75	3.00 of 4
ET3	2911	27,000	85	0.67	2.68 of 4
NRCDA (643-7E) (closed)	0	701	100	0.03	0.12 of 4
NRCDA (643-26E)	14	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 performance objectives. The monitoring program is implemented in accordance with DOE Manual 435.1-1 (DOE 2011) 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 to be completed in FY2021 to further evaluate the exceedance of the action levels and incorporate ET 3 vadose zone monitoring as well as new information obtained during recent field characterization (Kubilius and Joyce, 2018).

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 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. The vadose zone monitoring program employs a series of about 300 active lysimeters, which are grouped into 99 lysimeter clusters. In 90 of the clusters, one lysimeter is designated as an "action-level 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 action-level lysimeters are compared to the administrative limits. Tritium results from the fall 2019 lysimeter sampling event were published in FY2020 (Dixon to Rigsby, 2020).

Nine lysimeter clusters do not have an action-level 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 ET 1 (VL-23), two at ET 2 (ET2-VL-4, ET2-VL-8), one at ST 1 (VL-3A), two at ST 2 (ST2-VL-1, ST2-VL-6), one at ST 3 (ST3-VL-7) and one at ST 8 (ST8-VL-3). These nine clusters are still sampled, and the results are reviewed for notable changes.

In FY2020, samples were collected at 83 of the 90 action-level lysimeters. The other seven lysimeters were dry for both fall and spring sampling periods. Analytical results in FY2020 were at or below administrative limits at 73 of the 83 sampled action-level lysimeters. Table 5-2 provides a summary of FY2020 tritium data for each of the action-level lysimeters above administrative limits (where the PA Expected Behavior is the administrative limit for that DU). Table 5-3 provides summary data for all action-level lysimeters. Tritium concentrations in ten action-level lysimeters exceeded administrative limits: three at ET 1, two at ET 2, and one each at ST 1, ST 4, ST 7, ST 8, and ST 14 (locations shown in Figure 5-1). ET 1 action-level lysimeter VL-22 was sampled for the first time since FY2016. The tritium concentration in this action-level increased slightly from what was measured in 2016. ET1 lysimeter VL-15 exceeded administrative limits in FY2019 but was dry in FY2020. ET1 lysimeter VL-17 exceeded the administrative limit for the first time in FY2020.

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. Of the 90 AL lysimeters, only four exceeded this threshold. No individual disposal unit had more than one AL lysimeter 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 action-level lysimeters which exceeded their administrative limits in FY2020 or earlier are discussed individually below.

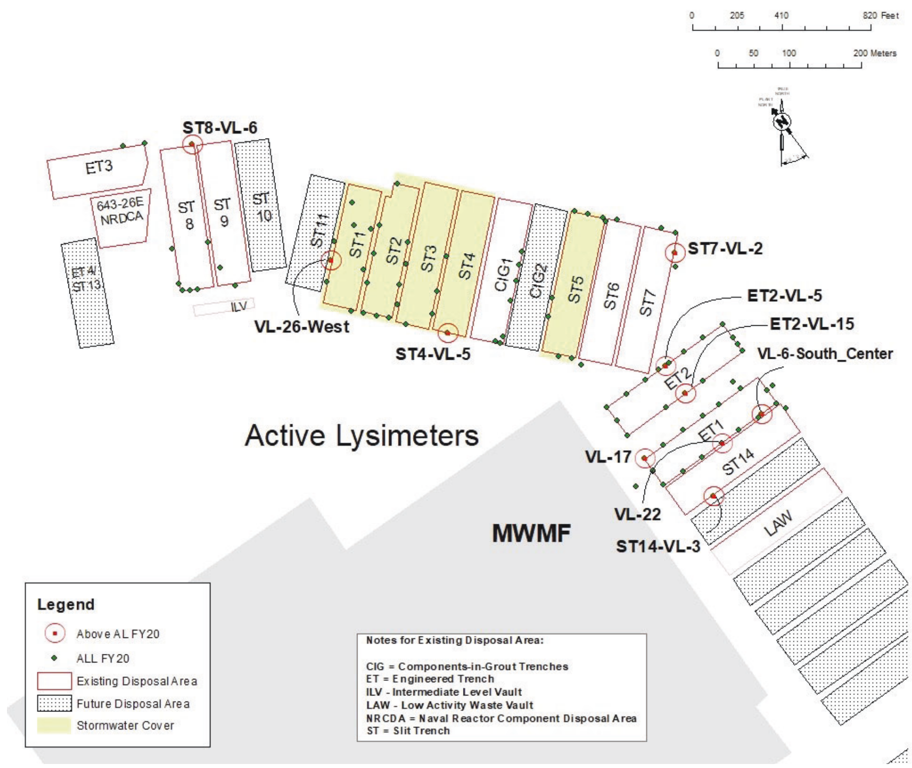

Figure 5-1. Layout showing disposal units, current action-level lysimeters, locations of administrative limit exceedances, and stormwater runoff covers.

5.1.1 Engineered Trench 1

There are 17 action-level lysimeters associated with Engineered Trench 1. Of these 17 lysimeters, three were dry during both FY2020 sampling events. Samples were collected from 14 action-level lysimeters during either or both FY2020 sampling events. Three of the 14 action-level lysimeters sampled in FY2020 exceeded the tritium concentration administrative limit of 101 pCi/mL: those in clusters VL-6-South Center (VL-6-SC), VL-17, and VL-22. In addition, the action-level lysimeter at VL-15 was dry in FY2020, but its most recent sample (FY2019) exceeded the administrative limit.

VL-6-SC. This action-level 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. Since 2014, concentrations in the action-level lysimeter have been 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. The tritium concentration in the shallow lysimeter at this location decreased substantially in FY2020 (105 pCi/mL) compared to the most recent measurement (1026 pCi/mL Fall 2018). This suggests the tritium concentration in the AL lysimeter may decrease in the future. Concentrations in adjacent lysimeters remain below the action level (AL) (VL-7 and VL-23). ST14-VL-2 is the closest lysimeter station to VL-6-SC (less than 10 ft). The tritium concentration in the AL lysimeter at ST14-VL-2 is trending upwards (24 pCi/mL) but 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 dry in FY2020 and was last successfully sampled in FY2019. 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 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 are increasing again. 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 FY2020 when the tritium concentration peaked at 199 pCi/mL. Because this was the first exceedance for this AL lysimeter, the analytical laboratory was asked to review quality control information associated with the sample and to re-analyze the sample if possible. Although there was not enough sample remaining for a second analysis, the laboratory reported that all quality control checks were normal, and the result was considered verified. For the spring event, the concentration had declined to 60 pCi/mL. 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 may continue to increase in the future.

VL-22. The AL lysimeter was successfully sampled for the first time since FY2016. The tritium concentration measured in the spring 2020 sampling event was 300 pCi/mL which is comparable to the FY2016 value (289 pCi/mL). 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 ET 1 sampling locations, a study was undertaken to assess whether the elevated concentrations challenged the PA conclusions (Flach and Whiteside, 2016). Because ET 1 and ET 2 were analyzed together in the 2008 ELLWF PA, they were evaluated together in this study. The 2008 ELLWF PA model conservatively assumed hypothetical waste disposal timing and distribution based on both trenches opening and being filled simultaneously. In reality, the average disposal dates for ET 1 and ET 2 differ by more than eight years, which will result in some plume separation. Because the as-disposed-of waste conditions for ET 1 and ET 2 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 ET 1 and ET 2 is likely to ensure that performance objectives are met. This conclusion was later confirmed by the Special Analysis 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 FY2020. Two of the 15 AL lysimeters, ET2-VL-5 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. The tritium concentration decreased to 2126 pCi/mL in FY2020. The shallow lysimeter in this cluster reached a maximum in fall 2016, and it has been declining since. Because concentrations at these two lysimeters follow a similar trend, the concentration at ET2-VL-5 may continue to decrease over time. 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-15. Tritium concentrations at this AL lysimeter have been increasing since 2015 and reached a peak of 231 pCi/mL in the fall FY2020 sampling event. The concentration declined to 190 pCi/mL in the spring FY2020 sampling event. Concentrations in the shallow lysimeters in this cluster are elevated but have generally been declining since 2016. This suggests that concentrations at the AL lysimeter may also decrease in the future. As with ET2-VL-5, the operational soil cover was extended beyond this lysimeter location during FY2019.

5.1.3 Slit Trench 1

In FY2020, one of the eight AL lysimeters in Slit Trench 1, VL-26-West, exceeded the tritium concentration administrative limit of 61 pCi/mL. Additionally, a second lysimeter, AT-6, exceeded the limit in FY2017, but has not since. However, in FY2020, the tritium concentration in AT-6 was 60.3 pCi/mL, which is slightly less than 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 AL 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 2020 result was 494 pCi/mL which was slightly less than the fall 2020 result of 499 pCi/mL. 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 ST 1 near VL-26-West is localized and should have minimal effect on groundwater near the trench.

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. In spring 2020, the tritium concentration was 59.7 pCi/mL which was slightly less than the fall result of 60.3 pCi/mL. The tritium concentrations in the shallow lysimeters at AT-6 are generally trending downward. This suggests the tritium concentration in the action level lysimeter may begin to trend downward.

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 FY2020. 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 2020, the concentration was 111 pCi/mL. Concentrations in the shallower lysimeters within the cluster are elevated but have been gradually trending downward since spiking in 2009. Tritium data from this cluster will continue to be monitored as part of the vadose zone program.

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 FY2020. 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. 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 FY2020, with a concentration of 63 pCi/mL (spring 2020). This lysimeter first exceeded the administrative limit in FY2018. The shallow lysimeter at this cluster is elevated but the tritium concentration appears to be declining. 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 FY2020 with a concentration of 193 pCi/mL (spring 2020). 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 are conducted on a quarterly basis per procedure SW15.6-INP-SWF-03 (SWM, 2020a). 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, 2020a). Four inspections were conducted in FY2020. After damage to the cover due to a hurricane that came through the area in October 2018, the cover was replaced with the same material as the original storm water runoff cover in early CY2020. In August 2020, during the quarterly inspection, a defective tear was found. The cover will be repaired under the cover warranty. The cover damage is not expected to impact PA assumptions as the limits were calculated with and without a cover; the lower of the two being used in the WAC.

Inspections of the Slit Trench water barriers are performed quarterly (SWM, 2020a). 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 FY2020 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 2018 (FY2019) by procedure 724-EAV-50 (SWM, 2020b) 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, 2019) 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, 2019 and SWM, 2017) and dispositioned accordingly. All FY2020 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 invertebrates consumption, recreational activities, and irrigation) at locations below ELLWF, is published in the 2019 Annual Environmental Report (SRNS, 2020) and shown in Table 5-4. This value is 0.16 mrem/yr, which is far below the DOE 458.1 dose limit of 100 mrem/yr.

Table 5-1. Current PA Monitoring Summary.

<table>
<tr><th>Area</th><th>Monitoring Location</th><th>Sampling Frequency</th><th>Radionuclide / Other Substance</th><th>Administrative Limits</th></tr>
<tr><td>Vadose Zone</td><td>Beneath and adjacent to the trenches</td><td>Twice per year</td><td>Tritium</td><td>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</td></tr>
<tr><td rowspan="5">Sump Water</td><td rowspan="3">Vault Sumps</td><td rowspan="3">Prior to pumping when threshold liquid levels are exceeded</td><td>Gross Alpha</td><td>1.35E+3 pCi/L
(or ≥ 3.0 dpm/mL)</td></tr>
<tr><td>Nonvolatile Beta</td><td>7.20E+3 pCi/L
(or ≥ 16.0 dpm/mL)</td></tr>
<tr><td>Tritium</td><td>8.0E+8 pCi/L
(or ≥ 1.78E+6 dpm/mL)</td></tr>
<tr><td rowspan="2">Engineered Trench 2 Sump</td><td rowspan="2">Prior to pumping when threshold liquid levels are exceeded</td><td>Gross Alpha</td><td>1.35E+3 pCi/L
(or ≥ 3.0 dpm/mL)</td></tr>
<tr><td>Nonvolatile Beta</td><td>7.20E+3 pCi/L
(or ≥ 16.0 dpm/mL)</td></tr>
<tr><td>Groundwater</td><td colspan="4">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]</td></tr>
<tr><td>Vault Concrete</td><td>Inspections of vaults; subsidence inspections</td><td>Every two years</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Trench Cover Monitoring</td><td>Inspections of trench covers</td><td>Four times a year</td><td>N/A</td><td>N/A</td></tr>
</table>

[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 Results[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Engineered Trench 1 VL-6-SC	Radionuclide Transport	• 786 pCi/mL • Concentrations in the action-level lysimeter are trending **upward** after a period of decline. The lysimeter above the action level lysimeter shows a decreasing trend. This suggests the concentration in the action level lysimeter may decrease 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 PO's to be met
ELLWF Engineered Trench 1 VL-17	Radionuclide Transport	• 199 pCi/mL • VL-17 **exceeded** the action level for the first time in the fall sampling event for FY20. However, for the spring event, the concentration had **declined** to 60 pCi/mL. 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 may continue to **increase** 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 PO's to be met
ELLWF Engineered Trench 1 VL-22	Radionuclide Transport	• 300 pCi/mL • VL-22 was successfully sampled for the first time since FY2016. Tritium concentrations have been trending **upward** since 2010. The FY2020 result is comparable to FY2016. Concentrations appear to have **plateaued**. Concentrations in the shallow lysimeter have been trending **downward** and suggest this lysimeter may **decline** 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 PO's to be met

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Engineered Trench 2 ET2-VL-5	Radionuclide Transport	• 2126 pCi/mL • This lysimeter was successfully sampled for the first time since 2018. Concentrations in the action-level lysimeter are trending **downward** compared to 2018. The upper lysimeter is also trending **downward**. • See Section 5.1.2	101.3 pCi/mL	Operational soil cover was extended past ET2-VL-5 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 Engineered Trench 2 ET2-VL-15	Radionuclide Transport	• 231 pCi/mL • Concentrations in the action-level lysimeter have **fluctuated**. Concentrations in the upper lysimeter have generally trended **downward** in recent events. See Section 5.1.2	101.3 pCi/mL	Operational soil cover was extended past ET2-VL-5 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 VL-26-West	Radionuclide Transport	• 499 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 action-level lysimeter may begin 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 PO's to be met

Disposal Facility/Unit	Monitoring Purpose	Monitoring Results[1]	PA Expected Behavior (Below)	Action Taken	PA/CA Impacts
ELLWF Slit Trench 4 ST4-VL-5	Radionuclide Transport	• 111pCi/mL • Concentrations in the action-level lysimeter have been slowly trending **upward** but may be reaching a **plateau**. The tritium concentration in the shallow lysimeter is also elevated but has trended **downward** since the fall of 2009. See Section 5.1.4	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 7 ST7-VL-2	Radionuclide Transport	• 440 pCi/mL • Concentrations in the action-level lysimeter continue to fluctuate. Concentrations in the upper lysimeters are at background. See Section 5.1.5	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 8 ST8-VL-6	Radionuclide Transport	• 63 pCi/mL • Concentrations in the action-level lysimeter are trending **upward** but may be reaching a **plateau**. Although elevated, the tritium concentration in the shallow lysimeter has begun to **decline**. See Section 5.1.6	46.9 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect PO's to be met
ELLWF Slit Trench 14 ST14-VL-3	Radionuclide Transport	• 193 pCi/mL • Concentrations in the action-level lysimeter are trending **upward** but the lysimeter above is at **background**. See Section 5.1.7	63.8 pCi/mL	Will continue to monitor this location as part of vadose zone monitoring program.	Expect PO's to be met

[1]Trends discussed in more depth within the text

Table 5-3 Summary FY2020 Tritium Data (pCi/mL) for Action-Level Lysimeters.

Well ID (Elevation in ft msl)	FY2020 Sampling Events	
	Fall +	Spring +
CIG Trench (Administrative Limit = 29.6 pCi/mL)		
CIG1-VL-1 (236)	*	13
CIG1-VL-2 (237)	4	3
CIG1-VL-3 (233)	*	5
CIG1-VL-4 (232)	*	13
CIG1-VL-5 (238)	*	3
VL-30-End (240)	*	4
VL-31 (241)	*	4
Engineered Trench 1 (Administrative Limit = 101.3 pCi/mL)		
AT-22-East (233)	4	3
AT-23-North (237)	2	2
VL-6-South_Center (233)	673	786
VL-7-SE_Corner (235.7)	11	11
VL-8-East_Center (234.9)	49	49
VL-10-North_Center (233)	*	9
VL-13 (237)	7	6
VL-14 (239)	*	*
VL-15 (235)	*	*
VL-16 (235)	5	4
VL-17 (238)	199	60
VL-18 (234)	3	6
VL-18-Auger (234)	8	3
VL-19 (238)	4	4
VL-20 (243)	*	*
VL-21 (239)	*	12
VL-22 (241)	*	300
Engineered Trench 2 (Administrative Limit = 101.3 pCi/mL)		
ET2-VL-1 (242)	*	4
ET2-VL-2 (242)	4	5
ET2-VL-3 (245)	4	3
ET2-VL-5 (247)	2126	*
ET2-VL-6 (244)	55	14
ET2-VL-7 (245)	19	12
ET2-VL-9 (242)	2	2
ET2-VL-10 (242)	3	2
ET2-VL-11 (246)	3	2
ET2-VL-12 (240)	5	6
ET2-VL-14 (240)	25	20
ET2-VL-15 (247)	231	190
ET2-VL-16 (242)	2	2
ET2-VL-18 (242)	5	4
ET2-VL-19 (248)	*	7
Engineered Trench 3 (Administrative Limit = 43.7 pCi/mL)		
ET3-VL-1 (221)	1	2
ET3-VL-2 (226)	2	2
Slit Trench 1 (Administrative Limit = 61.2 pCi/mL)		
AT-5 (226)	*	*
AT-6 (227)	60	60
AT-8 (232)	3	3
ST1-VL-1 (245)	3	3
VL-2 (225)	7	7
VL-25-West (246)	3	2
VL-26-West (245)	499	495
VL-27-West (245)	5	5

Well ID (Elevation in ft msl)	FY2020 Sampling Events	
	Fall +	Spring +
Slit Trench 2 (Administrative Limit = 61.2 pCi/mL)		
ST2-VL-4 (232)	*	3
ST2-VL-7 (231)	12	12
ST2-VL-8 (240)	3	4
VL-32 (231)	4	3
VL-33 (229)	5	3
VL-34 (227)	5	4
VL-35 (227)	3	3
Slit Trench 3 (Administrative Limit = 61.2 pCi/mL)		
ST3-VL-4 (234)	18	19
ST3-VL-5 (236)	*	*
ST3-VL-8 (238)	4	3
ST3-VL-10 (240)	3	3
ST3-VL-12 (243)	*	*
Slit Trench 4 (Administrative Limit = 61.2 pCi/mL)		
ST4-VL-5 (238)	109	111
ST4-VL-8 (239)	3	3
Slit Trench 5 (Administrative Limit = 61.2 pCi/mL)		
ST5-VL-1 (237)	7	9
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
Slit Trench 6 (Administrative Limit = 61.2 pCi/mL)		
ST6-VL-1 (233)	2	2
ST6-VL-2 (241)	3	4
ST6-VL-3 (235)	2	2
Slit Trench 7 (Administrative Limit = 61.2 pCi/mL)		
ST7-VL-1 (233.5)	2	3
ST7-VL-2 (231.7)	384	440
ST7-VL-3 (232)	3	2
ST7-VL-4 (232)	4	*
ST7-VL-5 (229)	2	*
ST7-VL-6 (229)	6	2
Slit Trench 8 (Administrative Limit = 46.9 pCi/mL)		
ST8-VL-1 (235.5)	3	5
ST8-VL-2 (227)	3	2
ST8-VL-4 (230)	2	2
ST8-VL-5 (229)	2	2
ST8-VL-6 (238)	63	63
Slit Trench 9 (Administrative Limit = 46.9 pCi/mL)		
ST9-VL-1 (239)	2	3
ST9-VL-2 (229)	*	*
ST9-VL-3 (240)	3	3
Slit Trench 14 (Administrative Limit = 63.8 pCi/mL)		
ST14-VL-1 (240)	4	4
ST14-VL-2 (239)	17	24
ST14-VL-3 (237)	155	193

\+ All data in pCi/mL
* Yielded no sample
Pink shading = Exceeds Adminstrative 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	0.16 mrem	<100 mrem	NA	None	None

5.6 Monitoring Conclusions

The majority of action-level lysimeter locations, approximately 89%, remained below administrative limits in FY2020. A majority of the action level 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 ten action level 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., 2019a) and trends in these wells continue to be monitored.

Trench cover in FY2020 revealed minor defects (cover – depressions, erosion areas, 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 (UTRC, SR) continue to fall well below DOE public dose limits based on annual compliance monitoring.

6.0 Research and Development

In FY2020, the SRNL Environmental & Biological Sciences Section produced multiple 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" indicates the PA impact will be evaluated in the next PA revision.

Table 6-1. Research and Development Activities.

Document Number	Results	PA/CA Impact
SRNL-STI-2019-00748, Rev. 1	**FY2019 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility** The FY2019 Performance Assessment Annual Review for the E-Area Low-Level Waste Facility affirms that the disposal facility continued to operate with the bounds of the current PA and CA baseline and satisfied all the requirements, conditions, and limitation identified in the Disposal Authorization Statement and the Radioactive Waste Management basis. (Wohlwend et al. 2020)	None
SRNL-STI-2020-00054, Rev. 0	**FY2019 Savannah River Site Composite Analysis Annual Review** The FY2019 Composite Analysis Annual Review concludes that the 2010 SRS CA remains valid and there is reasonable assurance that SRS will meet the performance objectives delineated in DOE Order 435.1. The impact to the CA of baseline changes arising from the recent Saltstone Disposal Facility (SDF) PA revision and ongoing ELLWF PA revision is expected to be minor for the following reasons: The primary contributors to the SRS CA dose impact at the Upper Three Runs point of assessment are the H-Canyon and Mixed Waste Management Facility, contributing 68% and 9%, respectively, to the dose impact at that POA. The combined contribution to the Upper Three Runs dose impact from all PA's (SDF, ELLWF, F and H Tank Farms) is ~2% of this total. The model validation performed indicates that the CA projected dose, while generally conservative, provides a reasonable representation of the maximum annual doses and that doses evaluated are well below the SRS established 15 mrem/yr administrative limit. (Stagich and Butcher, 2020)	None
SRNL-STI-2019-00193, Rev. 0	**PORFLOW Implementation of Vadose Zone Conceptual Model for Slit and Engineered Trenches in the E-Area Low Level Waste Facility Performance Assessment** This report presents a summary of the conceptual models to be used in representing Slit and Engineered Trenches in PORFLOW simulations as part of the ELLWF PA. Key details that are discussed include: model geometries, spatially dependent hydro-stratigraphic representations, model dimensionality, and boundary conditions (i.e., infiltration rates, cover overhangs, subsidence). Accounting for differences in the percent of non-crushable materials, eighteen unique models, defined by seven hydro-stratigraphic groupings, will be used to represent slit and engineered trenches. (Danielson to Butcher, 2019a)	TBD
SRNL-STI-2020-00162, Rev. 0	**PORFLOW Implementation of Special Waste Form Models for Slit and Engineered Trenches in the E-Area Low Level Waste Facility Performance Assessment** The implementation of special waste forms in the deterministic PORFLOW ST and ET models to be used in the next revision of the ELLWF PA is outlined in this report. Four SWF implementation methods will be used: effective Kd, delayed release, solubility-controlled/diffusion-controlled release, and complex special waste form model updates. In addition, the implementation of models that address the presence of tall used equipment storage boxes in ST08-10 is considered a special waste form and is described. (Danielson to Crowley, 2020)	TBD

Document Number	Results	PA/CA Impact
SRNL-STI-2019-00357, Rev. 0	**PORFLOW Implementation of Vadose Zone Conceptual Models for Naval Reactor Component Disposal Area in the E-Area Low Level Waste Facility Performance Assessment** This report documents PORFLOW models that have been developed to implement the proposed conceptual models for the two Naval Reactor Component Disposal Areas, NR07E and NR26E, for the purpose of evaluating dose impacts and producing disposal limits for the ELLWF. Separate three-dimensional models have been developed for each NR Pad to capture the unique geometry/features of the waste zone and subsurface hydrostratigraphic units, and chronology of facility events for each disposal unit. Naval Reactor waste is comprised of highly radioactive components consisting of activated corrosion-resistant metal alloy contained within welded thick-walled steel casks, and auxiliary equipment primarily contaminated with lower levels of Activated Corrosion Products residing on the metal surfaces and contained within thinner-walled bolted containers. Four modeling cases have been proposed to capture the uncertainty in the waste release characteristics of the two types of waste forms (i.e., time to hydraulic failure of bolted container and type of metal alloy component within welded casks). Results from modeling two of the four cases are presented for a limited set of isotopes representing a range of radionuclide decay and elemental chemical properties. (Hang and Hamm, 2020)	TBD
SRNL-STI-2020-00365, Rev. 0	**PORFLOW Implementation of Component-in-Grout Special Waste Form Model for the E-Area Low-Level Waste Facility Performance Assessment** This report details the key inputs and assumptions for developing a conceptual model of groundwater radionuclide contaminant transport through the vadose zone from existing Component-in-Grout segments in the ELLWF. Components disposed of within the CIG segments consist of large radioactively contaminated equipment and smaller waste forms contained in B-25 boxes and SeaLand containers encapsulated by a minimum one-foot grout layer on all sides. In the 2021 ELLWF PA revision, groundwater radionuclide contaminant transport through the vadose zone will be modeled for the nine existing CIG segments located within the Slit Trench 23 footprint – no additional CIG segments are planned at this time. Groundwater modeling consists of the sequential calculation of time varying, steady-state flow fields that serve as inputs for radionuclide contaminant transport simulations carried out in PORFLOW. Water infiltration rate boundary conditions for each flow field account for four distinct time periods: the operational period (i.e., no cover), the operational closure period (i.e., the placement of a local operational runoff cover), the interim closure period (i.e., the placement of an area-wide interim closure cover that extends across all trenches and maintenance requirements remain in place), and the final closure period (i.e., where a low permeability, multi-layer, soil-geomembrane final closure cap is placed and no maintenance requirements remain in place). In addition to the intact cover conditions, four CIG segments (CIG-4 through CIG-7) have been identified as having non-negligible subsidence potential. To account for this, subsidence infiltration boundary conditions have been modeled for two cases: the conservative base case where subsidence occurs immediately at the time of final closure and the best-estimate case where subsidence occurs 200 years post-closure. The flux-to-the-water-table profiles for each radionuclide will act as source terms at the water table during radionuclide transport through the aquifer allowing calculation of the predicted dose through various pathways. (Danielson, 2020)	TBD

Document Number	Results	PA/CA Impact
SRNL-STI-2019-00636, Rev. 0	**A Limited-in-Scope Comparison of Subsidence Scenarios for 3D Vadose Zone PORFLOW Trench Models** This technical memorandum summarizes the results from two separate sequences of 3D PORFLOW vadose zone flow and contaminant transport models that were used to test the impact of different spatial distributions of subsidence boundary conditions. More specifically, the two simulation setups used a general conceptual model for an engineered trench: one with a subsided region specified in the center of the trench and one with a subsided region located at the end of the trench (i.e., at the lower end of the closure cap slope). Because of the substantially higher water infiltration rate associated with the subsided region at the end of the trench, this geometry produced higher absolute peak fluxes to the water table for all six radionuclides that were simulated. However, the slower release rate of the centrally located subsided hole geometry produced a higher flux to the water table in the time period subsequent to the absolute peak. These generalized qualitative differences, and their impacts on the overall modeling workflow (i.e., from vadose zone models to limits and dose calculations), will receive appropriate consideration during the development of conceptual models. (Danielson to Butcher, 2019b)	TBD
SRNL-STI-2020-00079, Rev. 0	**E-Area Low-Level Waste Facility GoldSim System Model** This report documents the development of the ELLWF trench system model. The GoldSim Monte Carlo simulation software is utilized to model the release and transport of radiological inventory disposed (both currently and in the future) within Engineered and Slit Trenches. This model is in support of the sensitivity and uncertainty analysis for the ELLWF PA. The ELLWF system model utilizes a hybrid-approach to accurately describe the disposal system. The Hydrologic Evaluation of Landfill Performance model provides the infiltration data to both PORFLOW and GoldSim. PORFLOW is used to benchmark/calibrate the GoldSim model to ensure confidence in the stochastic results. Finally, the concentrations from GoldSim transport simulations are fed into the SRNL Dose Toolkit (Aleman 2019) to calculate dose impacts. (Wohlwend, 2020)	TBD
SRNL-STI-2020-00214, Rev. 0	**GoldSim Modeling of Vadose Zone Transport for E-Area Naval Reactor Component Disposal Areas: Model Description and Benchmarking** A GoldSim model of flow and radionuclide transport to the water table through the Naval Reactor Components Disposal Area waste disposal sites and underlying vadose zones was developed. The model is designed to be used for Monte Carlo uncertainty analysis in support of the ELLWF PA. This report describes the model and shows results obtained from benchmarking/calibrating the model to best-estimate deterministic results obtained using a PORFLOW model of NRCDA vadose zone transport (Hang and Hamm 2020). The PORFLOW model is three-dimensional while the GoldSim model is a simplified one-dimensional treatment. Nevertheless, the GoldSim model was able to accurately reproduce PORFLOW results with some adjustment to the nominal dispersion coefficient and vadose zone flow area used as “tuning” parameters. The close agreement between the two models provides confidence that GoldSim will give results accurately reflecting the behavior of releases from the NRCDA under off-normal operating conditions for sensitivity and uncertainty analysis. (Smith, 2020)	TBD

Document Number	Results	PA/CA Impact
SRNL-STI-2020-00346, Rev. 0	**GoldSim E-Area Low-Level Waste Facility Aquifer Zone Model Calibration Methodology** A one-dimensional (1D) GoldSim model was developed to model the transport of radionuclides through the aquifer zone to the 100-m POA for Slit Trench 6 (ST06). The model calculates the maximum concentration at the POA for parent and daughter radionuclides. During the development of the GoldSim Aquifer model, results from the PORFLOW GSA flow model were investigated thoroughly and it was found that the flow below ST06 is complex due to the presence of multiple hydrostratigraphic layers. In order to better estimate the complex three-dimensional (3D) behavior, two streamtubes were employed in the 1D GoldSim Aquifer model. Results from PORFLOW transport simulations were used to benchmark the GoldSim model. GoldSim model results were found to be comparable to those obtained by PORFLOW. Typically, it is difficult to reproduce 3D flow effects with a 1D model and, in that respect, results of this benchmarking study are very good. The GoldSim model is intended to be used for Monte Carlo analysis to determine uncertainty in radionuclide concentrations at the 100-m POA. Ultimately, the GoldSim Aquifer model will be connected to the vadose zone via mass transfer from the bottom of the DU to the footprint pathway element. (Wohlwend and Hamm, 2020)	TBD
SRNL-TR-2019-00337, Rev. 0	**Savannah River National Laboratory Dose Toolkit** The SRNL Dose Toolkit is a computational framework for the processing of PORFLOW or GoldSim radionuclide transport simulation concentrations into groundwater pathway doses at prescribed POAs (e.g. 100-m POA). The computational framework includes the PreDose Module, PreDoseMaxConc Module, PA/CA Limits and Doses Tool, ELLWF Dose Investigation Tool and the F-Area Dose Tool (Aleman, 2019). The function of each algorithm is: • **PreDose Module**: This module expands PORFLOW or GoldSim radionuclide transport short chain concentrations into full chain activity concentrations assuming secular equilibrium with short chain precursor radionuclides. The output of this module is input to the PreDoseMaxConc Module or the PA/CA Limits and Doses Tool. • **PreDoseMaxConc Module:** This module determines the maximum concentration at each point in time for each parent nuclide and its full chain progeny in a DU from a series of PreDose files. Each series of PreDose files is derived from PORFLOW flow and transport simulations where various VZ scenarios were analyzed. The output of this module is ASCII or binary PreDose concentration time series files used as input to the PA/CA Limits and Doses Tool. • **PA/CA Limits and Doses Tool:** This tool was developed to implement the dose calculations and parameters described in SRNL-STI-2015-00056, Rev. 1 "Dose Calculation Methodology and Data for Solid Waste Performance (PA) and Composite Analysis (CA) at the Savannah River Site" (Smith et al. 2016). The model calculates doses and disposal limits for a resident farmer (i.e., the groundwater only all-pathways receptor) and an inadvertent intruder for Performance Assessment (PA), resident and recreational doses for Composite Analysis (CA), and PA disposal limits based on EPA water protection standards. The output of this tool includes: 1) GW/II inventory limits and detailed dose pathway information for the PA and CA 2) maximum GW and II screening factors for the Tier-1 and Tier-2 screening analyses. 3) cumulative concentration and dose files for the ELLWF Dose Investigation Tool and the F-Area Dose Tool. • **ELLWF Dose Investigation Tool:** The tool is designed to compute deterministic (single realization) and stochastic (random future inventories) point-of-assessment dose impacts from select parent radionuclides within ST's, ET's, and LAWV DU's in the ELLWF. • **F-Area Dose Tool**: The tool was developed to quantify the dose impact to groundwater protection and all pathways human dose receptors at multiple point-of-assessments surrounding key facilities or buildings within F-Area.	TBD

Document Number	Results	PA/CA Impact
SRNL-STI-2020-00174, Rev. 1	**Groundwater and Intruder Radionuclide Screening** The explicit measurement and tracking of all 1,252 ICRP-107 radionuclides can be reduced when process knowledge, burial history, and radiological aspects are factored into conservative groundwater and intruder screening processes. This groundwater and intruder screening report addresses the "screening" and "bounding" tiers of a five-tiered inventory limit system. The groundwater and inadvertent intruder screening analyses start with this 1,252-long radionuclide list and reduce it down to more manageable lists that are applicable to the various disposal unit types contained within E-Area. A revision to this report in FY2021 will complete the remaining Tier-2 screening step. The list of radionuclides remaining following Tier-2 will be evaluated in detail in the 2022 ELLWF PA. (Aleman and Hamm, 2020)	TBD
SRNL-STI-2020-00039, Rev. 0	**Safety Function and Features, Events and Processes for the E-Area Performance Assessment** This report presents the results of a Features, Events & Processes (FEPs) screening and review process used to identify FEPs that are relevant for the ELLWF and specifically those FEPs that could have a detrimental impact on the effectiveness of a given safety function. For this PA, a default list of FEPs developed at the International Atomic Energy Agency and an approach implemented for PAs at the Hanford and Idaho sites are used to identify processes and events that could influence the effectiveness of a given safety function for the ELLWF (e.g., subsidence can impact the safety function of the cover system and lead to increased infiltration). The safety concept for closure of the ELLWF encompasses a variety of different features (i.e., administrative controls, natural site features, and engineered barriers) that reduce the potential impacts on human health and the environment from the residual waste that will remain after closure. The first part of this task involved identifying safety functions that are relevant for the E-Area PA. The resulting table of safety functions is provided in Appendix A of the report. The results of the screening and review of FEPs for the safety functions identified for E-Area is documented in Appendix B. The review was conducted in a working meeting with the PA team and key site personnel using a graded approach based on similar work that was completed at the Hanford and Idaho Sites. (Seitz, 2020)	TBD
SRNL-STI-2020-00007, Rev. 0	**Exposure Pathways and Scenarios for the E-Area Low-Level Waste Facility Performance Assessment** This report evaluates and screens potential transport and exposure pathways to the member of the public (MOP) and inadvertent intruder. The primary mechanism for transport of radionuclides from the ELLWF to the MOP is expected to be leaching to the groundwater, groundwater transport to the well at the 100-m POA, and subsequent internal or external human exposure. The main transport mechanism for the inadvertent intruder is direct intrusion into the waste zone or excavation of areas near the waste zone. The resulting set of pathways that failed to be screened out will be evaluated in the 2022 ELLWF PA. (Stagich and Jannik, 2020)	TBD
SRNL-STI-2019-00355, Rev. 1	**Hydraulic Properties Data Package for the E-Area Soils, Cementitious Materials, and Waste Zones – Update** This report provides hydraulic property estimates for the soils, cementitious materials, and waste zones associated with the E-Area low-level radioactive waste disposal units to support the ELLWF PA. Nominal or "best estimate" hydraulic property values for use in the deterministic modeling are provided along with representations of the hydraulic property value uncertainty for use in sensitivity and uncertainty modeling. The hydraulic properties provided for each of the E-Area materials include porosity, dry bulk density, particle density, saturated hydraulic conductivity, characteristic curves (suction head, saturation, and relative permeability), and effective diffusion coefficient. (Nichols and Butcher, 2020)	TBD

Document Number	Results	PA/CA Impact
SRNL-STI-2019-00363, Rev. 0	**Infiltration Data Package for the E-Area Low-Level Waste Facility Performance Assessment** This report contains the input parameters, cap design and material properties assumptions, and the modeling results for the Hydrologic Evaluation of Landfill Performance (HELP) infiltration model simulations performed in support of the ELLWF PA. The infiltration estimates establish the upper boundary condition for the PORFLOW vadose-zone model and GoldSim model simulations for the following E-Area disposal unit types: Slit and Engineered Trenches, Low-Activity Waste Vault, Intermediate-Level Vault, Component-in-Grout special waste form trench segments, and the Naval Reactor Component Disposal Areas. The infiltration data package builds upon relevant, foundational PA technical reports and memoranda from the past 15 years and is supported by three important components: the HELP model input parameter datasheets, HELP model input and output filenames and directory structure, and infiltration rates as a function of time for each scenario for each disposal unit type. (Dyer, 2019a)	TBD
SRNL-L3220-2020-00008, Rev. 0	**Re: Fall 2019 Lysimeter Tritium Data** The purpose of this memo is to provide the Fall 2019 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 2019 were at or below the administrative limits at 62 out of 71 sampled locations. There were 9 AL lysimeters above the administrative limits. There were 19 dry AL lysimeters in Fall 2019. (Dixon to Rigsby, 2020)	None
SRNL-STI-2019-00722, Rev. 1	**E-Area LLWF Final Closure Cap Design – Constructability Evaluation Criteria for the Plot 8 and NR07E Disposal Areas** SRNS Design Engineering was asked to complete a constructability evaluation of the proposed final closure cap design for the Plot 8 (Engineered Trenches ET 7, ET 8, and ET 9) and 643-7E NRCDA (NR 7E) disposal areas located outside the original ELLWF footprint. This memorandum presents the guidelines and criteria for the constructability evaluation. Design Engineering was able to confirm that the proposed expansion to the E-Area conceptual closure cap design can be constructed as envisioned. (Dyer to Welch, 2019)	TBD
SRNL-STI-2020-00173, Rev. 0	**Generation of Gamma Factors for a Loaded B25 Waste Box** This document outlines the approach used to generate dose rates external to the B-25 box on a per Ci basis, a value referred to throughout this document as gamma factor, for numerous nuclides using nuclear emission data compiled from Evaluated Nuclear Data File (ENDF) sources by Oak Ridge for use in their nuclear depletion codes. The external dose rates of the loaded B-25 box are measured to ensure safety limits are not exceeded prior to shipping the B-25 to Solid Waste for burial in an ET, ST or the LAWV. The measurable gamma dose rates expected outside the B-25 as a function of loaded radioactivity for a given nuclide would allow for a ranking of each nuclide's radiological impact. This ranking, in conjunction with estimable loading concentrations based upon engineering judgment and process knowledge has been used to develop a screening tool to refine the list of reportable nuclides and their respective reporting thresholds. This screening tool was incorporated into the Groundwater and Intruder screening process in Aleman and Hamm (2020). (Verst, 2020)	TBD

Document Number	Results	PA/CA Impact
SRNL-STI-2019-00362, Rev. 0	**Justification for Use of the HELP Model to Estimate Infiltration Rates for the E-Area Low-Level Waste Facility Performance Assessment** This report supplements the infiltration data package report prepared by Dyer (2019a) for the upcoming ELLWF PA and provides further justification for the use of the HELP model for E-Area PA infiltration calculations. Specifically, this study performs; 1) a comparison of HELP model results to field- and modeling-based water balance, soil infiltration, and ground-water recharge studies that have been conducted at or near SRS over several decades, 2) an evaluation of the hydrologic model and design and performance recommendations for the planned SDF closure cap at SRS, and 3) a side-by-side comparison of the HYDRUS-1D and HELP models to assess their capabilities to efficiently perform the wide range of intact and subsidence infiltration model simulations across multiple disposal unit types as required for the E-Area LLWF PA. (Dyer, 2019b)	TBD
SRNL-STI-2020-00219, Rev. 0	**PORFLOW 6.43.0 Testing and Verification Document** This report is a continuation of the series of PORFLOW quality assurance (QA) documents. In this report PORFLOW updated test cases were necessary to account for new features in PORFLOW and to ensure those features perform as described. The only feature difference between PORFLOW version 6.42.9 and 6.43.0 is now PORFLOW can run a model with up to 3,300,000 nodes. The QA tests confirm PORFLOW Version 6.43.0 on either 64-bit Redhat Enterprise Linux 6.10 or 8.2 meets the needs of SRNL for PA-CA modeling applications at SRS. (Whiteside, 2020)	None
SRNL-TR-2019-00376, Rev. 1	**Source Term for Tritium Releases from TPBAR Disposal Containers in the ILV** At the request of SWM Engineering, SRNL documented the source term for tritium release from TPBAR disposal containers in the E-Area Intermediate Level Vault that was analyzed in the 2008 ELLWF PA. SRNL performed a review of the 2008 PA effort associated with the TPBAR inventory limits and confirmed the existing tritium TPBAR inventory limits during this review. This memorandum documents the transmittal of the data provided to SWM Engineering in support of their development of a UDQE to assess a non-conforming TPBAR disposal container for disposal in the ILV. (Smith to Simmons, 2020)	None

7.0 Planned or Contemplated Changes

A PA revision is currently ongoing to update of ELLWF PA technical baseline and is anticipated to be reviewed and approved by 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 ELLWF 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 performance objectives. This provides increased confidence that the ongoing PA revision will produce acceptable GW limits.

Optimization of the PA groundwater monitoring program is underway that will lead to a revision of the ELLWF PA monitoring plan in FY2021. Action Level lysimeters at the ELLWF are experiencing an increasing number of administrative limit exceedances for tritium concentrations in vadose zone groundwater. Therefore, a revision to the PA Monitoring Plan [last revised in 2012 (Millings, 2012)] is planned to be started in FY2021 to include monitoring in the saturated zone (SZ). 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. Discriminating between the two sources is possible based on the presence of chlorinated solvent "fingerprints" associated with groundwater contamination originating from the MWMF.

Development of a new waste inventory tracking software is currently underway to the eventual retirement of the in-use WITS. The new program, Consolidated Waste Tracking System (CWTS), will replace WITS in FY21 with its initial release (Phase 1), and will include the functionality of the other SWMF waste tracking programs with future releases (Phases 2 and 3). The need to develop a new consolidated software came from Microsoft's announcement that they would be ending support of Microsoft Access. This lack of support put more strain on SWMF resources to maintain the databases to interact with ongoing Microsoft operating system updates. Eventually, the idea was settled on to develop one single web-based application that would contain all of the functionality of the current SWMF waste tracking programs. The use of a consolidated web-based application allows for a less specialized workforce to maintain the applications as well as resulting in better performance of the software overall. The complete functionality of the software is described through an in-depth requirements document (Mccurry, 2020).

A summary of these three 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
Implementation of Updated of ELLWF PA technical baseline	A FY2016 PA planning document surveyed the 2008 ELLWF 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	FY22
Optimization of Groundwater Monitoring Program at the E-Area Low-Level Waste Facility	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)	Update to the monitoring plan	FY21-FY22
Implementation of CWTS	Due to Microsoft's end of support of the Microsoft Access application, the SWMF decided to develop a new consolidated waste tracking program that would contain the functionality of all current SWMF waste tracking programs. That functionality is described in detail through the requirements document (Mccurry, 2020).	Update PA/CA references from WITS to "waste inventory tracking software"	FY21-FY22

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: *PORFLOW Qualification for use in E-Area Low-Level Waste Facility Performance Assessment*, (McDowell-Boyer and Flach, 2011)*, 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, *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 & 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, 2020), and ELLWF Waste Acceptance Criteria (SRS-1S). This annual review affirms that the supporting studies performed in FY2020 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 performance objectives 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 review and approval is scheduled to occur in FY2022.

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