

SRR-CWDA-2011-00055
Revision 1

FY2010 ANNUAL REVIEW
SALTSTONE DISPOSAL FACILITY (Z AREA)
PERFORMANCE ASSESSMENT

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ACRONYMS/ABBREVIATIONS

ARP	Actinide Removal Process
CA	Composite Analysis
CFR	Code of Federal Regulations
CY	Calendar Year
DAS	Disposal Authorization Statement
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy-Headquarters
FDC	Future Disposal Cell
FMF	Fuel Material Facility
FY	Fiscal Year
LFRG	Low-Level Waste Disposal Facility Federal Review Group
LLW	Low-Level Waste
MCU	Modular Caustic Side Solvent Extraction Unit
MOP	Member of the Public
NDAA	Ronald W. Reagan National Defense Authorization Act (NDAA) for Fiscal Year 2005
NRC	Nuclear Regulatory Commission
PA	Performance Assessment
R&D	Research and Development
RAI	Request for Additional Information
SA	Special Analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SDF	Saltstone Disposal Facility
SOF	Sum of Fractions
SPF	Saltstone Production Facility
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation LLC
SRS	Savannah River Site
UDQ	Unreviewed Disposal Question
UDQE	Unreviewed Disposal Question Evaluations
WAC	Waste Acceptance Criteria

1.0 EXECUTIVE SUMMARY

The Z-Area Saltstone Disposal Facility (SDF) presently consists of two disposal repositories, Vaults 1 and 4, described in the *Radiological Performance Assessment (PA) for the Z-Area Saltstone Disposal Facility* (hereinafter referred to as the 1992 PA). The 1992 PA and the *Special Analysis (SA): Revision of Saltstone Vault 4 Disposal Limits* (hereinafter referred to as the 2005 SA), establish controls to govern waste operations and monitoring performance of the SDF. The mechanisms to demonstrate that operations are within the bounds of the 1992 PA and 2005 SA are Waste Acceptance Criteria (WAC), a Unreviewed Disposal Question (UDQ) Evaluation (UDQE) program, periodic inspections of vault integrity, quarterly engineering evaluation of inventory and operations and a comprehensive environmental monitoring program. [X-SD-Z-00001, SW24:SSF-ENG-2002] These data are compared with the critical features, limits, and predictions of the 1992 PA and 2005 SA to evaluate the past year's performance. An evaluation of performance since the *FY2009 Annual Review Saltstone Disposal Facility (Z-Area) Performance Assessment* (SRR-CWDA-2009-00036) results in the following general conclusions:

- The current performance evaluation conducted on Vaults 1 and 4 indicates operations conducted through fiscal year 2010 (FY2010) were within the performance envelope of the 1992 PA and 2005 SA.
- Future Disposal Cells (FDC) are designed with significant differences that will require a revised SDF PA prior to disposition of any salt waste in the new units. [DOE O 435.1 Chg 1] The revised SDF PA (SRR-CWDA-2009-00017) has been approved by the Low-Level Waste Disposal Facility Federal Review Group (LFRG) for release to the U.S. Nuclear Regulatory Commission (NRC), and has been provided to the NRC for their information consistent with the *Ronald W. Reagan National Defense Authorization Act of Fiscal Year 2005* (NDAA), Section 3116 (b) monitoring protocols.
- The total inventory of radionuclides in Vaults 1 and 4 through FY2010 is well below that shown to be acceptable in the 1992 PA and 2005 SA.

2.0 PURPOSE OF REVIEW

The SDF is managed by Savannah River Remediation LLC (SRR) for the U.S. Department of Energy (DOE). The 1992 PA and 2005 SA provide reasonable assurance that the potential dose impact on a future, hypothetical member of the public (MOP), an inadvertent intruder, as well as impacts to the environment from the Low-Level Waste (LLW) disposal site, will comply with pertinent requirements of Chapter IV of DOE Manual 435.1-1, and Title 10, of the Code of Federal Regulations (CFR) Part 61, *Licensing Requirements for Land Disposal of Radioactive Waste*, Subpart C as required by NDAA, Section 3116. The DOE, through its *Waste Management Order*, DOE Order 435.1 Change 1, requires an active maintenance program for the SDF PA. A maintenance program is required to continue to reduce uncertainty in the inputs and assumptions in order to provide greater confidence in the results of the analyses and in the long-term plans for public and environmental protection. Additionally, a disciplined process to address potential changes in disposal operations and/or discoveries (e.g., new waste forms, change in unit design) is required to ensure that proposed changes do not adversely affect SDF performance. Another purpose of the PA maintenance program is to confirm the continued adequacy of the PA through annual reviews of the disposal facility activities. A review of the 1992 PA and 2005 SA is conducted in a systematic manner that incorporates all of the following considerations.

1. Radionuclide Inventories, Waste Volumes, and Waste Types - The review of waste radionuclide inventories and waste volumes includes a comparison of the actual waste receipts to the projected inventory limits in the 1992 PA and subsequent SAs.
2. Research and Development (R&D) - The R&D activities are primarily documented in technical reports. The R&D activities are designed and funded to provide additional information for further reduction in the uncertainties associated with PA results. In addition, SAs or UDQEs may be conducted to provide new information or to understand impacts of potential or actual changes to the physical facility, operations, or source inventory.
3. PA Monitoring - The current monitoring program (WSRC-RP-2000-00325) includes sampling of the salt waste feed stream in Tank 50 to characterize inventory, evaluate final waste form composition, and periodic sampling of grout raw materials. Physical inspections of structures and monitoring of system parameters help ensure that the system produces a grout with physical and chemical properties that are consistent with that described in the 1992 PA.

All of these factors are reviewed annually to evaluate the need to conduct special studies or to prepare a revision of the SDF PA.

3.0 ANNUAL REVIEW

3.1 Waste Volumes and Radionuclide Inventories

Construction of SDF Vaults 1 and 4 was completed between February 1986 and July 1988. The Saltstone Production Facility (SPF) started radioactive operations June 1990. Disposal into Vault 1 occurred intermittently from June 1990 to September 1996. Disposal into Vault 4 began in January 1997 and continues to date. FDCs will consist of a cylindrical cell, 150 feet in diameter by 22 feet high. Figure 3.1-1 shows FDCs 2A and 2B, which are under construction. The nominal useable volume of a cell is approximately 2,600 kilogallons of grout, after accounting for interior obstructions and the requirement for a 2-foot cold cap. Therefore, each disposal cell, starting with FDCs 3A, 3B, 5A and 5B hold approximately 1,500 kilogallons of feed solution. FDCs 2A and 2B will have a slightly less nominal useable volume for grout disposal due to an additional one foot of clean pour (Type V concrete) in these cells. The pour will be performed as part of addressing suspected compromised areas detected during water tightness testing. Lessons learned from the construction of FDCs 2A and 2B will be applied to all future cells. The additional FDCs will be constructed as needed in coordination with salt processing production rates. Operation of the SDF is expected to continue until FY2026, based on the closure sequence outlined in the current *Liquid Waste System Plan* (SRR-LWP-2009-00001).

Figure 3.1-1: Saltstone Facility Aerial View



As part of the FY2010 annual review, the existing radionuclide inventories for Vault 1 and Vault 4 were updated to account for decay, and the inventory for Vault 4 was also updated to reflect the disposal operations over the year. [X-CLC-Z-00034]

3.1.1 Waste Volumes

The salt solution production history through FY2010 is presented in Table 3.1-1 and new waste receipts into the Saltstone Facility in FY2010 are detailed in Table 3.1-2. An estimate of the remaining grout capacity of the vaults can be made by comparing the level in each cell times the cell surface area. Vault 1 is currently at 50% of its volumetric capacity with Cells A, B, and C being full. Vault 1 Cells D, E, and F are empty. Currently, there are no plans to use Vault 1 Cells D, E, and F for saltstone disposal since they are not fitted with the attributes required for saltstone disposal. Therefore, no additional waste receipts were placed in Vault 1 during FY2010. [SRR-LWP-2009-00001]

Table 3.1-1: Tank 50 Salt Solution Historical Data

Fiscal Year	Salt Solution Processed (gal)	
	Vault 1	Vault 4
1990	246,660	0
1991	651,279	0
1992	105,391	0
1993	28,020	0
1994	261,058	0
1995	129,900	0
1996	607,774	0
1997	0	212,370
1998	0	339,310
1999	0	0
2000	0	0
2001	0	0
2002	0	263,830
2003	0	1,292,474
2004	0	0
2005	0	0
2006	0	0
2007	0	244,480
2008	0	1,342,930
2009	0	1,526,298
2010	0	1,012,000
Vault (1 & 4) Totals:	2,030,082	6,233,692
Total Salt Solution Processed Through End of September 2010:		8,263,774

[SRR-CWDA-2009-00036, X-CLC-Z-00034]

Table 3.1-2: Tank 50 Salt Solution Processed

Time Period	Salt Solution Processed (gal)	Vault
1 st Quarter FY2010	510,000	4
2 nd Quarter FY2010	94,000	4
3 rd Quarter FY2010	270,000	4
4 th Quarter FY2010	138,000	4
Total FY2010 Receipts	1,012,000	

[X-CLC-Z-00034]

Vault 4, Cell A contains 10,000 drums (added to Vault 4 in the 1990's) of a non-hazardous cementitious waste form (referred to as saltcrete) generated from the operation of wastewater treatment at the Fuel Material Facility (FMF). Vault 4, Cell A also contains the wooden pallets used in the movement of the FMF drums (one pallet to four drums). [ESH-FSS-9000373] The void space surrounding the drums in Vault 4, Cell A is filled with clean grout.

As of September 30, 2010, Vault 4 has used 74% of its capacity for grout disposal (14.8 million gallons of grout added versus 20 million gallon capacity), not including final clean cap installation. It should be noted that clean caps may be installed between grout layers for radiological shielding purposes.

3.1.2 Waste Inventory

The radionuclide inventory disposal limits determined in the 2005 SA are implemented in the WAC. The radionuclide inventories are tracked as fractions of the individual radionuclide limits. The sum of fractions (SOF) for each vault is controlled to ≤ 1 to ensure compliance with the 1992 PA and 2005 SA limits. [WSRC-TR-2005-00074, X-SD-Z-00001, WSRC-RP-92-1360]

All activity reported from the FY2009 annual review was decayed for one year, reflecting an inventory as of September 30, 2010, and then the FY2010 receipts were added. [SRR-CWDA-2009-00036] The inventory associated with the FMF waste is included in the Vault 4 inventory. Table 3.1-3 provides the resulting total combined inventory for Vaults 1 and 4. The facility total inventory of each radionuclide is compared to its respective 2005 SA derived disposal limit and the result is expressed as a fraction of the limit in Table 3.1-3. Only those radionuclides that were not screened out in the 2005 SA are reported here. [WSRC-TR-2005-00074] The total of these fractions is called the SOF.

Table 3.1-3: Saltstone Disposal Facility Sum of Fractions (9/30/2010)

Radionuclide	Total Ci^{a,c} 9/30/10	10,000-Year Limit Total Ci/vault^b	Fraction of 10,000-Year Limit
Ac-227	1.2E-06	8.8E+07	1.3E-14
Am-241	1.5E+01	3.4E+08	4.5E-08
Am-242m	1.7E-02	9.8E+06	1.7E-09
Am-243	2.2E-01	3.0E+05	7.3E-07
C-14	1.1E+01	4.4E+07	2.4E-07
Cf-251	2.4E-15	1.8E+06	1.4E-21
Cm-242	1.4E-02	2.5E+09	5.6E-12
Cm-243	7.0E-02	7.0E+09	1.0E-11
Cm-244	3.4E+01	1.1E+15	3.1E-14
Cm-245	2.2E-05	8.4E+06	2.7E-12
Cm-247	1.2E-14	2.5E+04	4.9E-19
Co-60	1.3E-01	5.8E+09	2.2E-11
Cs-134	1.8E+01	4.1E+19	4.4E-19
Cs-135	1.4E+00	8.1E+13	1.8E-14
Cs-137	2.5E+05	6.0E+06	4.1E-02
Eu-152	3.8E-02	6.4E+06	5.9E-09
Eu-154	4.5E+00	1.2E+08	3.8E-08
Eu-155	9.7E-01	1.1E+19	8.8E-20
H-3	5.5E+01	5.5E+11	1.0E-10
I-129	4.1E-01	2.2E+02	1.9E-03
Mo-93	2.8E+03	6.2E+05	4.6E-03
Nb-93m	1.2E+02	1.5E+05	8.2E-04
Nb-94	3.5E-03	1.0E+03	3.5E-06
Ni-59	4.2E-01	2.5E+17	1.7E-18
Np-237	2.4E-01	6.7E+04	3.5E-06
Pa-231	4.8E-06	2.2E+04	2.2E-10
Pb-210	2.2E-01	3.9E+11	5.6E-13
Pu-238	2.4E+02	1.3E+07	1.8E-05
Pu-239	4.9E+01	1.4E+10	3.5E-09
Pu-240	5.4E+01	3.0E+12	1.8E-11
Pu-241	2.5E+02	1.0E+10	2.5E-08
Pu-242	1.3E-02	4.9E+10	2.6E-13
Pu-244	4.4E-05	3.7E+03	1.2E-08
Ra-226	9.3E+00	4.2E+02	2.2E-02
Ra-228	1.4E-05	3.7E+08	3.8E-14
Sb-125	1.8E+02	1.4E+17	1.3E-15
Se-79	8.2E+00	1.0E+03	8.2E-03

Table 3.1-3: Saltstone Disposal Facility Sum of Fractions (9/30/2010) (Continued)

Radionuclide	Total Ci ^{a,c} 9/30/10	10,000-Year Limit Total Ci/vault ^b	Fraction of 10,000-Year Limit
Sn-126	2.1E+00	1.2E+03	1.7E-03
Sr-90	2.9E+03	2.4E+16	1.2E-13
Tc-99	5.0E+02	3.7E+13	1.4E-11
Th-228	1.7E-01	1.9E+19	8.7E-21
Th-229	5.5E-04	8.6E+03	6.4E-08
Th-230	2.8E-02	3.3E+02	8.5E-05
Th-232	1.4E-04	1.6E+02	8.5E-07
U-232	1.1E-01	9.0E+03	1.2E-05
U-233	3.9E+00	1.4E+04	2.8E-04
U-234	4.1E+00	4.5E+03	9.2E-04
U-235	7.8E-02	1.0E+05	7.8E-07
U-236	1.2E-01	3.2E+08	3.8E-10
U-238	1.4E-01	6.6E+04	2.1E-06
TOTAL (SOF)			8.2E-02

a All activity reported from the FY2009 annual inventory was decayed one year. [X-CLC-Z-00034]

b Limits are assumed to apply to the entire SDF inventory for conservatism.

c The FY2010 receipts were not decay-corrected. [X-CLC-Z-00034]

The SOF indicates how full the disposal facility is with regard to radionuclide activity with a SOF value of 1.0 reflecting a resulting peak year dose during the 10,000-year compliance period being equal to the most restrictive regulatory performance objective. The SOF for the SDF is approximately 0.08, well within the 1992 PA and 2005 SA limits. [WSRC-RP-92-1360, WSRC-TR-2005-00074]

3.2 Special Analyses and Unreviewed Disposal Question Evaluations

3.2.1 Special Analyses

No SAs were completed in FY2010.

3.2.2 Unreviewed Disposal Question Evaluations

No UDQEs were completed in FY2010.

3.3 Research and Development Activities in FY2010

During FY2010, several studies were either initiated or continued to support a PA revision or to monitor the existing disposal facility. In some of the studies discussed here, the work was completed in FY2009 but the report that presents the results was not issued until FY2010. In other cases, studies were initiated in FY2010 but work will not be completed and documented until FY2011.

SRNL-STI-2009-00636, Iodine, Neptunium, Plutonium, and Technetium Sorption to Saltstone and Cement Formulations Under Oxidizing and Reducing Conditions

This SDF PA maintenance study (follow-up to SRNL-STI-2008-00045) attempted to measure the sorption of key radionuclides to saltstone using short study duration. Sorption of both technetium and iodine did not appear to have reached steady state during the 4-day equilibration times used in these experiments. The technetium distribution coefficients values reported were low as a result. It was determined that distribution coefficient values of technetium require a longer-term study in order to reach steady state. The recommendations from the study supported the values used in the SDF PA revision.

SRNL-STI-2009-00637, Reduction Capacity of Saltstone and Saltstone Components

This study measured the reduction capacity of saltstone containing different slag concentrations and determined that reduction capacity of saltstone was approximately 820 µeq/g. Values from this work supported those previously reported.

SRNL-STI-2009-00419, Hydraulic and Physical Properties of ARP/MCU Saltstone Grout

This 2009 maintenance study expanded on the work previously completed. The primary focus of this task was to investigate the impact of admixtures, organics, water-to-premix ratio, aluminate concentration, and temperature of curing on the performance properties of Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit (ARP/MCU) saltstone. To that end, 11 batches of ARP/MCU saltstone grout were prepared and tested by a subcontract laboratory for saturated hydraulic conductivity, dry bulk density, porosity, and moisture retention characteristics. Only one batch yielded values that were not in alignment with values used in the SDF PA revision. This single batch was cured at an elevated temperature and resulted in values of hydraulic conductivity in the order of 8.0E-07 cm/sec. The SDF PA revision evaluated a value of 1.0E-07 cm/sec as a sensitivity analysis and showed that performance objectives were still met.

SRNL-STI-2009-00804, Characterization of Core Sample Collected from the Saltstone Disposal Facility

This report documented visual and physical observations of actual saltstone core samples taken from SDF Vault 4 in comparison with prepared simulants.

In April 2009, the core samples were removed from the evacuated sample container, inspected, transferred to polyvinyl chloride containers, and backfilled with nitrogen for storage until development of test methods (e.g., hydraulic conductivity, distribution coefficient) could be finalized.

The resulting density and porosity measurement values of the Vault 4 core samples, 1.90 g/cm³ and 59.90% respectively, were comparable to values achieved for laboratory prepared samples. The x-ray diffraction analysis identified phases consistent with the expectations for hydrated saltstone. Microscopic analysis revealed morphology features characteristic of cementitious materials with flyash and calcium silicate hydrate gel. The core colors indicated the saltstone was in a reduced state.

When taken together, the results of the density, porosity, x-ray diffraction analysis, and microscopic analysis support the conclusion that the Vault 4, Cell E core sample is representative of the expected waste form. Additional physical and chemical testing of the core samples is in progress.

SRNL-STI-2010-00167, Design and Testing of the Formed-Core Sampling System for Saltstone Facility Vaults

This study developed data related to the applicability of a formed core sampling methodology for future use in saltstone in-lieu of the core boring methodology that was damaging to the samples taken. Formed core sampling appears to be preferable to core boring, as it will likely reduce the need to disturb the sample both physically and chemically.

SRNL-STI-2010-00527, Iodine, Neptunium, Radium, and Strontium Sorption to Savannah River Site Sediments

This report determined the distribution coefficient for neptunium, strontium, iodine, and radium in Savannah River Site (SRS) soils. The results of the evaluation supported those values used in the SDF PA revision and, in particular, showed that the SDF PA revision was conservative relative to radium, a dose driver in the PA.

3.4 Planned Activities

3.4.1 Revise the Saltstone Disposal Facility Performance Assessment

An SDF PA revision (SRR-CWDA-2009-00017) was begun in FY2008 to support continued disposal authorization and the eventual closure of the SDF. This SDF PA revision provides the technical basis and results to demonstrate continued compliance with pertinent requirements of DOE O 435.1 Chg 1 and 10 CFR 61, as required by the NDAA Section 3116. The revised SDF PA uses a hybrid approach that melds both deterministic modeling using PORFLOW and probabilistic sensitivity/uncertainty analysis using GoldSim to calculate the likely dose received by a hypothetical future MOP and hypothetical future inadvertent intruder following facility closure. The revised SDF PA reflects revision to previous SDF performance evaluations, including the 1992 PA, 2002 SA, 2005 SA and the Performance Objective Demonstration Document, and encompasses two existing repositories

(Vaults 1 and 4), and 64 future disposal cells. [WSRC-RP-92-1360, WSRC-TR-2002-00456, WSRC-TR-2005-00074, CBU-PIT-2005-00146] The revised SDF PA has received LFRG approval. This revision has been provided to the NRC consistent with their monitoring role under NDAA Section 3116(b). Initial reviews by the NRC have resulted in RAIs. Savannah River Remediation personnel responded to those RAIs. Further review by the NRC is ongoing and additional RAIs are expected in December 2010. It is expected that additional modeling support will be performed to define or narrow the uncertainty of sensitive parameters in the model. Activities will also include development of a PA Facility Implementation Plan and a Management Readiness Checklist to support facility implementation of the new SDF PA.

3.4.2 Update the Disposal Authorization Statement

No update to the SDF Disposal Authorization Statement (DAS) is required per the requirements of DOE M 435.1-1 or the current DAS based on a revision to the SDF PA. [DOE_09-28-1999] DOE will determine if an updated DAS will be issued for SDF following approval of the revised SDF PA consistent with the recent decision to issue a new DAS for the SRS E-Area Facility.

3.4.3 Update the Closure Plan

The SRS LLW management is regulated under DOE O 435.1 Chg 1. A DAS was issued by DOE-HQ on September 28, 1999, authorizing operations of the SDF. The DAS conditions of approval included a requirement to prepare a closure plan complying with the DOE O 435.1 Chg 1 within one year of DAS issuance. [DOE_09-28-1999] The *Closure Plan for the Z-Area Saltstone Disposal Facility* (hereinafter referred to as the SDF Closure Plan) complied with DOE O 435.1 Chg 1, DOE G 435.1-1, and DOE M 435.1-1 and was issued and approved in FY2000. The SDF Closure Plan must now be maintained and modified to reflect changes to the facility. The SDF Closure Plan revision will also incorporate changes reflected in the revised SDF PA. [WSRC-RP-2000-00426]

3.4.4 Revise the Monitoring Plan

The *Performance Assessment Monitoring Plan for the Z-Area Saltstone Disposal Facility* (hereinafter referred to as the SDF Monitoring Plan) is based on the 1992 PA, and compliance with DOE O 435.1 Chg 1 requirements. [WSRC-RP-2000-00325] This task involves revising the current plan to incorporate and integrate the ongoing activities relative to NDAA Section 3116 monitoring and activities relative to compliance with the *Saltstone Consent Order of Dismissal* (07-ALJ-07-121-CC). The SDF Monitoring Plan revision will be updated based on the revised SDF PA.

3.4.5 Special Analyses

No SAs are currently planned for FY2011.

3.4.6 Unreviewed Disposal Question Evaluations

A formal system to evaluate disposal practice changes and proposed actions is in place at the SDF. The process consists of providing UDQEs of proposed activities and new information. The UDQEs will continue to be required throughout the life of

the facility. Additionally, the *Saltstone Facility Unreviewed Disposal Question* procedure will be revised to reflect the revised SDF PA. [SW24:SSF-ENG-2002] The procedure revision will also include NDAA Section 3116 waste determination criteria. [NDAA_3116]

3.4.7 Studies

A number of studies initiated in FY2010 will continue to carry over into FY2011. The activities that are being carried forward into FY2011 are those that will further reduce uncertainty and provide additional model support for assumptions relevant to the SDF PA revision. An update to the maintenance program, which will incorporate the results of the SDF PA revision, will be completed in FY2011. The FY2011 maintenance program update will outline the test and research activities needed to maintain the SDF PA revision and will eliminate those activities that are determined to no longer be necessary to support the revised SDF PA based on the updated analyses. Listed below are those FY2011 planned activities that are a continuation of work initiated in FY2010.

- The Savannah River National Laboratory (SRNL) has been conducting additional technetium research for longer duration tests (i.e., months versus days/weeks) and in environments in where the oxygen levels can be controlled. Currently ongoing preliminary test results performed in lower oxygen environments, closer to those expected within the saltstone monolith, yield higher distribution coefficient similar to literature values. This is an ongoing PA maintenance activity and the results have not yet been published.
- Further analysis of saltstone core material to assess PA impactive properties such as hydraulic conductivity and distribution coefficient values will continue in FY2011. In addition, testing of saltstone simulants utilizing a wide range of saltstone compositions is ongoing.
- FY2011 scope includes a continuation of the SIMCO Technologies, Inc. work and additional studies into other saltstone degradation mechanisms (e.g., microbial attack and the impacts of radiation).

3.4.8 Performance Assessment Monitoring

The environmental monitoring and vault inspection programs were developed to be consistent with the SDF PA. The monitoring data evaluation is presented in this section.

Reason for Monitoring - Per the requirements in the DAS issued for the SDF, a monitoring plan was written, approved, and implemented within one year of issuance of the DAS. The monitoring plan requires an annual data review and evaluation. Following this annual data review and evaluation, any modifications to the monitoring plan that may be applicable will be noted and the plan updated as necessary. Since the development of the monitoring plan, six additional monitoring wells have been installed in Z Area in close proximity to Vaults 1 and 4. Future monitoring wells will be installed, as necessary, to ensure adequate and timely

monitoring of the groundwater resources. [DOE_09-28-1999, WSRC-RP-2000-00325]

Monitoring, to be performed as part of the plan, is intended to meet the requirements of DOE O 435.1 Chg 1, DOE M 435.1-1, and DOE G 435.1-1. These documents require disposal facilities to be monitored for compliance with the conditions of the DAS. In particular, the following must be addressed:

- The site-specific PA and Composite Analysis (CA) shall be used to determine the media, locations, radionuclides, and other substances to be monitored.
- The environmental monitoring program shall be designed to include measuring and evaluating releases, migration of radionuclides, FDC subsidence, and changes in disposal facility and disposal site parameters, which may affect long-term performance.
- The environmental monitoring programs shall be capable of detecting changing trends in performance to allow application of any necessary corrective action prior to exceeding regulatory performance objectives. [DOE_09-28-1999]

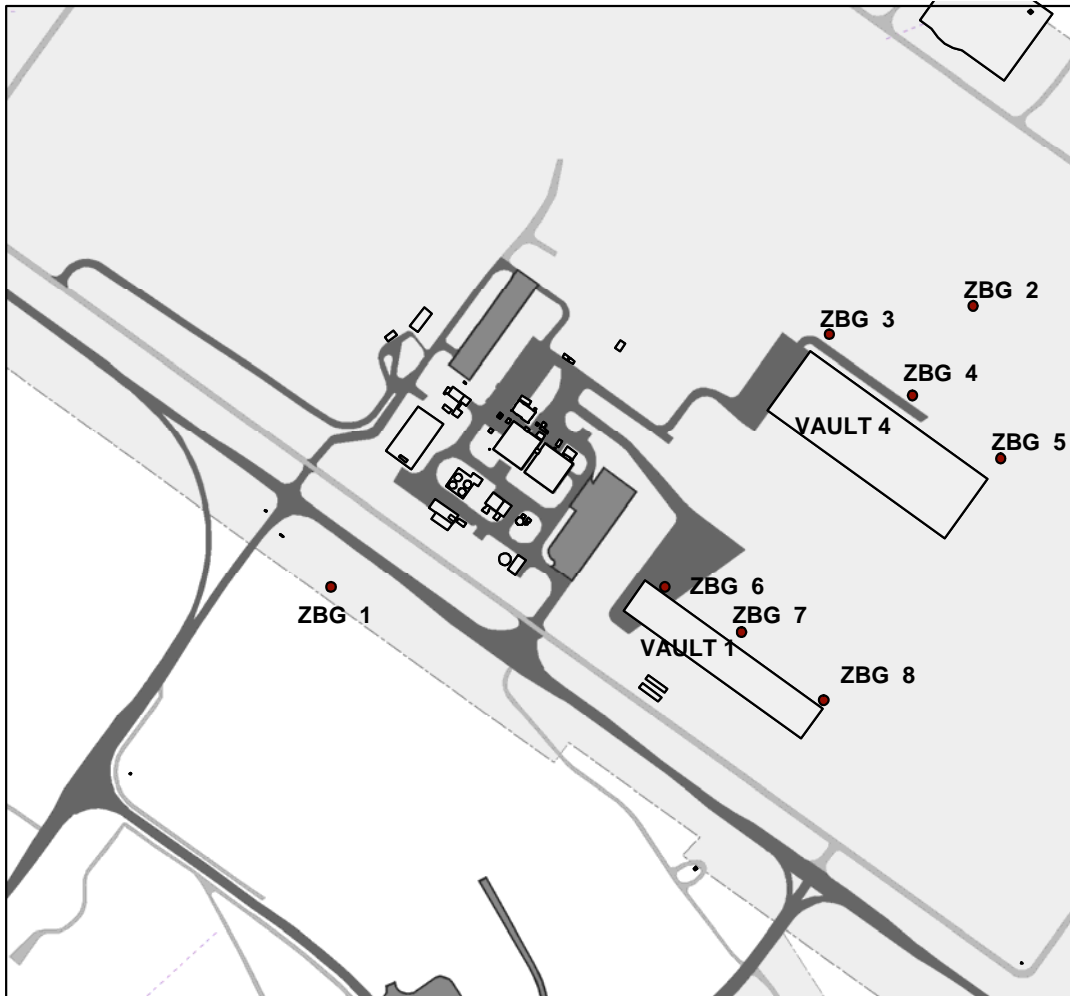
Monitoring Plan - Table 3.4-1 summarizes the monitoring that has been implemented to assess the SDF compliance with the performance objectives identified in the 1992 PA, 2005 SA, and included in the DAS. [WSRC-RP-92-1360, WSRC-TR-2005-00074, DOE_09-28-1999] The table has been adjusted from that presented in the monitoring plan to include six additional monitoring locations. [WSRC-RP-2000-00325] Additionally, no hydrocone sampling has been performed since 2000. Biennial hydrocone samples are no longer required by South Carolina Department of Health and Environmental Control (SCDHEC) because permanently installed monitoring wells are used instead. Figure 3.4-1 shows the monitoring locations with respect to Vaults 1 and 4.

Table 3.4-1: Summary Monitoring Table

Pathway / Relevant Feature	Media / Inspection	Monitoring Location	Radionuclide/ Other Substance	Sampling Frequency	Sampling Method	Analytical Method	Minimum Detectable Activity / Method Detection Limit
Groundwater Pathway	Groundwater	Well ZBG1 Well ZBG2 Well ZBG3 Well ZBG4 Well ZBG5 Well ZBG6 Well ZBG7 Well ZBG8	Gross Alpha Nonvolatile Beta Tritium Nitrate (as N) Nitrite (as N)	Twice/Yr (Semiannual)	Well Sampling	As Designated in the Groundwater Protection Management Program	As Designated in the Groundwater Protection Management Program
Vault Integrity	Vault External /Internal Features (As Appropriate)	Periphery of Vaults 1 and 4	N/A	Quarterly	Visual	N/A	N/A
		Periphery of Vault 4 (Lower 8 Ft of Exterior Wall)	N/A	Annually	Digital Photography	N/A	N/A

N/A = Not Applicable
[WSRC-RP-2000-00325]

Figure 3.4-1: SDF Existing Monitoring Well Locations



In addition to exposure pathways, certain facility features are relevant to monitoring release of constituents to the surrounding environment. Per the existing monitoring plan, quarterly visual inspection of the vault integrity is sufficient to indicate conditions that may affect vault integrity. [WSRC-RP-2000-00325] The SDF has met this requirement by creating an *Inspection Program Plan for Z-Area Vault 4*. [LWO-LWE-2008-00023] In-service inspection of Vault 4 will be performed to provide a historical photographic record of the external vault condition. Inspections were made of Vault 4 during 2008 to document cell wall coating and wall conditions, including baseline inspections. [SRR-STI-2010-00153] An examination, using digital photography, is to be performed on all accessible exterior surfaces every 12 months, with up to a 25% grace period allowance. The 2009 inspection program was successfully completed with a total of 564 direct digital still photographs documented. These inspections were compared with the results of the 2008 inspection, revealing no areas of concern. [SRR-STI-2010-00153] Additionally, daily visual inspections were performed of the Vault 4 exterior walls per SDF

procedure to identify any structural deterioration. The SDF procedure also requires monthly visual inspections of Vault 4 roof and Vault 1 exterior walls. [451-Z-4001]

Data Evaluation - The *Z-Area Groundwater Monitoring Report for 2010* states that the Z-Area groundwater wells were sampled twice during 2010 and that “sampling did not reveal evidence of new releases from the Saltstone vaults.” [SRNS-TR-2010-00374] The estimate of groundwater flow velocity in the area is unchanged from 2009. Groundwater sampling during the active filling of the units, during facility closure activities, and during the institutional control period will detect an unanticipated failure of the system. The analytical and vault inspection results to date do not contradict model estimates.

Other Monitoring Activities - During calendar year (CY) 2010, the NRC conducted two onsite observations and completed zero technical reviews of documents produced by SRS. As part of the NRC monitoring process, these observations and technical reviews generate issues, recommendations, and follow-up actions.

During CY2010, NRC identified five new follow-up actions. These actions are being tracked in a Saltstone Monitoring database maintained by the SRR Closure and Waste Disposal Authority Department.

4.0 COMPOSITE ANALYSIS SUMMARY

The *FY 2010 Annual Review E-Area Low-Level Waste Facility Performance Assessment and Composite Analysis* annual review concluded that SRS LLW disposal activities, as well as other activities, conducted in FY2010 did not adversely impact the CA. The CA review has shown that no significant changes in source terms or land use controls have occurred that would alter the analysis or conclusions of the CA. None of the R&D activities resulted in any impact on the validity of the current CA. All groundwater and stream monitoring locations were below action levels. [SRNS-STI-2011-00024]

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