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SAVANNAH RIVER SITE LIQUID WASTE FACILITIES PERFORMANCE ASSESSMENT MAINTENANCE PROGRAM

FY2011 Implementation Plan

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ACRONYMS/ABREVIATIONS

ARP/MCU	Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit
C&WDA	Closure and Waste Disposal Authority
CA	Composite Analysis
CAB	Citizens Advisory Board
CFR	Code of Federal Regulations
DAS	Disposal Authorization Statement
DOE	Department of Energy
DOE-HQ	Department of Energy - Headquarters
DOE-SR	Department of Energy - Savannah River
EPA	Environmental Protection Agency
FDC	Future Disposal Cell
FTF	F-Tank Farm
FY	Fiscal Year
HTF	H-Tank Farm
LFRG	Low-Level Waste Disposal Facility Federal Review Group
LLW	Low-Level Waste
MOP	Member of the Public
NDAA	National Defense Authorization Act
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
SEM	Scanning Electron Microscopy
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation
SRS	Savannah River Site
TER	Technical Evaluation Report
UCQ	Unreviewed Closure Question
UCQE	Unreviewed Closure Question Evaluation
UDQ	Unreviewed Disposal Question
UDQE	Unreviewed Disposal Question Evaluation

1.0 EXECUTIVE SUMMARY

The *Radiological Performance Assessment* (PA) *Report for the Z-Area Saltstone Disposal Facility* (SDF) *at the Savannah River Site* (SRS) and the *Performance Assessment for F-Tank Farm* (FTF) *at the Savannah River Site,* managed by Savannah River Remediation, LLC (SRR) for the U.S. Department of Energy (DOE), assess the calculated dose impact on a future, hypothetical member of the public (MOP) and an inadvertent intruder, as well as environmental impacts from the respective facilities to verify compliance with DOE performance standards. In addition, the SDF PA (hereinafter referred to as 1992 PA) and the *Special Analysis*(SA)*: Revision of Saltstone Vault 4 Disposal Limits* (hereinafter referred to as 2005 SA), is used to support demonstration of compliance with pertinent requirements of the *Ronald W. Reagan National Defense Authorization Act (NDAA) for Fiscal Year 2005,* Section 3116 (hereinafter referred to as NDAA Section 3116). Development and approval of an H-Area Tank Farm (HTF) PA has been initiated and Revision 0a was provided to DOE-Savannah River (DOE-SR) at the end of Fiscal Year 2010 (FY2010). The FTF PA and HTF PA will be used to demonstrate compliance with applicable criteria of NDAA Section 3116 in support of closure of the SRS tank farms. The *Savannah River Site DOE 435.1 Composite Analysis* (hereinafter referred to as the CA) is a management tool required to assist DOE in assessing the possible impacts on the public and environment from multiple sources of legacy radioactive material at a DOE site (e.g., SRS) in order to determine where DOE may need to focus attention or take mitigating actions. [WSRC-RP-92-1360, SRS-REG-2007-00002, WSRC-TR-2005-00074, NDAA_3116, SRR-CWDA-2010-00128, SRNL-STI-2009-00512]

The DOE, through Order 435.1, Change 1, *Radioactive Waste Management,* requires the on-going maintenance of all PAs and the CA. Because PA and CA results are, in part, based on data that is uncertain due to utilization of projected conditions thousands of years into the future, a maintenance program is needed to continue to reduce uncertainty in the inputs and assumptions providing 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 and/or closure operations (e.g., change in disposal unit design, new residual material characterization) is needed to ensure that proposed changes do not adversely affect conclusions reached for PA results. The purpose of the PA maintenance program is to confirm the continued adequacy of a PA and to increase confidence in the results of the PA. The elements of the PA maintenance program are:

- Unreviewed Disposal Questions (UDQ)/Unreviewed Closure Questions (UCQ) and Special Analyses (SAs)
- Monitoring
- PA revisions
- Testing and research

The program implementation plan is prepared and updated annually and submitted to DOE. The preparation and execution of the plan is consistent with the *Maintenance Guide for U.S. Department of Energy Low-Level Waste Disposal Facility Performance Assessments and Composite Analysis* (DOE_11-10-1999) as reflected in DOE Order 435.1, Change 1. Beginning with the FY2010 implementation plan, the SRS Liquid Waste facilities' PA maintenance

activities have been contained in a separate implementation plan from that for the E-Area Low-Level Waste (LLW) Facility and the CA. The purpose for this change is to better align the documents with the new SRS contract structure. Coordination of the activities across SRS to ensure consistency among the programs and to avoid duplication of effort will be carried out by the SRS DOE Order 435.1 Working Group.

A summary of liquid waste maintenance activities is contained in Appendix A of this report. Maintenance activities for the individual PAs are summarized in Appendix A, Tables A.1-1 through A.1-3. Appendix A, Table A.1-4 contains a summary of all PA maintenance activities. This implementation plan reflects the PA-related activities for the current fiscal year and the projected out-year activities for estimation and planning purposes. Actual work performed in the out-years may be adjusted based on new program information and will be dependent on the actual allocated budget for that year.

Section 2.0 includes a summary of the PA maintenance program activities for the SDF, Section 3.0 contains the activities for FTF, and Section 4.0 covers HTF. Each section includes activities relating to the following areas:

- Annual maintenance program activities
- PA development/revisions (in-progress and future)
- Testing and research activities
- atrocious

In December 2005, the U.S. Nuclear Regulatory Commission (NRC) issued its Technical Evaluation Report (TER) for the review of DOE's draft NDAA Section 3116 basis document for salt waste disposal at SRS. The NRC concluded that there is reasonable assurance that DOE's proposed salt waste management approach can meet the criteria in NDAA Section 3116, provided certain assumptions made in DOE's analysis of the 2005 SA are verified via monitoring. A crosswalk showing the factors identified by the NRC in their TER and the maintenance program activities relating to these factors is included in Appendix B. [ML053010225, WSRC-TR-2005-00074, DOE-WD-2005-001]

A revision to the 1992 PA has been prepared to support continued disposal authorization and the eventual closure of the SDF. The new SDF PA (SRR-CWDA-2009-00017) will provide the technical basis and results to be used in subsequent documents to demonstrate continued compliance with pertinent requirements of DOE O 435.1, Chg 1 and Title 10 Code of Federal Regulations (CFR) Part 61 Subpart C, *Licensing Requirements for Land Disposal of Radioactive Waste*, as identified in NDAA Section 3116. SRR-CWDA-2009-00017 evaluates the existing disposal units, Vaults 1 and 4, Disposal Unit 2 Cells A and B (currently under construction), and all future disposal cells (FDCs). Approval of SRR-CWDA-2009-00017 and issuance of a new DOE Disposal Authorization Statement (DAS) will be required prior to disposition of any salt waste in SDF Disposal Unit 2.

Initial development of the FTF PA was started in FY2007, and was submitted to the Low-Level Waste Disposal Facility Federal Review Group (LFRG) for review in March 2009. The LFRG issued their final report in August 2009, which recommended the FTF PA was adequate for NRC consultation review without conditions. [LFRG_08-13-2008] In August 2008, Revision 0 of the FTF PA was transmitted to the NRC, U.S. Environmental Protection Agency (EPA), and South

Carolina Department of Health and Environmental Control (SCDHEC) for review and comment. Comments were received, and changes to Revision 0 of the FTF PA are complete and Revision 1 was issued and provided to the NRC for review in March 2010. The NRC responded with several requests for additional information (RAIs) in December 2010.

Initial planning for the HTF PA was initiated and a limited amount of work was performed in FY2008. Due to funding limitations, only a few activities related to the HTF PA were completed in FY2009. Work on the HTF PA was resumed in full at the beginning of FY2010. As required by the *Statement of Resolution of Dispute Concerning Extension of Closure Dates for Savannah River Site High-Level Radioactive Waste Tanks 19 and 18*, DOE shall submit the HTF PA to SCDHEC and EPA by March 31, 2011. [Dispute Resolution_11-19-2007] The HTF PA was submitted for DOE-HQ (DOE-Headquarters) review via an LFRG review team in November 2010. The only key issue and 18 of the 19 secondary issues identified by the LFRG team were resolved and incorporated in the PA prior to completion of the review team report, and the LFRG approved the PA in March 2011. The only remaining issue will be resolved by the activities described in Section 4.1.8. Revision 0 of the HTF PA was then transmitted to the SCDHEC and the EPA for review and comment.

2.0 Z-AREA SALTSTONE FACILITY

2.1 Z-Area Saltstone Disposal Facility Performance Assessment Annual Maintenance Activities

DOE O 435.1, Chg1 requires the on-going maintenance of all PAs. This maintenance includes a series of activities that must be performed on an annual basis. This section describes the activities required every year in support of the 1992 PA and 2005 SA regardless of the status of the in-progress or future PA revisions.

2.1.1 Maintain Saltstone Disposal Facility Performance Assessment Control Through Unreviewed Disposal Question Process

Description: A formal system to evaluate disposal practice changes and proposed actions is in place at the SDF. The UDQ process consists of providing UDQ Evaluations (UDQEs) of proposed activities or new information to ensure that the assumptions, results, and conclusions of the 1992 PA, 2005 SA, and the CA remain valid and the changes are within the bounds of the DAS. [SW24-SSF-ENG-2002, DOE_09-28-1999] If it is identified through the UDQ process that a proposed activity or new information is outside the bounds of the current analyses, SAs are prepared to update the technical baseline. An example of the UDQ process can be seen in Figure 2.3-1. The UDQEs and SAs will continue to be required throughout the life of the facility. For planning purposes, the estimated cost assumes that 12 UDQEs will be prepared in FY2011 (assumptions remaining at 12 for each out-year). In FY2011, the UDQ procedure will need to be revised to reflect the updates within the new SDF PA at a cost of $15K ($15,000). The estimated cost does not reflect the cost of any SAs. If an SA is required, it is estimated that approximately $100K would be required for its completion. Therefore, the estimated cost has the potential to vary for any given year.

Milestones: Provide UDQEs, UDQ procedure support, and SAs as needed to support SDF operations.

Expected Completion Date: On-going

Responsibility: SRR Closure and Waste Disposal Authority (C&WDA)

Estimated Cost: FY2011 $100K, FY2012 through FY2017 $85K/yr

2.1.2 Conduct Annual Saltstone Disposal Facility Performance Assessment Validation

Description: The purpose of the PA maintenance program is to confirm the continued adequacy of the current SDF PA and to increase confidence in the results of that PA. A requirement of the maintenance program is to conduct an annual review of the disposal facility activities. The annual PA review is conducted in a systematic manner that incorporates the following considerations:

1. Radionuclide inventories, waste volumes, and waste types disposed throughout the year
2. Testing and research activities performed during the year and planned for the out-years
3. Results of PA monitoring conducted in accordance with the PA Monitoring Plan for the SDF.

The above factors are reviewed annually to confirm the adequacy of the current facility PA, and to evaluate the need to conduct SAs or prepare a revision to that PA. The results of the review are documented in an annual review report for the current SDF PA.

Milestone: Issue a fiscal year PA annual review report.

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 through FY2017 $15K/yr

2.1.3 Prepare Annual Performance Assessment Maintenance Program Implementation Plan

Description: The purpose of the PA maintenance program is to confirm the continued adequacy of the PA and to increase confidence in the results. Every year the annual PA maintenance program fiscal year implementation plan is prepared and provided to DOE. The implementation plan outlines planned work for each fiscal year. The cost of preparing the implementation plan will be shared between SDF, FTF, and HTF. See the activities described in Sections 3.1.3 and 4.1.3 for FTF and HTF respectively.

Milestone: Issue a fiscal year PA maintenance program implementation plan.

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 through FY2017 $15K/yr

2.1.4 Maintain Z-Area Saltstone Disposal Facility Performance Assessment Closure Plan

Description: A closure plan for SDF (WSRC-RP-2000-00426) that complies with DOE O 435.1, Chg 1 and associated guidance was issued and approved in FY2000. The *Closure Plan for the Z-Area Saltstone Disposal Facility* must be maintained and modified as needed to reflect changes to the facility. The SDF Closure Plan is reviewed annually to determine if a revision is required. A revision to the SDF Closure Plan will be completed after issuance of a new SDF DAS. This process should begin in FY2011 and end in FY2012. The revision will incorporate design changes to the SDF reflected in new SDF PA (once approved and issued) after issuance of a new DAS.

Milestone: Revise current SDF Closure Plan and review annually in out-years.

Expected Completion Date: On-going (SDF Closure Plan revision after DAS issued)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $15K, FY2012 through FY2017 $5K/yr

2.1.5 Maintain Saltstone Disposal Facility Performance Assessment Monitoring Plan

Description: A monitoring plan for SDF PA (WSRC-RP-2000-00325) that complies with DOE O 435.1, Chg 1 and associated guidance was issued and approved in FY2000. The PA monitoring plan must be maintained and modified as needed to reflect changes to the facility. The monitoring plan is reviewed annually to determine if a revision is required. A revision to the SDF PA Monitoring Plan will be started this fiscal year and completed in FY2012 after issuance of a new DAS. The current SDF PA Monitoring Plan is based on the 1992 PA and compliance with DOE O 435.1, Chg 1 requirements. The revision will incorporate and integrate the on-going activities relative to NDAA Section 3116 monitoring for salt waste disposal at SRS. It is anticipated that a revision will also be required in FY2015 to ensure the SDF PA Monitoring Plan is kept up to date.

Milestone: Revise current PA monitoring plan incorporating updates in new SDF PA and NDAA Section 3116 monitoring. Review annually in out-years.

Expected Completion Date: On-going (SDF PA Monitoring Plan issued after DAS issued)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $15K, FY2012 through FY2014 $5K/yr, FY2015 $15K, FY2016 through FY2017 $5K/yr

2.1.6 Provide General Technical Support on Saltstone Disposal Facility Performance Assessment Issues

Description: This task is to provide general technical and programmatic support on SDF PA issues, NRC activities, and other regulatory issues that affect SDF operations. Activities include supporting NRC on-site observation visits and technical reviews, general project support, testing and research activity support, and development of resolution path forward for NRC open items. Research activity support includes monitoring of research done by outside agencies (e.g., Cementitious Barriers Partnership, academic research). These activities also include support on interactions with SCDHEC, SRS Citizens Advisory Board (CAB), the LFRG, National Academy of Sciences, and other regulatory and stakeholder bodies.

Milestone: Provide on-going technical support on regulatory and policy issues/activities affecting SDF operations.

Expected Completion Date: On-going

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $750K, FY2012 through FY2017 $575K/yr

2.2 Saltstone Disposal Facility Performance Assessment Development/Revisions

A revision to the 1992 PA has been prepared to support continued disposal authorization and the eventual closure of the SDF. The revised PA will provide the technical basis and results to be used in subsequent documents to demonstrate continued compliance with pertinent requirements of DOE O 435.1, Chg 1 and 10 CFR 61, Subpart C as required by NDAA Section 3116. The new SDF PA will incorporate the existing disposal units, Vaults 1 and 4, as well as Disposal Unit 2 Cells A and B, and all FDCs. Approval of the new SDF PA and issuance of a DAS will be required prior to disposition of any salt waste in SDF Disposal Unit 2. [WSRC-RP-92-1360, SRR-CWDA-2009-00017]

2.2.1 Performance Assessment Development for In-Progress Saltstone Disposal Facility Performance Assessment Revision

Description: C&WDA will manage individual PA tasks, develop PA program planning documents, set up PA report organization, prepare regulatory review matrices, and develop/maintain PA input packages for technical review and incorporation into the PA. In addition, C&WDA will prepare the PA document, including interpretation and integration of results. Savannah River National Lab (SRNL) will support C&WDA in development of the Conceptual Models, execution of the models, and interpretation of the results, as needed. The revised SDF PA, SRR-CWDA-2009-00017, has received LFRG approval and been reviewed by the NRC. Approval of the new SDF PA and issuance of a DAS cannot be predicted until the NRC RAIs have been resolved. It is expected that additional modeling support may be required 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 after final approval.

Milestone: PA revision issued for facility implementation.

Expected Completion Date:
1QFY2010 (LFRG approval of PA revision for stakeholder review) – Complete
3QFY2010 (Initial NRC review) – Complete
4QFY2010 (Initial C&WDA RAI response) - Complete
1QFY2011 (Further NRC review) - Complete
3QFY2011 (C&WDA RAI response, SRNL modeling)
4QFY2011 (DOE-HQ approval)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $325K, 1QFY2012 $5K

2.2.2 Prepare Out-year Saltstone Disposal Facility Performance Assessment Revisions

Description: A future revision of the SDF PA will be scheduled as required and agreed upon by DOE. The SDF PA will be revised when warranted, but for estimating purposes, the next revision is projected to start in FY2015. Unless otherwise noted in the PA, the future PA revision will include the following items at a minimum:

- Analyses and results contained in all SAs that have been completed to date
- Analyses and results of all UDQEs completed to date
- Changes in site future land use plans or closure plans
- Changes to PA guidance documents requirements

Milestone: Issue PA revision.

Expected Completion Date: FY2016

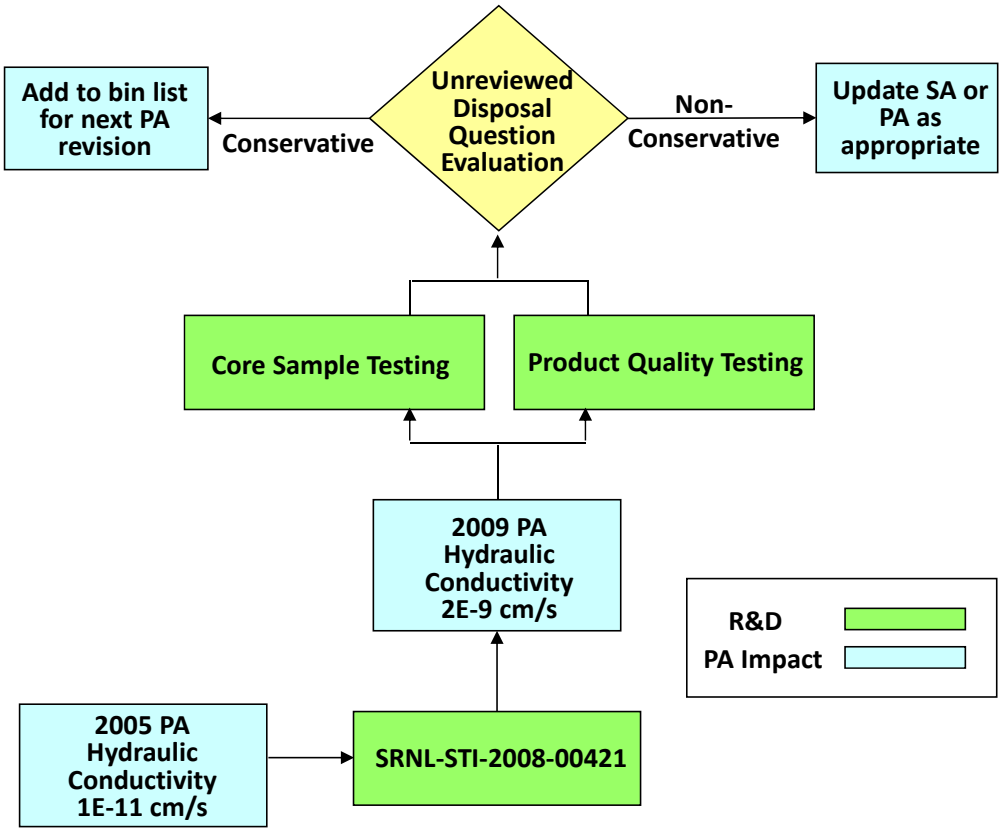
Responsibility: SRR C&WDA

Estimated Cost: FY2015 $1,500K, FY2016 $1,500K

2.3 Z-Area Saltstone Disposal Facility Performance Assessment Testing & Research Activities

This section contains the PA-related testing and research activities that have been used as input into SRR-CWDA-2009-00017 and are being performed as part of the on-going maintenance activities aimed at reducing uncertainty in the SDF PA model, or are verification sampling and analysis of materials properties used in the PA (i.e., verification of emplaced saltstone properties and vault concretes). An example of the process by which the SDF PA is informed by ongoing research is shown in Figure 2.3-1. As ongoing research provides new information or reduces uncertainty, this information will be evaluated (via the UDQE process in Section 2.1.1) against the information used as a basis for PA modeling.

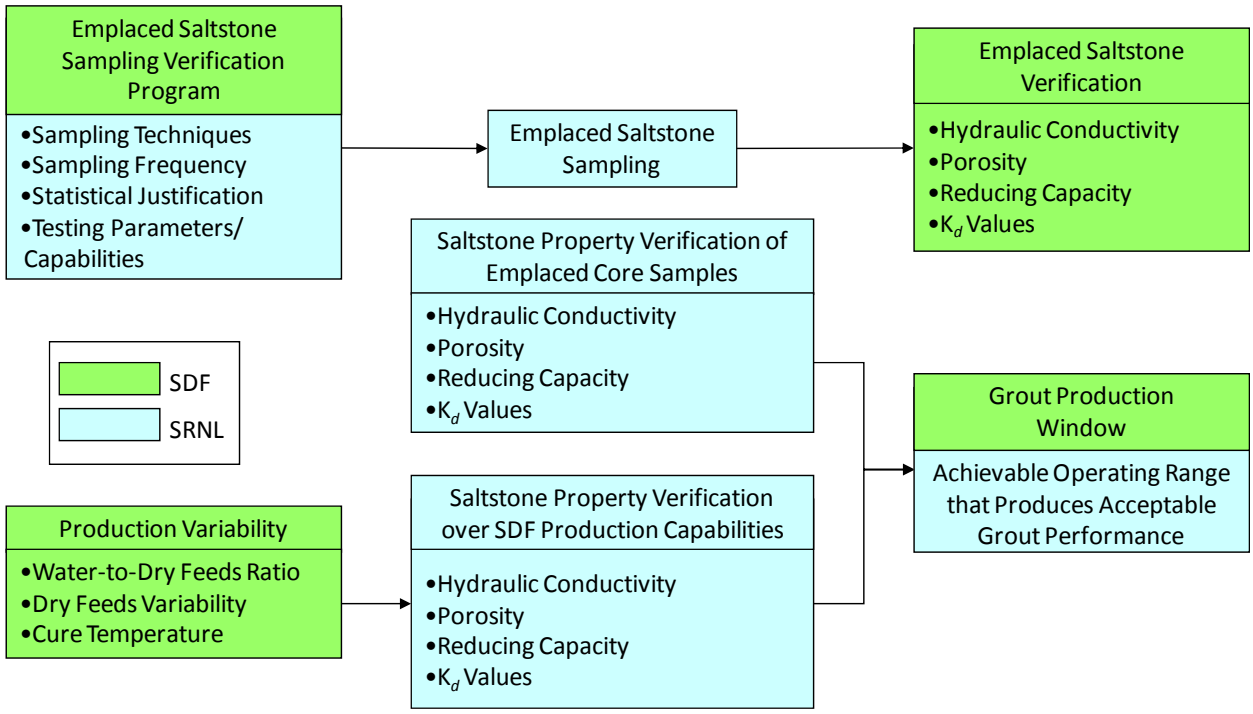
Figure 2.3-1: Relationship between SDF PA and Ongoing Research



Disposal operations will proceed according to the current revision of the *Liquid Waste System Plan* (SRR-LWP-2009-00001). After saltstone production operations have ceased, a closure cap will be installed over the SDF to mitigate the infiltration of water through the disposal units and the saltstone waste form. There are key questions related to closure cap design and performance that could affect the results of the PA (e.g., plugging of the drainage layer). However, the most recent revision to the PA suggests that parameters most sensitive to SDF performance are related to the saltstone waste form and the disposal units themselves. [SRR-CWDA-2009-00017]

As such, in the near term, resources are prioritized to support research and development (R&D) activities related to key parameters of the saltstone waste form and the disposal units. In addition, since SDF closure cap design and installation are at least 20 years in the future, R&D work performed to support other closure sites may be used in the future rather than developed independently at SRS. Consequently, although it is recognized that closure cap R&D activities may be needed, their priority and scheduled need is such that they are not addressed in this plan. Figure 2.3-2 below provides a simple illustration of the parallel testing efforts described in detail in this section. From an overall perspective, the illustration below depicts how R&D activities and on-going testing of the saltstone waste form are being cultivated using an integrated, systematic approach.

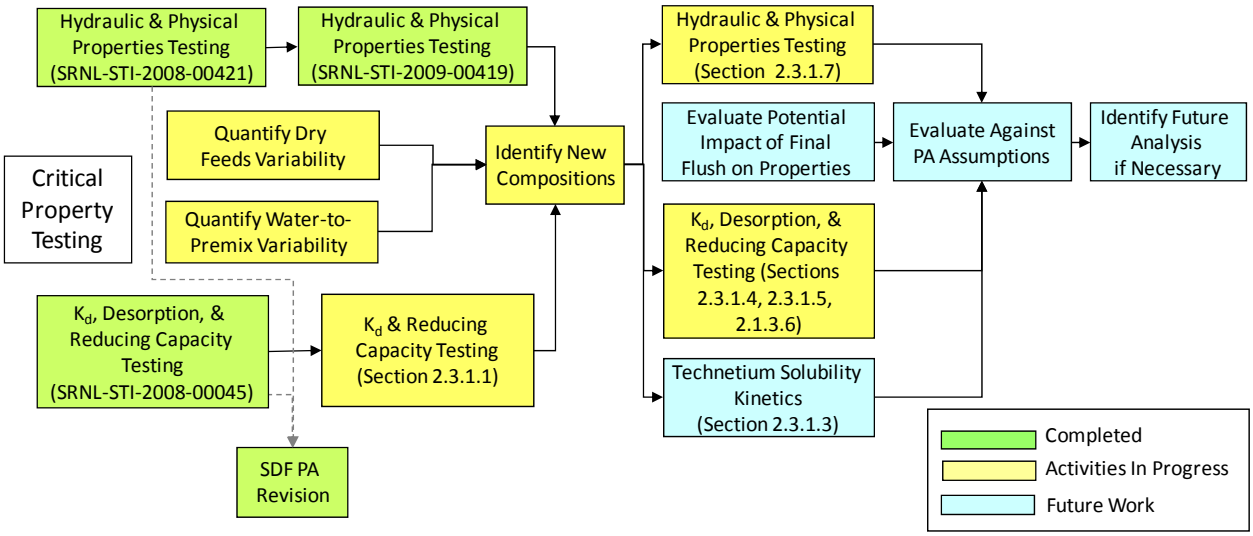
Figure 2.3-2: Saltstone Research, Development, and Testing Program Elements



2.3.1 Critical Property Testing

Several parameters are essential to reducing uncertainty in PA values, specifically in the areas of hydraulic conductivity, reduction capacity, and distribution coefficients for cured saltstone. The current strategy aims at reducing uncertainty in critical property parameters, including current research efforts, is shown in Figure 2.3-3.

Figure 2.3-3: Critical Property Testing Strategy



The maintenance activities presented in this section concern critical values such as Kd values, hydraulic conductivities, reduction capacities, water retention characteristics, and kinetic parameters. The SDF PA relies on such values to make informed predictions about system behaviors over long periods. It is therefore desirable to reduce uncertainty in these parameters where possible. The maintenance activities presented here are intended to reduce uncertainty around properties in SDF PA modeling.

There were many K_d values used during the preparation of the revised SDF PA. Values were used for greater than 40 radionuclide species (note that radioisotopes of the same element have the same K_d and solubility values) and eight solid phases. Additionally, ranges for each value and their type of statistical distribution (e.g., normal or log normal) provide additional confidence in the results of the PA. These values were generated in different ways depending on the availability of experimental data. Part of these efforts (Sections 2.3.1.4 and 2.3.1.5) focus on reducing uncertainty in the K_d values that are most important to the SDF PA.

In FY2008, studies concerning hydraulic and diffusion properties of saltstone materials were initiated to make new measurements of initial saltstone (nominal composition) and vault hydraulic properties in the laboratory. These studies included measurement of saturated hydraulic conductivity, dry bulk density, particle density, and porosity. In addition, water retention data (up to 15 bar) was determined. These experiments were completed in FY2009 and the information was used to support the SDF PA revision. [SRNS-STI-2009-00477] Additional testing was initiated in FY2009 to determine further the influence of variability in saltstone composition on hydraulic properties.

In FY2010, work was completed to establish the capability to perform hydraulic conductivity measurements on radioactive samples. Future testing and research activities on this topic will be carried out by the maintenance activities presented in this section. In FY2010, tests were initiated to study varying formulations and cure temperatures.

Testing activities relevant to saltstone oxidation and technetium release from saltstone were initiated in FY2010 continuing into out-years and are expected to require establishment of property testing capability. The testing is expected to include a variety of field and laboratory tests including sample archiving and aging studies.

2.3.1.1 Study Technetium Interaction with Reducing Saltstone

Description: Previously, the longevity that saltstone could maintain a reducing environment was estimated by indirect measurements of pure SRS blast furnace slag reduction capacity. In order to reduce uncertainty in these values, testing was initiated to measure the reducing capacity of saltstone simulant formulations.

Saltstone Simulant Reduction Capacity: In FY2008, experiments were initiated to provide direct measurements of the reduction capacity of saltstone simulant, not of the slag as a separate ingredient. This task also included measurement of the reduction capacity of the future disposal unit concrete mix. The results of this study were used by modelers to estimate how long the saltstone remained in a reduced chemical state. Documentation of the experiment was completed in FY2009 and the information used to support the SDF PA revision. A final report was issued that included the results from this activity along with the results from maintenance activities.

Additional testing was initiated in FY2009 to understand further the influence of saltstone formulations on reducing conditions. [SRNL-STI-2009-00636]

Milestone: SRNL Technical Reports

Expected Completion Date: 1QFY2009 (Initial testing) - Complete
1QFY2010 (Additional testing) – Complete

Responsibility: SRR C&WDA

Estimated Cost: Complete

2.3.1.2 Measure Slag Redoxidation Stoichiometry

Description: The objective of this task was to measure how much dissolved oxygen is required to oxidize all of the slag in saltstone. Slag is added to saltstone to promote the immobilization of some radionuclide species (e.g., plutonium, neptunium, uranium, and technetium) Based on insight gained from related work completed in FY2010, this testing would no longer provide valuable information. Funds allocated to this project will therefore be used on other tasks of higher priority scope.

2.3.1.3 Technetium Solubility Kinetics

Description: Presently, the current PA assumes that saltstone contaminants convert from their oxidized form (mobile form) to their reduced form and vice versa instantaneously, as dictated by thermodynamics. A third functional design criterion may prove that the reduction rate is orders of magnitude quicker than the oxidation rate. For example, it may require hours to days for technetium (VII) to reduce to technetium (IV) in the presence of slag, whereas the reverse reaction, the oxidation of technetium (IV) to technetium (VII), may require years to decades to occur once oxygenated water comes in contact with the technetium (IV) on the slag. [SRR-CWDA-2009-00017] The objective of this task, which should begin in FY2012, will be to evaluate the kinetics of this process.

Expected Benefit: This task is expected to provide the oxidation rate of technetium (IV) from an initially reduced saltstone system. Calculations would also be conducted to demonstrate the effect of a non-steady state model (kinetic model) describing technetium oxidation and reduction from saltstone and the subsequent release rate of technetium from saltstone.

Milestone: SRNL Technical Reports

Expected Completion Date: FY2012

Responsibility: SRR C&WDA

Estimated Cost: FY2012 $40K

2.3.1.4 Technetium K_d Distributions

Description: Testing under this effort focuses on K_d to support reduction of uncertainty or unnecessary conservatism in the SDF PA with respect to technetium K_d values and distributions. Future testing may use funds estimated for this effort to investigate similar information concerning other important radionuclides.

Technetium Leach Testing: Simulant blocks of saltstone formulations were prepared with technetium spikes and allowed to cure. At regular intervals during the curing process, samples of simulant were removed and leach tested to determine the K_d values as the simulants cured with the expectation that the K_d would increase as a function of cure time.

The leach testing ran for more than 230 days and had stopped producing data of interest. It became evident from the work, however, that the saltstone technetium K_d changed with time, making additional study in an inert environment advantageous. Additional testing options in an inert environment to simulate the internal environment of the saltstone monolith are currently being evaluated.

Expected Benefit: K_d values are commonly shown to be the most important or among the most important parameters influencing the outcomes of PA predictions. This task is expected to reduce the uncertainty of K_d values of the key radionuclide technetium.

Milestone: SRNL Technical Reports

Expected Completion Date: Technetium leach testing end 2QFY2011

Additional Testing FY2012

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $75K, FY2012 through FY2015 $40K/yr

2.3.1.5 Plutonium K_d Distributions

Description: Testing under this effort focuses on K_d to support reduction of uncertainty or unnecessary conservatism in the SDF PA with respect to plutonium K_d values and distributions. Future testing may use funds estimated for this effort to investigate similar information concerning other important radionuclides.

Literature Search: This effort will take plutonium K_d data from the SRS, compile it, and generate a distribution of values. It will include a literature review, statistical analysis, and a final report.

Expected Benefit: This activity is expected to give a baseline of current knowledge about the distribution of plutonium K_d values found in literature.

Milestones: Literature Review Report

Expected Completion Date: 1QFY2012

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $40K, FY2012 through FY2015 $40K/yr

2.3.1.6 Measurement of Reduction Capacity of New Saltstone Formulations

Description: The objective of this task will be to measure the reduction capacity of the various saltstone materials created as part of the effort to define the optimum SDF operating window, and to determine any impacts to reduction capacity due to production variability.

Saltstone Formulation Testing: In FY2011, technetium desorption measurements will be taken in lower oxygen environments, thus under more strongly reducing conditions, over extended durations in order to mimic what is taking place in the saltstone core. The reduction capacity of the saltstone over time will also be measured.

Expected Benefit: Results from this work will provide the reduction capacity of various saltstone formulations and will help to clarify the operating window in which saltstone must be produced by the SDF in order for the saltstone to exhibit desirable characteristics.

Milestone: Final report

Expected Completion Date: FY2012

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $40K, FY2012 $20K

2.3.1.7 Measure Hydraulic/Physical Properties of Saltstone Mixes Constrained by Saltstone Disposal Facility Capabilities

Description: The SDF produces grout by blending salt waste solution and dry feeds materials, and pumping the grout to disposal cells to cure. From FY2009 studies, the three most critical parameters to saltstone performance are water-to-pre-mix ratio, dry feeds variability, and the curing temperature. [SRNL-STI-2009-00810, SRNL-STI-2009-00546]

Critical Variable Testing: This activity will measure water-to-pre-mix ratio, dry feeds variability, and the curing temperature over the range of SDF capabilities to determine the operating ranges that produce an acceptable waste form. Saltstone Facility Engineering will provide operational ranges related to the parameters of interest in order to define upper and lower bounds of the tests. It is expected that this testing will continue in out-years in an effort to refine understanding of process parameters on critical saltstone property values.

High-Temperature Grout Property Testing: The objective of this testing is to determine if the moisture retention properties of the high temperature grout are different from the baseline case. Samples tested for hydraulic conductivity at the offsite laboratory would also be tested for moisture retention over the range from 0 to 15 bar. Additionally, in the on-site laboratory, the moisture potential of up to 12 samples will be measured using a controlled and measured vapor pressure method over an even larger pressure range. The porosity and dry bulk density of these samples will also be measured. Onsite data would be combined with data from an offsite laboratory to establish the grout drainage curve. These data will be analyzed to determine the appropriate moisture retention parameters.

Expected Benefits: This testing is expected to determine the range of performance properties as a function of the compositional and operational variables, creating an operating window for SDF operations to ensure that grout produced will have acceptable hydraulic and physical

properties. It is expected to validate the hydraulic and physical property inputs to the SDF PA for the Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit (ARP/MCU) baseline mix, thereby reducing uncertainty in values used in the PA. It is expected that the effort will identify and qualify the key variables that drive the performance property values and correlate the Young's modulus, a relatively easy-to-measure parameter, with performance properties in order to reduce future cost and schedule for performance evaluation of mixes.

Milestones: SRNL report 1QFY2012

Ongoing SRNL Technical Reports

Expected Completion Date: FY2017

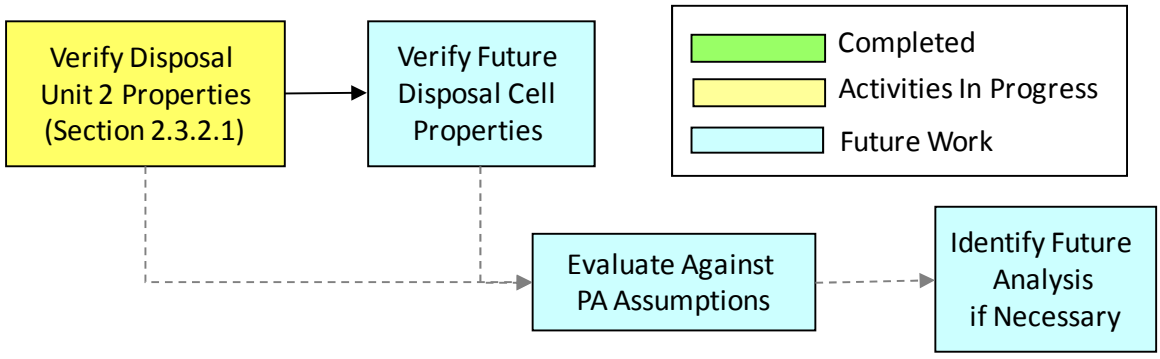
Responsibility: SRR C&WDA

Estimated Cost: FY2011 $255K, FY2012 through FY2017 $75K/yr

2.3.2 Disposal Unit Properties

The maintenance activities presented in this section establish an understanding of the properties of the saltstone disposal units. This understanding reduces uncertainty in the SDF PA by confirming the properties of materials actually used in construction of the saltstone disposal units. The current strategy for disposal unit testing is shown in Figure 2.3-4.

Figure 2.3-4: Disposal Unit Property Testing Strategy



2.3.2.1 Verify Hydraulic/Physical Properties of Disposal Unit Concrete

Description: FDCs benefit from a PA informed design. The design and materials for construction are modeled using laboratory prepared samples gathered from the actual disposal units during construction.

Disposal Unit 2 Properties: Samples of concrete used in the construction of FDCs were collected from Disposal Unit 2 for analysis to verify that the materials used in the field meet or exceed materials properties identified in the PA testing. Verification of FDC material properties is anticipated as part of an overall performance verification process. This testing will begin in FY2011 and will continue as needed to support additional FDC material testing.

Expected Benefit: This activity is expected to validate the hydraulic and physical properties

assumed for the disposal units in the SDF PA and develop correlation between laboratory cured samples and field cured samples.

Milestone: Disposal Unit 2 materials report 1QFY2012

Ongoing SRNL Technical Reports

Expected Completion Date: FY2017

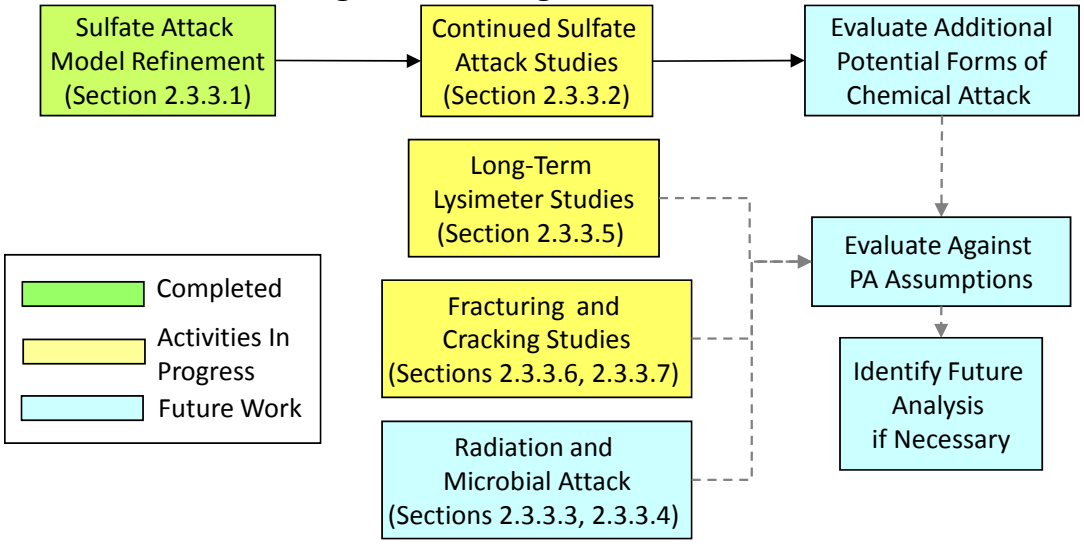
Responsibility: SRR C&WDA

Estimated Cost: FY2011 $35K, FY2012 through FY2017 $60K/yr

2.3.3 Degradation Studies

Maintenance activities presented in this section will establish the R&D programs needed to address data and information needs relevant to cementitious degradation mechanisms and the frequency and extent of fractures in both saltstone and disposal unit concrete. The overall strategy to gain a better understanding of degradation mechanisms is shown in Figure 2.3-5.

Figure 2.3-5: Degradation Studies



2.3.3.1 Refine Sulfate-Attack Model

Description: This task involved utilizing advanced models of degradation mechanisms of disposal unit concrete. In a previous memorandum on sulfate attack, one of the products of the analysis was a probabilistic prediction of concrete failure due to sulfate attack. [SRNS-STI-2008-00050, SRNS-STI-2008-00052] The current "sulfate degradation" model utilized needed to be reviewed and updated, with more recent models that have been developed, including additional geochemical modeling and fracture mechanics.

Sulfate Model: SRNL utilized advanced offsite model/simulation/analysis capability to forecast SDF disposal unit concrete (Vaults 1 and 4, and FDCs) physical degradation over time based upon sulfate attack, carbonation, and other degradation mechanisms. Service life predictions were made using the Stadium Service Life Prediction Code software developed

by SIMCO Technologies, Inc. The degradation was expressed in terms of changes to effective permeability and diffusion coefficient. In addition to service life prediction modeling, the subcontracted work included property measurements and exposure validation testing on samples of disposal unit concrete mixes and on simulated saltstone. Results from this study have been used to refine PA assumptions of disposal unit concrete degradation and saltstone properties. Subtasks include:

- Performing initial service life estimates using literature data for concrete properties using mixes similar to SDF disposal unit mixes. Results have been used as input for SDF PA revision.
- Preparing samples and measuring relevant properties for SDF disposal unit concrete mixes required to support service-life prediction modeling. Run Stadium software using SDF disposal unit mixes.
- Confirm service life predictions by exposing samples to corrosive solutions, analyzing samples for relevant data, and compare to service life predictions.
- Preparing samples and measuring relevant properties for saltstone required to run Stadium software. Predicting durability of saltstone exposed to infiltrating water.

This testing is anticipated to take several years to complete in order to allow for comparisons between the simulated results from the Stadium software and the measured results over different exposure times. Revisions to reports will be generated to provide updated results from testing.

Milestone: Final Report

Expected Completion Date: 1QFY2009 (Initial testing) - Complete
4QFY2009 (Report revision) - Complete
4QFY2010 (Report revision) - Complete

Responsibility: SRR C&WDA

Estimated Cost: Complete

2.3.3.2 Continue Studies Related to Concrete Degradation Due to Chemical (Sulfate) Attack

Description: Chemical (sulfate) attack is believed to be a primary degradation mechanism in cementitious materials. This activity continues previous efforts to investigate these degradation mechanisms.

Sulfate Attack Studies: This activity, beginning in FY2011, contains long term, on-going studies related to the degradation resulting from chemical (sulfate) attack in Section 2.3.3.1. [SRNS-STI-2008-00050, SRNS-STI-2008-00052]

Milestone: SRNL Technical Reports

Expected Completion Date: FY2012

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $85K

2.3.3.3 Studies Related to Concrete Degradation Due to Radiation Damage

Description: Saltstone is a cementitious waste form. As such, damage to cementitious materials from radiolytic mechanisms must be understood. Future testing could include exposure of samples to the equivalent of 10,000 years of cumulative dose using Cobalt-60 gamma radiation. Gases generated due to exposure could result in internal pressurization and cracking. Analysis of gases generated from the exposure, measurement of the physical and mechanical properties of the cementitious samples after exposure, and the leach rates from both irradiated and unirradiated samples are possible areas of future testing.

Literature Review: This activity will initiate a review of relevant literature currently published. The literature review will begin in FY2012.

Expected Benefit: This activity is expected to produce a baseline of knowledge concerning cementitious degradation due to radiolytic mechanisms over long periods.

Milestone: Final report

Expected Completion Date: FY2013

Responsibility: SRR C&WDA

Estimated Cost: FY2012 $150K, FY2013 $200K

2.3.3.4 Studies Related to Concrete Degradation Due to Microbial Attack

Description: Microbial organisms present in the environment can promote damage to cementitious materials.

Literature Review: This activity will initiate a review of relevant literature currently published to assess the relevant microbial species, key variables, conditions, growth factors, and kinetics on both saltstone and disposal unit materials, and develop recommendations for follow-up experiments. The literature review will identify key variables, conditions, growth factors, kinetics, and microbial species. Its findings will assess the presence of sulfate, nitrate, nitrites, carbonates, aluminates, and hydroxide (pH) relative to SRS long-term storage of Saltstone materials. This includes the impact of saltstone and concrete on microbial survival, growth, and function and the microbial impact on integrity of saltstone and concrete.

The review will also assess the likelihood of significant microbial-mediated impacts on Saltstone and concrete to alter surface structure, water flow, and/or mobilization of key constituents. It will assess fate in soil of sulfate, nitrate, iodine, and technetium sulfide. It will examine the disposition of leached constituents in soil(s), the possibility for soil augmentation to enhance shallow land disposal, and provide summary assessment and recommendations. If justified, an experimental approach and path forward to address key issues may be developed. The test plan would include testing required to assess the likely microbial degradation mechanism impacts to saltstone and disposal unit concretes, as well as testing to assess the impact on fate and transport of key contaminants in the soil. The literature review will be initiated in FY2012.

Expected Benefit: This activity is expected to produce a baseline of knowledge concerning cementitious degradation due to microbial attack.

Milestone: Final report

Expected Completion Date: FY2013

Responsibility: SRR C&WDA

Estimated Cost: FY2012 $90K, FY2013 $30K

2.3.3.5 Reduction Capacity and K_d/Solubility Values of Radionuclides in Cementitious Materials (Lysimeter Studies)

Description: Understanding the long-term behavior of radionuclides in saltstone is essential to models that project this behavior over thousands of years.

Lysimeter Studies: The objective of this task is to measure the reduction capacity of radioactive samples by placing actual cementitious materials (saltstone or grout) spiked with a suite of radionuclides/analogues including, cesium, uranium, iodine, and technetium in lysimeters to be placed in an outside environment. The total exposure time is anticipated to be 10 years, with data available in as soon as two years. Saltstone and tank grout will be placed in the lysimeters and the reduction capacity, K_d, and solubility will be determined after environmental exposure.

Expected Benefit: This task is expected to provide trends in reduction capacity, K_d, and solubility over time to reduce uncertainty in similar values used in the SDF, FTF, and HTF PAs.

Milestone: Ongoing SRNL Technical Reports

Expected Completion Date: After FY2017

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $110K, FY2012 through FY2017 $30K/yr

2.3.3.6 Develop and Implement a Preliminary Deterministic Fracture Model

Description: Fracturing of the saltstone waste form results in accelerated degradation of saltstone and accelerated release of contaminants. A better understanding of this process would reduce uncertainty associated with values assumed in the PA.

Literature Review: This activity, which will begin in FY2012, involves a review of existing literature, and material testing needed to understand the mechanisms of crack formation and propagation in cementitious materials, as well as application of the research to the existing sensitivity case modeling performed in the PA.

Expected Benefit: This activity is expected to provide an understanding of how cementitious material fractures. This understanding will benefit the development of both the deterministic and stochastic fracture models. The activity will also help verify assumptions and sensitivities in the PA.

Milestone: Final report

Expected Completion Date: FY2012

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $50K, FY2012 $100K

2.3.3.7 Develop and Implement a Refined Stochastic Fracture Model

Description: Fracturing of the saltstone waste form results in accelerated degradation of saltstone and accelerated release of contaminants. A better understanding of this process would reduce uncertainty associated with values assumed in the PA.

Literature Review: This activity, which will begin in FY2013, involves material testing needed to understand, develop, and implement a stochastic fracture model that increases confidence in the degradation from fracturing assumed in the sensitivity cases evaluated in the PA. This activity will draw from the literature review conducted to inform the deterministic fracture model.

Expected Benefit: This activity is expected to provide an understanding of how cementitious material fractures. This will help verify assumptions and sensitivities in the PA.

Milestone: Final report

Expected Completion Date: FY2013

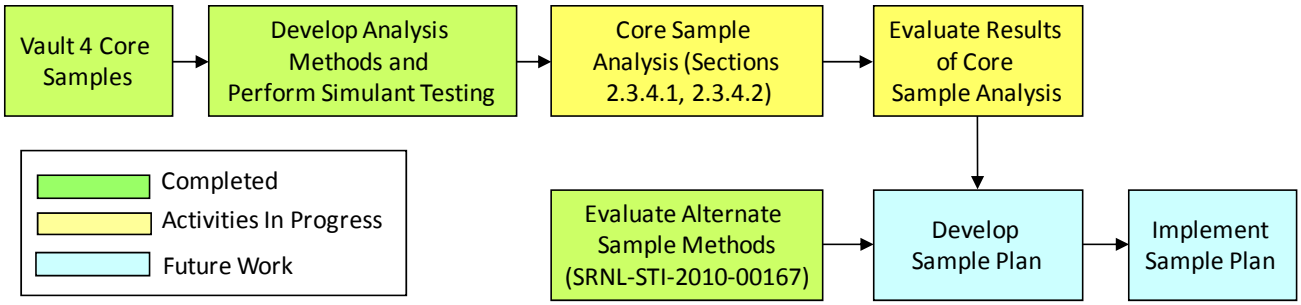
Responsibility: SRR C&WDA

Estimated Cost: FY2013 $150K

2.3.4 Emplaced Core Sampling

Maintenance activities presented in this section will establish the R&D programs in order to measure properties of emplaced saltstone samples. Saltstone samples collected from Vault 4 are currently undergoing testing, but future alternative sample collection methods may be less harmful to the samples and result in measurements that are more accurate. In the future, alternative sample collection methodologies may be employed that may have less impact on the sample itself, such as the formed-core sampling method. [SRNL-STI-2010-00167] The current sampling strategy is shown in Figure 2.3-6.

Figure 2.3-6: Emplaced Core Sampling Strategy



2.3.4.1 Verify Desorption K_d Values from Saltstone Samples

Description: The highest pedigree sorption data should be that generated from site-specific samples. In the case of present operations, it would be from saltstone samples removed from Vault 4. [LWO-RIP-2008-00006] Vault 4 samples were collected in FY2009 and aliquots of these samples were sent to SRNL to measure desorption constants.

Vault 4 Sample Studies: The purpose of this study is to produce high pedigree desorption K_d

values, effective diffusion coefficients, and scanning electron microscopy (SEM) images and maps from site-specific saltstone samples. Saltstone cores that were poured in December 2007 would have cured 2 to 3 years at the time of testing and K_d values should be more realistic than those achieved in shorter laboratory experiments. Tests entail grinding solid samples, adding to de-ionized water and allowing the sample to equilibrate for weeks. Samples are then separated; the aqueous phase to be analyzed and the solid phase to undergo total digestion/analysis to calculate the K_d. FY2010 tests of Vault 4 samples have been accomplished and the preliminary results will be available in FY2011.

Viable Vault 4 samples were tested, but future alternative sample collection methods may be less harmful to the samples and result in measurements that are more accurate. In the future, alternative sample collection methodologies may be employed that may have less impact on the sample itself, such as the formed-core sampling method. [SRNL-STI-2010-00167]

Expected Benefit: This study is expected to produce high pedigree desorption K_d values from site-specific saltstone samples in order to reduce uncertainty in K_d values that are critical to PA predictions. It will also produce effective diffusion coefficients (a parameter that combines both diffusion and sorption of the solute/radionuclide), and SEM images and maps to measure the oxidizing front or other types of chemical zones in the saltstone as a function of distance from the vault/saltstone interface.

Milestone: Vault 4 saltstone sample report FY2011

Ongoing SRNL Technical Reports

Expected Completion Date: FY2015

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $75K, FY2012 through FY2015 $60K/yr

2.3.4.2 Verify Hydraulic/Physical Properties of Saltstone Samples

Description: In order to validate the hydraulic and physical properties of saltstone, samples of the existing saltstone would give the highest pedigree results. Vault 4 samples were collected in FY2009 and aliquots of these samples were sent to SRNL to measure hydraulic conductivity. These measurements were performed on viable Vault 4 saltstone samples and it is recognized that the sample collection methodology currently employed may affect the viability of the samples. [LWO-RIP-2008-00006]

Vault 4 Sample Measurements: In FY2010, additional testing was performed on these samples to measure hydraulic properties of the saltstone more accurately. Techniques were used that significantly extended the range of the moisture retention curve beyond what has previously been measured for saltstone. These data were used to develop the transport parameters used in the vadose zone transport model. The parameters developed were significantly different than those previously used and demonstrated the importance of accurately measuring the moisture retention properties at the dry end of the moisture retention curve.

In the future, alternative sample collection methodologies may be employed that may have less impact on the sample itself, such as the formed-core sampling method. [SRNL-STI-

2010-00167] Future testing and verification of saltstone properties is anticipated as part of an overall performance verification process.

Expected Benefit: This activity is expected to improve quality for hydraulic/physical property values by in-house control of experimental procedures and data acquisition, decreases cost and schedule, establish in-house capability for measurement of actual core samples, and provide an independent measurement of permeability from a nationally recognized government laboratory or university for validation of the in-house and commercial measurements.

Milestone: Ongoing SRNL Technical Reports

Expected Completion Date: FY2017

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $40K, FY2012 through FY2017 $100K/yr

3.0 F-AREA TANK FARM

3.1 FTF PA Annual Maintenance Activities

DOE O 435.1, Chg 1 requires the on-going maintenance of all PAs. This maintenance involves a series of activities that must be performed on an on-going or annual basis. The activities in Section 3.1 represent those activities that will be required every year in support of the FTF PA regardless of the status of any on-going or future PA revisions. These activities will be initiated for the FTF PA once the PA is implemented, or sooner, if necessary, to support PA implementation and tank closure. It is anticipated that the FTF PA would be implemented in FY2011.

3.1.1 Maintain F-Area Tank Farm Performance Assessment Control Through Unreviewed Closure Question Process

Description: Similar to the UDQ process set up for evaluating disposal related questions in SDF, a UCQ process will be established for FTF closure activities (note, at this time this process will be referred to as the UCQ process for closure activities. The name for this program will be finalized after additional discussions with DOE). The UCQ process will consists of providing UCQ Evaluations (UCQEs) of proposed activities or new information to ensure that the assumptions, results, and conclusions of the approved PA and CA remain valid.

If identified through the UCQ process that a proposed activity or new information is outside the bounds of the approved PA or CA, SAs are prepared to update the technical baseline. UCQEs and SAs will continue to be required throughout the life of the facility. At this time, FTF does not have an approved UCQ procedure. Prior to implementation of the FTF PA, a UCQ procedure will need to be in place. For planning purposes, the estimated cost assumes that six UCQs will be prepared each year in the out-years (beginning FY2012). The estimated cost does not reflect the cost of any general FTF SAs.

If a general FTF SA is required, it is estimated that approximately $100K would be required to complete an SA. In FY2011, the FTF UCQ procedure will need to be developed at a cost of $50K. Therefore, the estimated cost will vary, up or down, depending on the actual number of UCQEs performed and the need to perform SAs in any given year. In addition, in support of the closure process, tank specific SAs will be prepared to document the final residual material contents of the tanks in comparison to the PA assumptions. Costs associated with the tank-specific SAs will be captured as part of the FTF Tier 2 closure plan as discussed in the Section 3.1.5 maintenance activity.

Milestone: Provide UCQEs, UCQ procedure support, and SAs as needed to support closure of FTF.

Expected Completion Date: On-going

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $50K, FY2012 through FY2017 $150K/yr

3.1.2 Conduct Annual F-Area Tank Farm Performance Assessment Validation

Description: The purpose of the PA maintenance program is to confirm the continued adequacy of the PA and to increase confidence in the results of the PA. One part of the maintenance program is to conduct an annual review of the facility closure activities. The annual PA review is conducted in a systematic manner that incorporates the following considerations:

- Radionuclide inventories, waste volumes, and waste types characterized throughout the year.
- Testing and research activities performed during the year and planned for the out-years.
- Results of PA monitoring conducted in accordance with the facility monitoring plan.

The above factors will be reviewed annually to confirm the adequacy of the current FTF PA and to evaluate the need to conduct SAs or prepare a revision to the PA. The results of the review will be documented in an annual review report for the FTF PA. Annual validation of the FTF PA will begin once the FTF PA has been implemented.

Milestone: Issue fiscal year PA annual review report

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $30K, FY2012 through FY2017 $20K/yr

3.1.3 Prepare Annual Performance Assessment Maintenance Program Implementation Plan

Description: The purpose of the PA maintenance program is to confirm the continued adequacy of the current PA and to increase confidence in the results. Every year the annual PA maintenance program fiscal year implementation plan will be prepared and provided to DOE. The implementation plan will outline planned work for each fiscal year covering a 6-year period. The cost of preparing the implementation plan will be shared between SDF, FTF, and HTF. See the maintenance activities in Sections 2.1.3 and 4.1.3 for SDF and HTF respectively.

Milestone: Issue fiscal year PA maintenance program implementation plan

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 through FY2017 $15K/yr

3.1.4 Develop/Maintain F-Area Tank Farm Performance Assessment Tier 1 Closure Plan

Description: SRS closure management is regulated under DOE O 435.1, Chg 1. Implementation of the FTF PA will require development and maintenance of an FTF Tier 1 closure plan complying with the DOE O 435.1, Chg 1 prior to grouting of any FTF waste tanks. Once developed, the closure plan will be reviewed annually to determine if a revision is required. The FTF Tier 1 closure plan is currently under development and is to be issued

in FY2011. Final approval of the FTF Tier 1 closure plan is dependent on issuance of the NDAA Section 3116 Waste Determination. In addition, review/revision of the plan will occur annually in the out-years.

Milestone: Develop Tier 1 closure plan and review annually.

Expected Completion Date: 2QFY2011 (Initial issuance)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $50K, FY2012 through FY2017 $5K/yr

3.1.5 Prepare F-Area Tank Farm Tank-Specific Performance Assessment Tier 2 Closure Plans

Description: SRS closure management is regulated under the Federal Facility Agreement and SCDHEC industrial wastewater treatment permit. [WSRC-OS-94-42, DHEC_03-03-1993] Implementation of the FTF PA will require development and maintenance of a DOE O 435.1, Chg 1 compliant Tier 1 closure plan as discussed in the maintenance activity in Section 3.1.4. In addition, a Tier 2 closure plan will be required for each individual waste tank or group of waste tanks prior to grouting. The Tier 2 closure plans will contain the waste tank-specific information required as part of the closure process. As a part of the development of the Tier 2 closure plans, waste tank-specific SAs documenting the final tank residual characterization in comparison to the FTF PA assumptions will be required. An SA reflecting the final characterization information for Tanks 18 and 19 was issued in FY2010. [SRR-CWDA-2010-00124] A Tier 2 closure plan for Tanks 18 and 19 is to be completed in FY2011. As schedules for remaining waste tank closures are finalized, estimated completion dates and waste tank groupings for the Tier 2 closure plans and the associated waste tank-specific SAs will be incorporated into the annual PA maintenance program fiscal year implementation plan. Estimations and tank groupings here are based on the closure timing in the *Liquid Waste System Plan* and the relative locations of tanks. [SRR-LWP-2009-00001] It is anticipated that a new DOE O 435.1, Chg 1 compliant Tier 2 closure plan will be needed at least once per fiscal year as FTF waste tanks are readied for operational closure (grouting).

Milestone: Issue waste tank-specific Tier 2 closure plan and associated SA.

Expected Completion Date: FY2011 (Tier 2 initial issuance for Tanks 18/19)
FY2012 (Tier 2 for Tanks 5/6)
FY2013 (Tier 2 for Tank 4)
FY2014 (Tier 2 for Tank 7)
FY2015 (Tier 2 for Tank 8)
FY2016 (Tier 2 for Tank 3)
FY2017 (Tier 2 for Tanks 1/2)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $100K, FY2012 through FY2017 $100K/yr

3.1.6 Develop/Maintain F-Area Tank Farm Performance Assessment Monitoring Plan

Description: SRS closure management is regulated under the Federal Facility Agreement and SCDHEC industrial wastewater treatment permit. [WSRC-OS-94-42, DHEC_03-03-1993] It is anticipated that FTF PA implementation will require development and maintenance of a monitoring plan complying with the DOE O 435.1, Chg 1 within 1 year of FTF PA implementation. Once developed, the monitoring plan will be reviewed annually to determine if a revision is required. For planning purposes, it is assumed that initial development of the FTF monitoring plan will occur in FY2012 and review/revision of the plan will occur annually in the out-years.

Milestone: Develop PA monitoring plan and review annually.

Expected Completion Date: FY2012 (Initial issuance of FTF PA)

Responsibility: SRR C&WDA

Estimated Cost: FY2012 $50K, FY2013 through FY2017 $10K/year

3.1.7 Provide General Technical Support on F-Area Tank Farm Performance Assessment Issues

Description: This task is to provide general technical and programmatic support on FTF PA issues, NRC activities, and other regulatory issues that affect FTF waste tank closure. Activities include supporting NRC on-site observation visits and technical reviews, general project support, testing and research activity support, and development of resolution path forward for NRC open items. This also includes support on interactions with SCDHEC, CAB, LFRG, National Academy of Sciences, and other regulatory and stakeholder bodies.

Milestone: Provide on-going technical support on regulatory and policy issues/forums affecting FTF closure activities.

Expected Completion Date: On-going

Responsibility: SRR C&WDA

Estimated Cost: FY2012 through FY2017 $150K/yr

3.2 F-Area Tank Farm Performance Assessment Development/Revisions

The FTF PA provides the technical basis and results to be used in subsequent documents to demonstrate compliance with performance objectives of *Licensing Requirements for Land Disposal of Radioactive Waste*, *Radioactive Waste Management*, *Federal Facility Agreement for the Savannah River Site*, *Standards for Wastewater Facility Construction*, and *Proper Closeout of Wastewater Treatment Facilities*. [10 CFR 61, DOE O 435.1, WSRC-OS-94-42, SCDHEC R.61-67, SCDHEC R.61-82]

3.2.1 Performance Assessment Development for In-Progress F-Area Tank Farm Performance Assessment

Description: In August 2008, the LFRG review team issued their final report (LFRG_08-13-2008) and Revision 0 of the FTF PA (SRS-REG-2007-00002) was submitted to the NRC, the EPA, the CAB, and the SCDHEC for review and comment. In FY2009, activities included

initiation of comment resolution and preparation of a PA comment response packages (SRR-CWDA-2009-00054, SRR-CWDA-2009-00055, and SRR-CWDA-2009-00056). Changes were incorporated into Revision 0 of SRS-REG-2007-00002 and Revision 1 was issued March 31, 2010. In FY2011, the SRS-REG-2007-00002 Revision 1 was reviewed by the NRC and other stakeholders as part of NDAA Section 3116 process in support of waste tank closure. The NRC issued a series of RAIs, which are currently under review by SRR.

Milestone: Issue PA comment response packages.

Expected Completion Date: 1QFY2010 (Issue comment response packages) - Complete
2QFY2010 (Issue PA revision 1) - Complete
FY2011 (Issue FTF PA for implementation)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $100K, FY2012 $50K

3.2.2 Prepare Out-year F-Area Tank Farm Performance Assessment Revisions

Description: A future revision of the FTF PA will be scheduled as required and agreed upon by DOE. The current FTF PA will be revised when warranted, but for estimating purposes, the next revision will be scheduled starting in FY2015. Unless otherwise noted in the FTF PA, the future FTF PA revision will include the following items at a minimum:

- Analyses and results contained in all SAs that have been completed to date
- Analyses and results of all UCQEs completed to date
- Changes in site future land use plans or closure plans
- Changes to PA guidance documents requirements

Milestone: Issue PA revision

Expected Completion Date: FY2017

Responsibility: SRR C&WDA

Estimated Cost: FY2015 $750K, FY2016 $750K, FY2017 $300K

3.3 F-Area Tank Farm Performance Assessment Testing & Research Activities

Receipt of NRC's comments to the FTF PA and draft FTF 3116 basis document were received in 1QFY2011. The issuances of the FTF PA and the Draft Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site (DOE/SRS-WE-2010-001) are anticipated to occur in FY2011. The schedule duration for comment resolution and revision of SRS documents is normally 3-months and includes drafting, reviews, and approvals. After approval and issuance of the FTF PA, the PA related testing and research activities identified, as part of the on-going maintenance will be performed. It is projected that the FTF PA would be implemented in FY2011.

4.0 H-TANK FARM

4.1 H-Area Tank Farm Performance Assessment Annual Maintenance Activities

DOE O 435.1, Chg 1 requires the on-going maintenance of all PAs. This maintenance involves a series of activities that must be performed on an on-going or annual basis. The activities in this section represent those activities that will be required annually in support of the HTF PA regardless of the status of any on-going or future PA revisions. These activities will be initiated for the HTF PA once the PA is implemented, or sooner, if necessary to support PA implementation and waste tank closure. It is anticipated that the HTF PA would be implemented in FY2013.

4.1.1 Maintain H-Area Tank Farm Performance Assessment Control Through Unreviewed Closure Question Process

Description: Similar to the UDQ process set up for evaluating disposal related questions in the SDF, a UCQ process will be established for HTF closure activities. The UCQ process will consist of providing UCQEs of proposed activities or new information to ensure that the assumptions, results, and conclusions of the approved PA and CA remain valid. If identified through the UCQ process that a proposed activity or new information is outside the bounds of the approved PA or CA, SAs are prepared to update the technical baseline. UCQEs and SAs will continue to be required throughout the life of the facility. At this time, HTF does not have an approved UCQ procedure. Prior to implementation of the HTF PA, a UCQ procedure will need to be in place. For planning purposes, the estimated cost assumes that six UCQs will be prepared each year in the out-years (beginning 2013). The estimated cost does not reflect the cost of any general HTF SAs. If a general HTF SA is required, it is estimated that approximately $100K would be required for the SA completion. In FY2012, the HTF UCQ procedure will need to be developed at an estimated cost of $50K. The estimated cost will depend on the actual number of UCQEs performed and the need to perform SAs in any given year. In addition, in support of the closure process, waste tank-specific SAs will be prepared to document the final residual material contents of the tanks in comparison to the PA assumptions. Costs associated with the waste tank-specific SAs will be captured as part of the HTF Tier 2 closure plan, as discussed in the maintenance activity in Section 4.1.5.

Milestone: Provide UCQEs, UCQ procedure support and SAs as needed to support HTF closure.

Expected Completion Date: On-going

Responsibility: SRR C&WDA

Estimated Cost: FY2012 $50K, FY2013 through FY2017 $150K/yr

4.1.2 Conduct Annual H-Area Tank Farm Performance Assessment Validation

Description: The purpose of the PA maintenance program is to confirm the continued adequacy of a facility PA and to increase confidence in the results of that PA. One requirement of the maintenance program is to conduct an annual review of the facility closure activities. The annual PA review will be conducted in a systematic manner that incorporates the following considerations:

- Radionuclide inventories, waste volumes, and waste types characterized throughout the year.
- Testing and research activities performed during the year and planned for the out-years.
- Results of PA monitoring conducted in accordance with the facility monitoring plan.

The above factors will be reviewed annually to confirm the adequacy of the HTF PA and to evaluate the need to conduct SAs or prepare a revision to the PA. The results of the review will be documented in an annual review report for the HTF PA. Annual validation of the HTF PA will begin once the PA has been implemented.

Milestone: Issue fiscal year PA annual review report

Expected Completion Date: 2QFY (Issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $30K, FY2014 through FY2017 $20K/yr

4.1.3 Prepare Annual Performance Assessment Maintenance Program Implementation Plan

Description: The purpose of the PA maintenance program is to confirm the continued adequacy of a facility PA and to increase confidence in the results. Every year the annual PA maintenance program fiscal year implementation plan will be prepared and provided to DOE. The implementation plan will outline planned work for each fiscal year covering a 6-year period. The cost of preparing the implementation plan will be shared between SDF, FTF, and HTF. See the maintenance activities in Sections 2.1.3 and 3.1.3 for SDF and FTF respectively.

Milestone: Issue fiscal year PA maintenance program implementation plan.

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 through FY2017 $15K/yr

4.1.4 Develop/Maintain H-Area Tank Farm Performance Assessment Tier 1 Closure Plan

Description: SRS closure management is regulated under the Federal Facility Agreement and SCDHEC industrial wastewater treatment permit. [WSRC-OS-94-42, DHEC_03-03-1993] Implementation of the HTF PA will require development and maintenance of a DOE O 435.1, Chg 1 compliant HTF Tier 1 closure plan prior to grouting of any HTF waste tanks. Once developed, the closure plan will be reviewed annually to determine if a revision is required. For planning purposes, it is assumed that development and issuance of the HTF Tier 1 closure plan will occur in FY2013 and initial issuance will occur in FY2013. In addition, review/revision of the plan will occur annually in the out-years.

Milestone: Develop Tier 1 closure plan and review annually.

Expected Completion Date: FY2013 (Initial issuance)

Responsibility: SRR C&WDA

Estimated Cost: FY2012 $50K, FY2013 through FY2017 $5K/yr

4.1.5 Prepare H-Area Tank Farm Waste Tank-Specific Performance Assessment Tier 2 Closure Plans

Description: SRS closure management is regulated under the Federal Facility Agreement and SCDHEC industrial wastewater treatment permit. [WSRC-OS-94-42, DHEC_03-03-1993] Implementation of the HTF PA will require development and maintenance of an HTF Tier 2 closure plan as discussed in the maintenance activity in Section 4.1.4. In addition, Tier 2 closure plans will be required for each individual waste tank or group of waste tanks prior to grouting. The Tier 2 closure plans will contain the waste tank-specific information required as part of the closure process. As a part of the development of the Tier 2 closure plans, waste tank-specific SAs documenting the final waste tank residual characterization in comparison to the current HTF PA assumptions will be required. As schedules for these waste tank closures are finalized, estimated completion dates and waste tank groupings for the Tier 2 closure plans and the associated waste tank-specific SAs will be incorporated into the annual PA maintenance program fiscal year implementation plan. Estimations and groupings here are based on the *Liquid Waste System Plan* and the relative locations of the tanks. [SRR-LWP-2009-00001] It is anticipated that at least one tank or waste tank group Tier 2 closure plan will be needed per fiscal year as HTF waste tanks are readied for closure.

Milestone: Issue waste tank-specific Tier 2 closure plans and associated SAs.

Expected Completion Date: FY2014 (Tier 2 for Tanks 16, 11/12)
FY2015 (Tier 2 for Tank 15)
FY2016 (Tier 2 for Tanks 13/14, 22/23, 21, 10)
FY2017 (Tier 2 for Tanks 9, 24)

Responsibility: SRR C&WDA

Estimated Cost: FY2014 $200K, FY2015 $100K, FY2016 $400K, FY2017 $200K

4.1.6 Develop/Maintain H-Area Tank Farm Performance Assessment Monitoring Plan

Description: SRS closure management is regulated under the Federal Facility Agreement and SCDHEC industrial wastewater treatment permit. [WSRC-OS-94-42, DHEC_03-03-1993] It is anticipated that HTF PA implementation will require development and maintenance of a DOE O 435.1, Chg 1 compliant monitoring plan within 1 year of PA implementation. Once developed, the monitoring plan will be reviewed annually to determine if a revision is required. For planning purposes, is assumed that initial development of the HTF monitoring plan will occur in FY2013 and review/revision of the plan will occur annually in the out-years.

Milestone: Develop PA monitoring plan and review annually.

Expected Completion Date: FY2014 (Initial issuance)

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $50K, FY2014 through FY2017 $5K/yr

4.1.7 Provide General Technical Support on H-Area Tank Farm Performance Assessment Issues

Description: This task is to provide general technical and programmatic support on HTF PA issues, NRC activities, and other regulatory issues affecting HTF waste tank closure activities. Activities include supporting NRC on-site observation visits and technical reviews, general project support, testing and research activity support, and development of resolution path forward for NRC open items. This also includes support on interactions with SCDHEC, CAB, LFRG, National Academy of Sciences, and other regulatory and stakeholder bodies.

Milestone: Provide on-going technical support on regulatory and policy issues/forums affecting HTF closure activities.

Expected Completion Date: On-going

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2017 $150K/yr

4.1.8 Develop Performance Assessment Model Archive and Revision Control

Description: This task will establish software and hardware resources for archiving development and final PA modeling files to a read-only storage medium. It will also implement software revision control software (e.g., subversion) to track changes to PA modeling input and information processing files through the project life cycle. This is the only remaining secondary issue to be closed from the HTF PA LFRG review.

Milestone: Closure of LFRG secondary issue

Expected Completion Date: FY2012

Responsibility: SRR C&WDA

Estimated Cost: FY2012 $30K

4.2 H-Area Tank Farm Performance Assessment Development/Revisions

Initial planning for the HTF PA was initiated and a limited amount of work was performed in FY2008. Due to funding limitations, only a few activities related to the HTF PA were completed in FY2009. Work on the HTF PA was resumed in full at the beginning of FY2010. As required by the *Statement of Resolution of Dispute Concerning Extension of Closure Dates for Savannah River Site High-Level Radioactive Waste Tanks 19 and 18*, DOE shall submit the HTF PA to SCDHEC and EPA by March 31, 2011. [Dispute Resolution_11-19-2007] The HTF PA will provide the technical basis and results to be used in subsequent documents to demonstrate compliance with 10 CFR 61, DOE O 435.1, Chg 1, the Federal Facility Agreement, and SCDHEC R.61-82 and R.61-67. Currently, the HTF PA activities remain on schedule for submittal to SCDHEC and EPA by end of 2QFY2011.

4.2.1 Performance Assessment Development for In-Progress H-Area Tank Farm Performance Assessment

Description: In FY2011, C&WDA will manage individual PA tasks, develop PA program planning documents, set up PA report organization, prepare regulatory review matrices, and develop/maintain PA input packages for technical review and incorporation into the PA. In addition, C&WDA will prepare the PA document, including interpretation and integration of results. SRNL will support C&WDA in development of the conceptual models, execution of the models, and interpretation of the results, as needed. The DOE review process is planned for FY2011 followed by stakeholder reviews. Implementation is anticipated in FY2013.

Milestone: Document modeling, issue draft PA to DOE-SR for review and respond to DOE comments.

Expected Completion Date: 2QFY2009 (Document modeling) – Complete
FY2010 (Draft PA to DOE-SR) – Complete
2QFY2011 (LFRG approval of PA) – Complete
2QFY2011 (Issue PA to EPA and SCDHEC) – Complete
4QFY2011 (Comment Resolution)

Responsibility: SRR C&WDA

Estimated Cost: FY2011 $850K, FY2012 $200K, FY2013 $100K

4.2.2 Prepare Out-year H-Area Tank Farm Performance Assessment Revisions

Description: A future revision of the HTF PA will be scheduled as required and agreed upon by DOE. The HTF PA will be revised when warranted, but for estimation purposes, the next revision will be scheduled starting in FY2017. Unless otherwise noted in the PA, future PA revision will include the following items at a minimum:

- Analyses and results contained in all SAs that have been completed to date.
- Analyses and results of all UCQEs completed to date.
- Changes in site future land use plans or closure plans.
- Changes to PA guidance documents requirements.

Milestone: Issue PA revision

Expected Completion Date: After FY2017

Responsibility: SRR C&WDA

Estimated Cost: FY2017 $750K

4.3 H-Area Tank Farm Performance Assessment Testing & Research Activities

This section of the PA maintenance program implementation plan contains PA related testing and research activities identified as part of the on-going maintenance of the HTF PA. The first revision of the HTF PA was completed at the end of FY2010, and a final revision to be released to DOE and the public is scheduled for completion by the end of 2QFY2011. This activity supports PA modeling support by SRNL during this process in FY2011 and ongoing support in the out years after issuance of the HTF PA.

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APPENDIX A

Summary Tables for the Liquid Waste Facilities PA Maintenance Program

A.1 Summary Tables for the Liquid Waste Facilities PA Maintenance Program

Tables A.1-1 through A.1-3 summarize the estimated expenditures by activity and fiscal year. Table A.1-4 contains a summary of the combined estimated expenditures for all the Liquid Waste facility PA maintenance activities. This implementation plan reflects the PA related activities in the annual operating plan for the current fiscal year and the projected out-year activities for estimation purposes.

Table A.1-1: Summary for the Z-Area Saltstone Disposal Facility PA Maintenance Program ($K)

	Maintenance Activity	FY11	FY12	FY13	FY14	FY15	FY16	FY17
	Task Performed Annually							
2.1.1	Maintain SDF PA Control Through UDQ Process	100	85	85	85	85	85	85
2.1.2	Conduct Annual SDF PA Validation	15	15	15	15	15	15	15
2.1.3	Prepare Annual PA Maintenance Program Implementation Plan	15	15	15	15	15	15	15
2.1.4	Maintain SDF Closure Plan	15	5	5	5	5	5	5
2.1.5	Maintain SDF PA Monitoring Plan	15	5	5	5	15	5	5
2.1.6	Provide General Technical Support on SDF PA Issues	750	575	575	575	575	575	575
	Annual Tasks Total	910	700	700	700	710	700	700
	Performance Assessment Development/Revisions							
2.2.1	PA Development for In-Progress SDF PA Revision	325	5	0	0	0	0	0
2.2.2	Prepare Out-year SDF PA Revisions	0	0	0	0	1500	1500	0
	PA Development/Revisions Total	325	5	0	0	1500	1500	0

Table A-1: Summary for the Z-Area Saltstone Disposal Facility PA Maintenance Program ($K) (Continued)

	Maintenance Activity	FY11	FY12	FY13	FY14	FY15	FY16	FY17
	Testing and Research Activities							
2.3.1.1	Study Technetium Interaction with Reducing Saltstone	0	0	0	0	0	0	0
2.3.1.2	Measure Slag Redoxidation Stoichiometry	0	0	0	0	0	0	0
2.3.1.3	Technetium Solubility Kinetics	0	40	0	0	0	0	0
2.3.1.4	Technetium K_d Distributions	75	40	40	40	40	0	0
2.3.1.5	Plutonium K_d Distributions	40	40	40	40	40	0	0
2.3.1.6	Measurement of Reduction Capacity of New Saltstone Formulations	40	20	0	0	0	0	0
2.3.1.7	Measure Hydraulic/Physical Properties of Saltstone Mixes Constrained by Saltstone Production/Disposal Facility Capabilities	255	75	75	75	75	75	75
2.3.2.1	Verify Hydraulic/Physical Properties of Disposal Unit Concrete	35	60	60	60	60	60	60
2.3.3.1	Refine Sulfate-Attack Model	0	0	0	0	0	0	0
2.3.3.2	Continue Studies Related to Concrete Degradation Due to Chemical (Sulfate) Attack	85	0	0	0	0	0	0
2.3.3.3	Studies Related to Concrete Degradation Due to Radiation Damage	0	150	200	0	0	0	0
2.3.3.4	Studies Related to Concrete Degradation Due to Microbial Attack	0	90	30	0	0	0	0
2.3.3.5	Reduction Capacity and K_d/Solubility Values of Radionuclides in Cementitious Materials (Lysimeter Studies)	110	30	30	30	30	30	30
2.3.3.6	Develop and Implement a Preliminary Deterministic Fracture Model	50	100	0	0	0	0	0
2.3.3.7	Develop and Implement a Refined Stochastic Fracture Model	0	0	150	0	0	0	0
2.3.4.1	Verify Desorption K_d Values from Saltstone Samples	75	60	60	60	60	0	0
2.3.4.2	Verify Hydraulic/Physical Properties of Saltstone Samples	40	100	100	100	100	100	100
	Testing and Research Total	805	805	785	405	405	265	265
	Z-AREA SDF PA COMPILED TOTAL	**2,040**	**1,510**	**1,485**	**1,105**	**2,615**	**2,465**	**965**

Table A.1-2: Summary for the F-Tank Farm PA Maintenance Program ($K)

	Maintenance Activity	FY11	FY12	FY13	FY14	FY15	FY16	FY17
	Tasks Performed Annually							
3.1.1	Maintain FTF PA Control Through UCQ Process	50	150	150	150	150	150	150
3.1.2	Conduct Annual FTF PA Validation	30	20	20	20	20	20	20
3.1.3	Prepare Annual PA Maintenance Program Implementation Plan	15	15	15	15	15	15	15
3.1.4	Develop/Maintain FTF PA DOE O 435.1, Chg 1 Tier 1 Closure Plan	50	5	5	5	5	5	5
3.1.5	Prepare FTF Waste Tank-Specific PA DOE O 435.1, Chg 1 Tier 2 Closure Plans	100	100	100	100	100	100	100
3.1.6	Develop/Maintain FTF PA Monitoring Plan	0	50	10	10	10	10	10
3.1.7	Provide General Technical Support on FTF PA Issues	0	150	150	150	150	150	150
	Annual Tasks Total	345	490	450	450	450	450	450
	Performance Assessment Development/Revisions							
3.2.1	PA Development for In-Progress FTF PA	100	50	0	0	0	0	0
3.2.2	Prepare Out-year FTF PA Revisions	0	0	0	0	750	750	300
	PA Development/Revisions Total	100	50	0	0	750	750	300
	Testing and Research Activities							
3.3	Future FTF PA Test and Research Activities To be Determined After Final PA Approval	-	-	-	-	-	-	-
	Testing and Research Total	-	-	-	-	-	-	-
	FTF PA COMPILED TOTAL	**345**	**540**	**450**	**450**	**1,200**	**1,200**	**750**

Table A.1-3: Summary for the H-Tank Farm PA Maintenance Program ($K)

	Maintenance Activity	FY11	FY12	FY13	FY14	FY15	FY16	FY17
	Tasks Performed Annually							
4.1.1	Maintain HTF PA Control Through UCQ Process	0	50	150	150	150	150	150
4.1.2	Conduct Annual HTF PA Validation	0	0	30	20	20	20	20
4.1.3	Prepare Annual PA Maintenance Program Implementation Plan	15	15	15	15	15	15	15
4.1.4	Develop/Maintain HTF PA DOE 435.1, Chg 1 Tier 1Closure Plan.	0	50	5	5	5	5	5
4.1.5	Prepare HTF Waste Tank-Specific PA DOE 435.1, Chg 1 Tier 2 Closure Plans.	0	0	0	200	100	400	200
4.1.6	Develop/Maintain HTF PA Monitoring Plan	0	0	50	5	5	5	5
4.1.7	Provide General Technical Support on HTF PA Issues	0	0	150	150	150	150	150
4.1.8	Develop PA Model Archive and Revision Control System	0	30	0	0	0	0	0
	Annual Tasks Total	15	145	400	545	445	745	545
	Performance Assessment Development/Revisions							
4.2.1	PA Development for In-Progress HTF PA	850	200	100	0	0	0	0
4.2.2	Prepare Out-year HTF PA Revisions	0	0	0	0	0	0	750
	PA Development/Revisions Total	850	200	100	0	0	0	750
	Testing and Research Activities							
4.3	Future HTF PA Test and Research Activities To be Determined After Final PA Approval	-	-	-	-	-	-	-
	Testing and Research Total	-	-	-	-	-	-	-
	HTF PA COMPILED TOTAL	**865**	**345**	**500**	**545**	**445**	**745**	**1,295**

Table A.1-4: Summary for the Liquid Waste Facilities PA Maintenance Program ($K)

Liquid Waste Facility PA	FY11	FY12	FY13	FY14	FY15	FY16	FY17
Z-Area SDF PA Maintenance Program Totals	2,040	1,510	1,485	1,105	2,615	2,465	965
FTF PA Maintenance Program Totals	345	540	450	450	1,200	1,200	750
HTF PA Maintenance Program Totals	865	345	500	545	445	745	1,295
COMPILED TOTAL	**3,235**	**2,370**	**2,085**	**1,780**	**4,040**	**3,890**	**2,690**

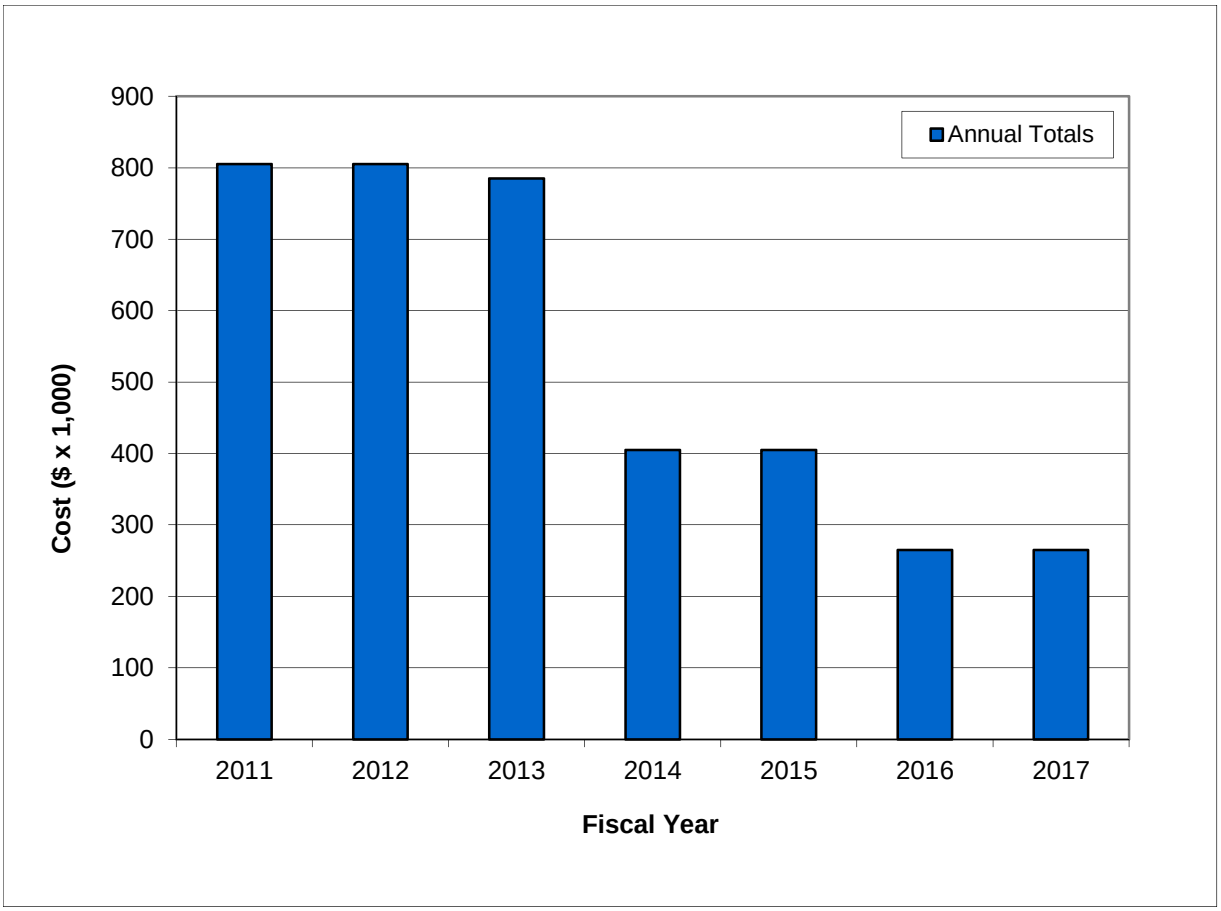
APPENDIX B

Summary - Salt Waste Disposal Testing & Research Funding Requirements for FY2011 through FY2017

B.1 Graphic Summary Salt Waste Disposal Testing & Research Funding Requirements for FY2011 through FY2017

This Salt Waste Disposal Figure B.1-1 portrays the trend of the funding requirements for this year and the next 6 years as it relates to testing and research. As indicated, the bulk of the spending (> $250K) is on the front end to allow for verification of assumptions in the PA. Progress into the out-years indicates research and testing is more focused on reducing uncertainties, thereby reducing funding (< $250K) requirements.

Figure B.1-1: Salt Waste Disposal Testing & Research Funding Requirements FY2011 - FY2017



APPENDIX C

Crosswalk for SDF PA Maintenance Activities and Factors Identified in the NRC Technical Evaluation Report Covering SRS Salt Waste Disposal

C.1 Crosswalk for SDF PA Maintenance Activities and Factors Identified in the NRC Technical Evaluation Report Covering SRS Salt Waste Disposal

On December 28, 2005, the NRC issued the TER for review of the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*. The NRC concluded that there is reasonable assurance that DOE's proposed salt waste management approach can meet the criteria in NDAA Section 3116 provided certain assumptions made in DOE's analysis of the Vault 4, 2005 SA are verified via monitoring. A crosswalk showing the factors identified by the NRC in their TER and the maintenance program activities relating to these factors is included in Table C.1-1. [ML0353010225, DOE-WD-2005-001]

Table C.1-1: NRC TER Factors for 10 CFR 61 Subpart C Compliance

Factor	Factor	Related PA Maintenance Activities as Described in this Document
1	The rate of waste oxidation and release of technetium from an oxidized layer of saltstone will be a key determinant of the future performance of the SDF, and therefore, whether 10 CFR 61.41 can be met. More realistic modeling will be important to achieving the performance objectives, and adequate model support is essential to providing the technical basis for the model results. It will be important to ensure that gas phase transport of oxygen through fractures will not significantly increase oxidation of technetium in the saltstone.	o The SDF PA revision currently in-progress (**2.2.1**) will incorporate a revised conceptual model for saltstone oxidation. The revised PA model will include information from new studies that were completed by the initial draft date of the new PA revision. Later studies will be incorporated via the UDQ process **(2.1.1)** or a future PA revision **(2.2.2)**: ▪ Rate of waste oxidation and release of technetium (**2.3.1**) ▪ Reducing capacity of saltstone (**2.3.1.6**) ▪ Measurement of key radionuclide K_d values (**2.3.1.4, 2.3.1.5**) ▪ Reduction Capacity and K_d/Solubility Values of Radionuclides in Cementitious Materials **(2.3.3.5)** o The SDF PA revision will include sensitivity and uncertainty analysis, which will provide a better understanding of the impact of waste oxidation and technetium release on performance objectives. o PA maintenance activities to provide additional model support are described under Factor 3.
2	The extent of degradation that may influence the hydraulic isolation capabilities of the saltstone and vaults will be a key factor in assessing whether the SDF can meet 10 CFR 61.41. Degradation mechanisms that may result in the hydraulic conductivity of degraded saltstone and vault concrete being larger than 1E-07 cm/s (1E-01 ft/yr) need to be evaluated with multiple sources of information (e.g., modeling, analogs, experiments [especially field scale and long-term], expert elicitation) to ensure that they are unlikely to occur. It will be important to ensure that field-scale physical properties (e.g., hydraulic conductivity, effective diffusivity) of as-emplaced saltstone are not significantly different from the results of laboratory tests of smaller-scale samples performed to date. It will be important to perform additional laboratory measurements of hydraulic conductivity because the data being relied upon represent limited samples that had a small range of curing times. In addition, because there was a fairly significant amount of variability in the TCLP test results, if DOE deviates significantly from the nominal saltstone composition, DOE should perform additional tests for hydraulic conductivity and effective diffusivity that justify the parameter values used over the range of compositions.	o The SDF PA revision currently in-progress (**2.2.1**) will incorporate updated assumptions for saltstone and vault concrete initial and degraded properties. The revised PA model will include information from new studies that were completed by the initial draft date of the new PA revision. Later studies will be incorporated via the UDQ process **(2.1.1)** or a future PA revision **(2.2.2)**: ▪ Initial vault and saltstone properties (**2.3.2.1, 2.3.4.1, 2.3.4.2**) ▪ Vault coating degradation (FY2008) ▪ Sulfate-Attack (**2.3.3.1, 2.3.3.2**) ▪ Degradation mechanisms (**2.3.3.3 , 2.3.3.4**) ▪ Saltstone expansive phase study (FY2008) ▪ Saltstone cracking (**2.3.3.6, 2.3.3.7**) o The SDF PA revision will include sensitivity and uncertainty analysis, which will provide a better understanding of the impact of the various cementitious properties on performance objectives. o A long-range program plan for on-going testing of degradation mechanisms associated with cementitious hydraulic properties is being developed (**2.3.3.3, 2.3.3.4**) to identify additional field/lab testing and identify test methods and equipment.

Table C.1-1: NRC TER Factors for 10 CFR 61 Subpart C Compliance (Continued)

Factor	Factor	Related PA Maintenance Activities as Described in this Document
3(1)	Adequate model support is essential to assessing whether the SDF can meet 10 CFR 61.41. The model support for, (1) moisture flow through fractures in the concrete and saltstone located in the vadose zone, (2) realistic modeling of waste oxidation and release of technetium, (3) the extent and frequency of fractures in saltstone and vaults that will form over time, (4) the plugging rate of the lower drainage layer of the engineered cap, and (5) the long-term performance of the engineering cap as an infiltration barrier is key to confirming performance assessment results.	(1) Moisture Flow through Fractures o New studies are being performed to establish new moisture characteristic curves for saltstone and vault concrete (**2.3.2.1, 2.3.4.2**). o A long-range program plan for on-going testing of degradation mechanisms associated with cementitious hydraulic properties is being developed (**2.3.3.2, 2.3.3.3**) to identify additional field/lab testing and identify test methods and equipment. o A future study will be performed to evaluate the rate of equilibration of saltstone water content
3(2)	Adequate model support is essential to assessing whether the SDF can meet 10 CFR 61.41. The model support for, (1) moisture flow through fractures in the concrete and saltstone located in the vadose zone, (2) realistic modeling of waste oxidation and release of technetium, (3) the extent and frequency of fractures in saltstone and vaults that will form over time, (4) the plugging rate of the lower drainage layer of the engineered cap, and (5) the long-term performance of the engineering cap as an infiltration barrier is key to confirming PA results.	(2) Waste Oxidation and Technetium Release o The SDF PA revision currently in-progress (**2.2.1**) will incorporate a revised conceptual model for saltstone oxidation. The revised PA model will include information from new studies that were completed by the initial draft date of the new PA revision. Later studies will be incorporated via the UDQ process **(2.1.1)** or a future PA revision **(2.2.2)**: ▪ Rate of waste oxidation and release of technetium (**2.3.1**) ▪ Reducing capacity of saltstone (**2.3.1.6**) ▪ Measurement of key radionuclide K_d values (**2.3.1.4, 2.3.1.5**) o The SDF PA revision (**2.2.1**) will include sensitivity and uncertainty analysis, which will provide a better understanding of the impact of waste oxidation and technetium release on performance objectives. o A long-range program plan for on-going testing of waste oxidation and release of technetium is being developed (**2.3.1, 2.3.3.5**) to identify additional field/lab testing and identify test methods and equipment.

Table C.1-1: NRC TER Factors for 10 CFR 61 Subpart C Compliance (Continued)

Factor	Factor	Related PA Maintenance Activities as Described in this Document
3(3)	Adequate model support is essential to assessing whether the SDF can meet 10 CFR 61.41. The model support for, (1) moisture flow through fractures in the concrete and saltstone located in the vadose zone, (2) realistic modeling of waste oxidation and release of technetium, (3) the extent and frequency of fractures in saltstone and vaults that will form over time, (4) the plugging rate of the lower drainage layer of the engineered cap, and (5) the long-term performance of the engineering cap as an infiltration barrier is key to confirming performance assessment results.	(3) Extent and Frequency of Fractures o The SDF PA revision currently in-progress (**2.2.1**) will incorporate updated assumptions for saltstone and vault concrete initial and degraded properties. The revised PA model will include information from new studies for saltstone cracking (FY2008) o A long-range program plan for on-going testing of the extent and frequency of fractures is being developed (**2.3.3.6, 2.3.3.7**) to identify additional field/lab testing and identify test methods and equipment.
3(4)	Adequate model support is essential to assessing whether the SDF can meet 10 CFR 61.41. The model support for, (1) moisture flow through fractures in the concrete and saltstone located in the vadose zone, (2) realistic modeling of waste oxidation and release of technetium, (3) the extent and frequency of fractures in saltstone and vaults that will form over time, (4) the plugging rate of the lower drainage layer of the engineered cap, and (5) the long-term performance of the engineering cap as an infiltration barrier is key to confirming performance assessment results.	(4) Plugging Rate of lower Drainage Layer o The SDF PA revision currently in-progress (**2.2.1**) will incorporate an updated closure cap design and model. o A long-range program plan for evaluating the plugging rate of the lower drainage layer is being developed to identify additional field/lab testing and identify test methods and equipment. o Evaluation of a replacement for the HELP code is currently planned.
3(5)	Adequate model support is essential to assessing whether the SDF can meet 10 CFR 61.41. The model support for, (1) moisture flow through fractures in the concrete and saltstone located in the vadose zone, (2) realistic modeling of waste oxidation and release of technetium, (3) the extent and frequency of fractures in saltstone and vaults that will form over time, (4) the plugging rate of the lower drainage layer of the engineered cap, and (5) the long-term performance of the engineering cap as an infiltration barrier is key to confirming performance assessment results.	5) Long-Term Performance of Engineered Cap o The SDF PA revision currently in-progress (**2.2.1**) will incorporate an updated closure cap design and model. o A long-range program plan for evaluating the long-term performance of the engineered cap is being developed to identify additional field/lab testing and identify test methods and equipment.

Table C.1-1: NRC TER Factors for 10 CFR 61 Subpart C Compliance (Continued)

Factor	Factor	Related PA Maintenance Activities as Described in this Document
4	The erosion control design is important to ensuring that 10 CFR 61.42 can be met because it eliminates pathways and scenarios for intruder dose assessments. Implementation of an adequate design that does not deviate significantly from information submitted to the NRC in CBU-PIT-2005-00203 and the associated references is important, or if it does deviate significantly that it is reviewed by NRC staff to ensure the revisions are consistent with long-term erosion control design principles.	o The SDF PA revision currently in-progress (**2.2.1**) will incorporate an updated closure cap design and model. o Future changes to the erosion control design, if not part of a PA revision, will need to be evaluated by the UDQ process (**2.1.1**) and will be reviewed as part of the annual PA validation (**2.1.2**) and closure plan review (**2.1.4**).
5	The infiltration control design is important to ensuring that 10 CFR 61.41 can be met because the release of contaminants to the groundwater is predicted to be sensitive to the large reduction in infiltration provided by the infiltration control. It is important to ensure that the design can be implemented and will perform as designed.	o Additional model support will be developed to substantiate assumptions about lower drainage layer plugging and long-term performance of the engineered cap. A long-range program plan for evaluating the plugging rate of the lower drainage layer is being developed as well as a long-range program plan for evaluating the long-term performance of the engineered cap.
6	Implementation of an adequate sampling plan is important to ensuring that 10 CFR 61.41 and 10 CFR 61.42 can be met. It is important to assess results of future sampling and confirm that current projections of the concentrations of highly radioactive radionuclides in treated salt waste (or grout) are greater than or equal to actual concentrations of highly radioactive radionuclides in treated salt waste (or grout).	o A review of the inventory of waste disposed of in the SDF is evaluated as part of the annual PA validation (**2.1.2**). In addition, feed tank sampling is reviewed with the NRC as part of the on-going support of the NRC monitoring role (**2.1.6**).
7	To ensure that Tank 48 waste can be safely managed, future tests of the physical properties of samples that contain organic materials similar to Tank 48 waste will need to confirm that the properties of the wasteform made from this waste will provide for suitable wasteform performance such that the disposal system will be able to meet the performance objectives. The technical basis should, at a minimum, include tests for hydraulic conductivity and effective diffusivity.	o Current plans are to treat the existing Tank 48 waste by organic destruction. The resulting material will then be treated by the Salt Waste Processing Facility prior to disposal of any material in SDF. Any additional testing or research activities required will be reviewed once the treatment method is finalized.
8	Predicted removal efficiencies of highly radioactive radionuclides by each of the planned salt waste treatment processes are a key factor in determining the radiological inventory disposed of in saltstone. The inventory, in turn, is an important factor in the determination that 10 CFR 61.41 and 10 CFR 61.42 can be met.	o A review of the inventory of waste disposed of in the SDF is evaluated as part of the annual PA validation (**2.1.2**). If inventories exceed the projections assumed in the SDF PA the inventory will need to be evaluated by the UDQ process (**2.1.1**). In addition, inventory is one of the areas reviewed with the NRC as part of the on-going support of the NRC monitoring role (**2.1.6**).

[Factors are from ML053010225, Section 4.3.1]