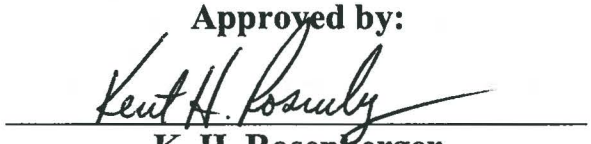
SRR-CWDA-2013-00049
Revision 1

Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program

FY2013 Implementation Plan

Approved by:



K. H. Rosenberger
Manager, Closure and Disposal Assessment

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Prepared by: Savannah River Remediation LLC
Closure and Waste Disposal Authority
Aiken, SC 29808

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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	U.S. Department of Energy
DRS	Diffuse Reflectance Spectroscopy
EPA	U.S. Environmental Protection Agency
FEP	Features, Events, and Processes
FFA	Federal Facility Agreement for the Savannah River Site
FTF	F-Tank Farm
FY	Fiscal Year
HRR	Highly-radioactive Radionuclide
HTF	H-Area Tank Farm
IPL	Integrated Priority List
IPT	Integrated Project Team
LFRG	Low-Level Waste Disposal Facility Federal Review Group
LW	Liquid Waste
MOP	Member of the Public
NDAA	National Defense Authorization Act
NEA-TDB	Nuclear Energy Agency – Thermochemical Database
NRC	Nuclear Regulatory Commission
PA	Performance Assessment
PNNL	Pacific Northwest National Laboratory
RAI	Request for Additional Information
SA	Special Analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SDF	Saltstone Disposal Facility
SDU	Saltstone Disposal Unit
SEM	Scanning Electron Microscopy
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation, LLC
SRS	Savannah River Site
TER	Technical Evaluation Report
UWMQ	Unreviewed Waste Management Question
UWMQE	Unreviewed Waste Management Question Evaluation
XAFS	X-ray Absorption Fine-structure
XANES	X-ray Absorption Near Edge Structure
XAS	X-ray Absorption Spectroscopy
XPS	X-ray Photoelectron Spectroscopy

1.0 EXECUTIVE SUMMARY

The revised *Performance Assessment* (PA) *for the Saltstone Disposal Facility* (SDF) *at the Savannah River Site* (SRS), the *Performance Assessment for F-Tank Farm* (FTF) *at the Savannah River Site*, and the *Performance Assessment for the H-Area Tank Farm* (HTF) *at the Savannah River Site* are managed by Savannah River Remediation LLC (SRR) for the U.S. Department of Energy (DOE). [SRR-CWDA-2009-00017, SRS-REG-2007-00002, SRR-CWDA-2010-00128] These PAs 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 after final closure as required by DOE Order 435.1, Change 1. In addition, the revised SDF PA (hereinafter referred to as 2009 SDF PA) and the FTF PA are 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). The 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. The CA is maintained by the SRS Maintenance and Operations contractor, Savannah River Nuclear Solutions. [SRNL-STI-2009-00512]

The DOE, through Manual 435.1-1, *Radioactive Waste Management Manual* and associated guidance, 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 using PA results. The purpose of the LW 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 LW PA Maintenance program are:

- Unreviewed Waste Management Questions (UWMQs)
- Testing and research
- Monitoring
- Special Analyses (SAs)
- PA revisions

This program implementation plan is prepared and updated annually and submitted to the 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 M 435.1-1. Beginning with the FY2010 Implementation Plan (SRR-CWDA-2010-00015), the LW PA Maintenance activities for the SRS Liquid Waste (LW) Facilities have been contained in a separate implementation plan

from that for the E-Area Low-Level Waste Facility and the CA. The purpose for this change is to better align the documents with the current 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 through the SRS DOE Order 435.1 Working Group.

A summary of LW 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 and Appendix A, Table A.1-4 further contains a roll-up cost summary of all LW 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 will be adjusted based on new program information and will be dependent on the contract baseline funding and associated actual allocated budget for that year.

Section 2.0 includes a summary of the LW 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:

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

The 2009 SDF PA was prepared to support continued disposal authorization and the eventual closure of the SDF. The 2009 SDF PA has provided the technical basis and results to be used in subsequent documents to demonstrate continued compliance with pertinent requirements of DOE M 435.1-1 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. The 2009 SDF PA evaluates the existing Saltstone disposal units (SDUs), Vaults 1 and 4 and SDU2, SDU3, and SDU5 (currently under construction), as well as all potential future disposal units. Approval of the 2009 SDF PA and issuance of a new DOE Disposal Authorization Statement (DAS), WDPD-12-49, was received in 2012 and disposition of salt waste in SDU2 has commenced.

In April 2012, the U.S. Nuclear Regulatory Commission (NRC) issued its Technical Evaluation Report (TER) for the review of the 2009 SDF PA. [ML121170309] The NRC concluded that there is reasonable assurance that DOE's proposed salt waste management approach can meet the criteria in 10 CFR 61, Sections 61.42, 61.43 and 61.44, provided certain assumptions made in DOE's analysis of the 2009 SDF PA are verified via monitoring. However, further assurance is necessary in order for the NRC to have reasonable assurance to meet the performance objective for protection of the general population from releases of radioactivity. DOE provided the NRC with additional information and analysis, held multiple discussions with NRC staff members and the NRC held public meetings to discuss their issues. The NRC issued a letter (ML12213A447) to DOE on August 31, 2012 stating that revised projected Tc-99 inventory analysis for SDUs 2, 3, and 5 is not likely to cause an off-site peak dose exceeding the requirements of 10 CFR 61.41. C&WDA will be performing a SA in FY2013 to provide further assurance that the general population will be protected from releases of radioactivity over the performance period using new technical data obtained since the 2009 SDF PA was issued.

Initial development of the FTF PA began in FY2007, and a draft was submitted to the Low-Level Waste Disposal Facility Federal Review Group (LFRG) for review in March 2008. The LFRG issued their final report (LFRG_08-13-2008) in August 2009, which recommended the FTF PA was adequate for NRC consultation review without conditions. In August 2008, Revision 0 of the FTF PA was transmitted to the NRC, the U.S. Environmental Protection Agency (EPA), and South Carolina Department of Health and Environmental Control (SCDHEC) for review and comment. A set of requests for additional information (RAIs) were received from the NRC in February 2009. [ML090150222] Detailed responses to the NRC RAIs [SRR-CWDA-2009-00054] and Revision 1 of the FTF PA [SRS-REG-2007-00002] were provided to the NRC for review in March 2010. The NRC responded with several additional RAIs in December 2010 as part of their consultative review of the Draft FTF 3116 Basis Document. [ML1032001240] In September 2010, Revision 0a of the *Tank 18/Tank 19 Special Analysis for the Performance Assessment for the F-Tank Farm at the Savannah River Site* (SRR-CWDA-2010-00124) was prepared and issued in support of operational closure of Tanks 18 and 19. Responses (SRR-CWDA-2011-00054) to the NRC RAIs, which utilized Revision 0a of the Tanks 18/19 SA, were provided to NRC in June 2011, and a TER (ML112371715) for FTF was issued in November 2011. Revision 0 of the Tank 18/19 SA, addressing NRC TER issues and stakeholder comments (SRR-CWDA-2010-00124), was issued in February 2012.

Issuance of the *Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site* (DOE-WD-2012-001) and supporting Basis Document for FTF (DOE/SRS-WD-2012-001) occurred in March 2012. In March 2012, following issuance of the FTF Section 3116 Waste Determination, DOE approved the Tier 1 Closure Plan (SRR-CWDA-2010-00147) for FTF (Tier 1 Authorization letter received March 29, 2012, DOE_03-28-2012), including its referenced FTF PA, Revision 1. Along with approval of the FTF Tier 1 Closure Plan, DOE approved the Tanks 18/19 Tier 2 Closure Plan (WDPD-12-39), including its referenced Revision 0, Tanks 18/19 SA (SRR-CWDA-2010-00124). Tanks 18 and 19 completed operational closure in September 2012 (DHEC_09-19-2012).

Revision 0 of the Tanks 5 and 6 SA was prepared in support of operational closure of Tanks 5 and 6. DOE comments on Revision 0 of the Tanks 5 and 6 SA were incorporated and Revision 1 was issued in January 2013. [SRR-CWDA-2012-00106]

Initial planning for the HTF PA (SRR-CWDA-2010-00128) 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. The HTF PA was submitted for DOE review via an LFRG review team in November 2010. Revision 1 of the HTF PA, incorporating FTF PA lessons learned and comments on HTF PA Revision 0, was issued in November 2012. DOE's Draft NDAA Section 3116 Basis Document for HTF (DOE/SRS-WD-2013-001) was prepared in FY2012 and early FY2013 and was provided, along with the HTF PA, Revision 1, to the NRC to initiate HTF 3116 Consultation in February 2013.

For FY2013, a PA Maintenance Integrated Project Team (IPT) was formed within SRR to review all of the LW PA maintenance testing requirements for FY2013 and prioritize the testing needs against the proposed funding. This IPT includes Facility, Project, C&WDA, Engineering, Quality Assurance, and Procurement personnel and was chartered with:

- Maximizing the benefit and coordination of research and development testing to address the LW PA Maintenance Plan and operational needs.
- Obtain the greatest reduction of risk and uncertainty by prioritizing and evaluating the testing and utilizing the cumulative resources from all SRR organizations.
- Provide a forum for information sharing between all SRR organizations which can provide the necessary reviews of technical information derived from either testing or operational modifications.

The LW PA Maintenance IPT created an Integrated Priority List (IPL) based on known PA testing, SDF operational efforts, and waste tank closure grout fill efficiency and assigned high, medium, and low priority to each testing activity (see Section 2.3). For FY2013, all of the high priority activities are in progress utilizing multiple vendors. The LW PA Maintenance IPT will also be looking at opportunities to utilize the DOE sponsored Cementitious Barriers Partnership and the Advanced Simulation Capability for Environmental Management tools as we perform this work.

2.0 Z-AREA SALTSTONE FACILITY

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

DOE M 435.1-1 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 2009 SDF PA regardless of the status of the in-progress or future PA revisions. All cost estimates are assumed bounding so no increases due to escalation are necessary.

2.1.1 Maintain Saltstone Disposal Facility Performance Assessment Control through Unreviewed Waste Management Question Process

Description: A formal system to evaluate disposal practice changes and proposed actions is in place for the SRS LW Facilities, known as the UWMQ process. For SDF, the UWMQ process consists of providing UWMQ Evaluations (UWMQEs) of proposed activities or new information to ensure that the assumptions, results, and conclusions of the current PA, any current SAs, the NDAA Section 3116 Waste Determination, and the CA remain valid and the changes are within the bounds of the DAS. If it is identified through the UWMQ process that a proposed activity or new information is outside the bounds of the current analyses, SAs are prepared to update the technical baseline. The UWMQEs and SAs will continue to be required throughout the life of the facility. For planning purposes, the estimated cost assumes that 12 UWMQEs will be prepared in FY2013 (assumptions remaining at 12 for each out-year). The estimated cost does not reflect the cost of any SAs. If an SA is required, it is estimated that approximately $600K would be required for its completion. Therefore, the estimated cost has the potential to vary for any given year.

Deliverables: Provide UWMQEs, UWMQ procedure support, and SAs as needed to support SDF operations.

Expected Completion Date: On-going

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2018 $85K/yr

2.1.2 Conduct Annual Saltstone Disposal Facility Performance Assessment Validation

Description: The purpose of the LW PA Maintenance program is to confirm the continued adequacy of the 2009 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
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.

Deliverable: Issue a fiscal year PA annual review report.

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2018 $15K/yr

2.1.3 Prepare Annual Performance Assessment Maintenance Program Implementation Plan

Description: The purpose of the LW PA Maintenance program is to confirm the continued adequacy of the PA and to increase confidence in the results. Every year the annual LW 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.

Deliverable: Issue a fiscal year LW PA Maintenance program implementation plan.

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2018 $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 M 435.1-1 and associated guidance was issued and approved in FY2000. The closure plan for SDF 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 must be completed before May 2013 as stipulated in the updated SDF DAS. This process is ongoing in in FY2013. The revision will incorporate design changes to the SDF reflected in the 2009 SDF PA.

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

Expected Completion Date: Ongoing (SDF Closure Plan revision after DAS issued)

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2018 $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 M 435.1-1 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 must be completed before May 2013 as stipulated in the updated SDF DAS. This process is ongoing in FY2013. 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 an additional revision will be required in FY2015 to ensure the SDF PA Monitoring Plan is kept up to date.

Deliverable: Revise current PA monitoring plan incorporating updates based on the 2009 SDF PA and NDAA Section 3116 monitoring. Review annually in out-years.

Expected Completion Date: Ongoing (SDF PA Monitoring Plan issued after DAS issued)

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2018 $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.

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

Expected Completion Date: Ongoing

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2018 $575K/yr

2.2 Saltstone Disposal Facility Performance Assessment Development/Revisions

A revision to the 1992 SDF PA has been prepared to support continued disposal authorization and the eventual closure of the SDF. The 2009 SDF PA provides the technical basis and results to be used in subsequent documents to demonstrate continued compliance with pertinent requirements of DOE M 435.1-1 and associated references and 10 CFR 61, Subpart C as required by NDAA Section 3116. The 2009 SDF PA incorporates the existing SDUs, Vaults 1 and 4, SDU2, SDU3, SDU5, and all future SDUs. Approval of the 2009 SDF PA and issuance of a DAS has been received and the disposition of salt waste into SDU2 has commenced. [WSRC-RP-92-1360, SRR-CWDA-2009-00017, WDPD-12-49]

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 Laboratory (SRNL) or an equivalent technical organization will support C&WDA in development of the Conceptual Models, execution of the models, and interpretation of the results, as needed.

The 2009 SDF PA has received LFRG approval and been reviewed by the NRC. The NRC responded with a TER in April 2012. [ML121170309] Implementation activities included development of a PA Facility Implementation Plan (SRR-CWDA-2012-00020) and a Management Readiness Checklist to support facility implementation of the 2009 SDF PA.

The NRC TER stated that the 2009 SDF PA did not provide NRC staff reasonable assurance against 10 CFR 61 in meeting the performance objective for protection of the general population from release of radioactivity (10 CFR 61.41). DOE provided the NRC with additional information and analysis and held multiple discussions with NRC staff members. The NRC issued a letter to DOE on August 31, 2012 stating that revised projected Tc-99 inventory analysis for SDUs 2, 3 and 5 is not likely to cause an off-site peak dose exceeding the requirements of 10 CFR 61.41. [ML12213A447] C&WDA will be performing a SA in FY2013 to provide further assurance that the general population will be protected from releases of radioactivity over the performance period using new technical data obtained since the 2009 SDF PA was issued to allow Tc-99 disposal at inventories modeled in the PA.

Deliverable: A new SA performed to include parameters that will provide further confidence to DOE and NRC that disposal activities at SDF will meet all performance objectives.

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 (RAI response) - Complete

3QFY2012 (NRC TER) - Complete

3QFY2012 (DAS issued) - Complete

3QFY2013 (FY2013 SA)

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $625K

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 2009 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 UWMQEs completed to date;
- Changes in site future land use plans or closure plans; and
- Changes to PA guidance documents requirements

Deliverable: 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 are being performed as part of the on-going maintenance activities aimed at reducing uncertainty in the 2009 SDF PA model, or are verification sampling and analysis of materials properties used in the PA (i.e., verification of emplaced saltstone properties and properties of saltstone cured to actual vault temperature and humidity). As ongoing research provides new information or reduces uncertainty, this information will be evaluated (via the UWMQE and SA process described in Section 2.1.1) against the information used as a basis for PA modeling.

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 2009 SDF 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 testing and modeling research activities related to key parameters of the saltstone waste form and the disposal units as reflected in figure 2.3-1. In addition, since SDF closure cap design and installation are at least 20 years in the future, testing and research work performed to support other closure sites may be used in the future rather than developed independently at SRS. Consequently, activities in this area (Section 2.3.3.10) will be delayed to support higher priority testing.

Figure 2.3-1: Saltstone Research, Development, and Testing Program Elements

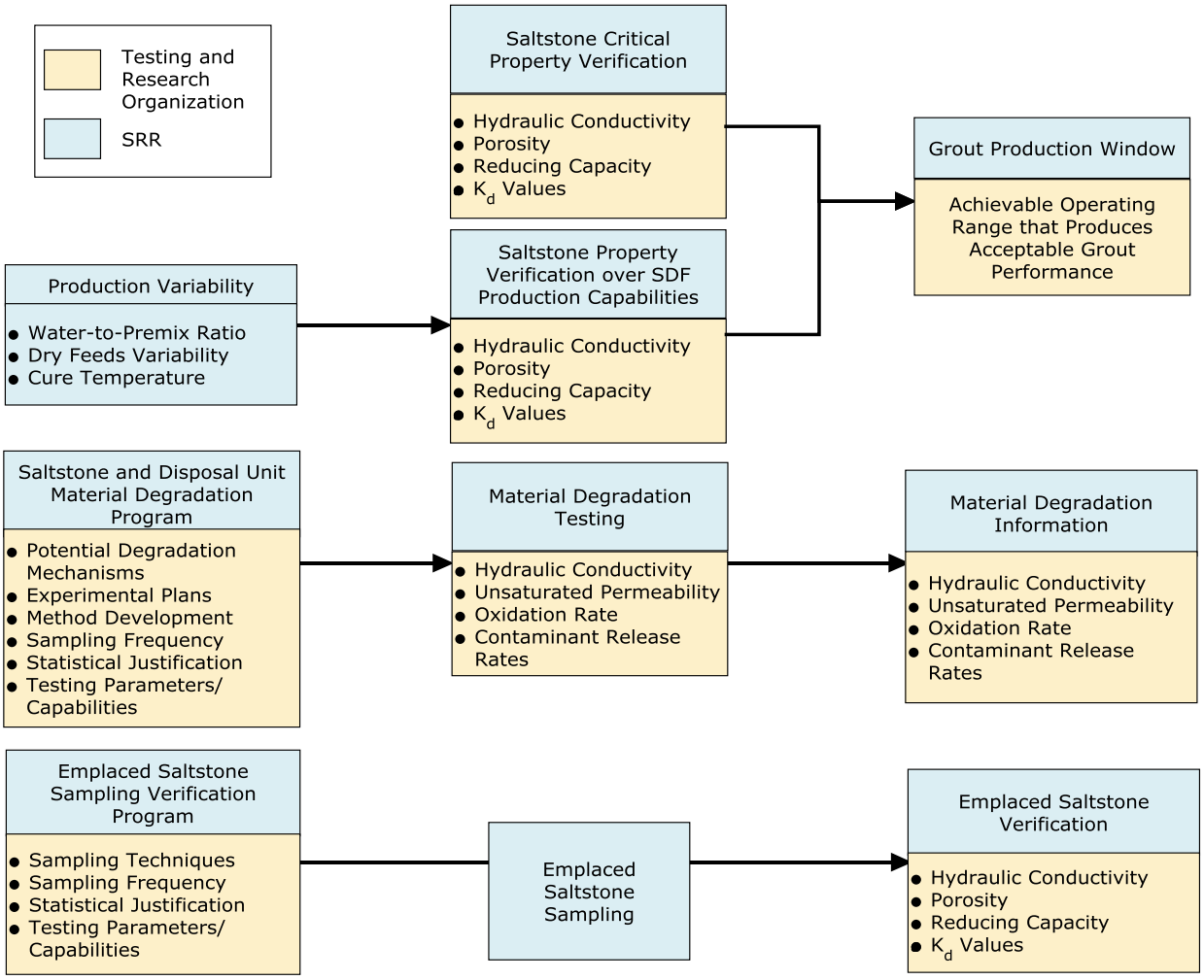
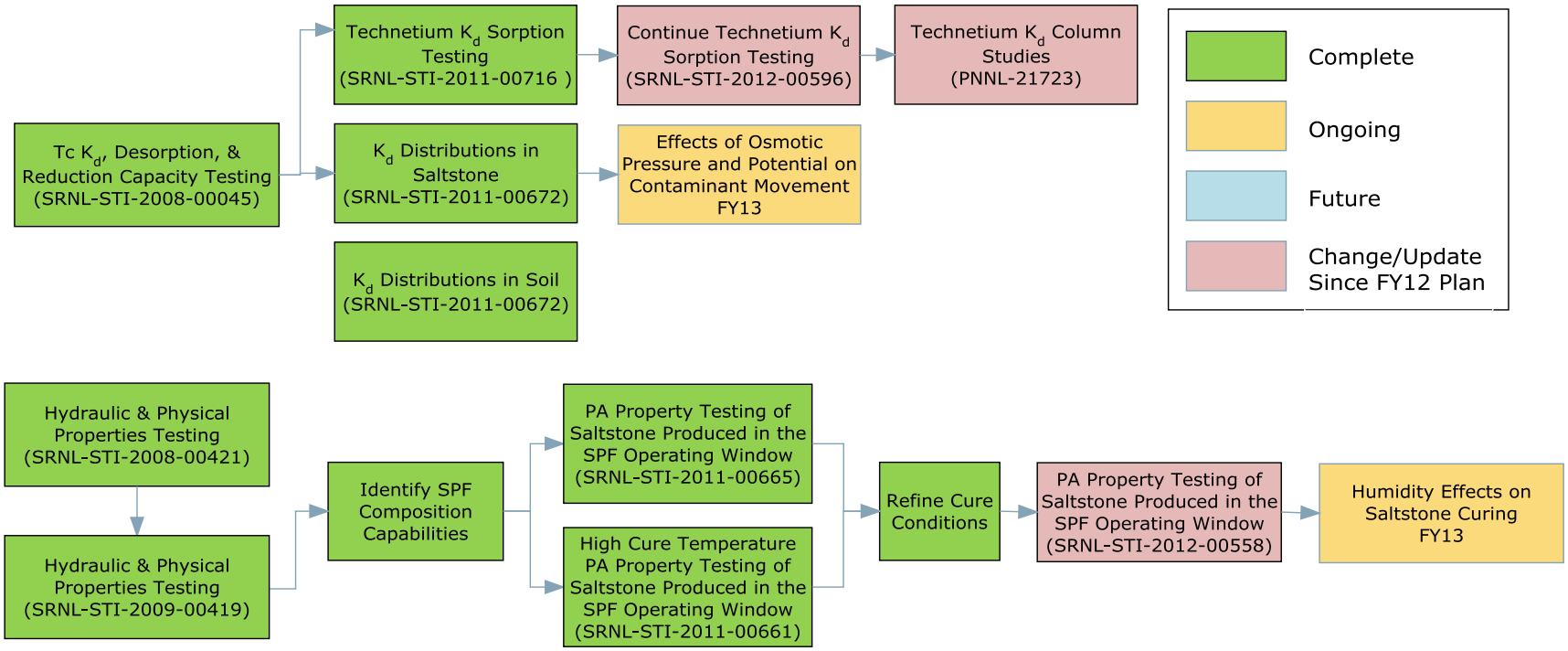


Figure 2.3-2 provides a simple illustration of some of the parallel testing efforts described in detail in this section. From an overall perspective, the illustration below depicts how testing and research activities and on-going testing of the saltstone waste form are being cultivated using an integrated, systematic approach.

Figure 2.3-2: Critical Property Testing Strategy



Funding estimations have been made for each on going or anticipated activity. While actual work performed is always dependent on current funding and priorities, this table provides a general idea of the work expected to be performed over the next six years.

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 2.3-2.

The maintenance activities presented in this section concern critical values such as K_d values, hydraulic conductivities, reduction capacities, water retention characteristics, and kinetic parameters. The 2009 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 2009 SDF PA modeling.

There were many K_d values used during the preparation of the revised 2009 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 focuses on reducing uncertainty in the K_d values that are most important to the 2009 SDF PA.

Several studies from FY2011 and FY2012 have influenced the direction of continued research on properties considered critical to the performance of saltstone. A study on the hydraulic and physical properties of saltstone and their correlation to the mix and curing conditions (SRNL-STI-2011-00665) and (SRNL-STI-2012-00558) has prompted further investigation into the effects of cure temperature and curing conditions on saltstone performance properties. Studies on the technetium K_d under anaerobic conditions began in FY2011 and continued in FY2012. The sorption experiment (SRNL-STI-2011-00716) started in FY2011 and continued until equilibrium was reached. [SRNL-STI-2012-00596] A column study was initiated to substantiate independently these values using an alternate method that provided additional information. [PNNL-21723]

2.3.1.1 Technetium K_d Sorption Testing

Description: Testing under this effort focused on the K_d of technetium in saltstone to support reduction of uncertainty or unnecessary conservatism in the 2009 SDF PA with respect to technetium K_d values and distributions. Testing involved the examination of Tc-99 sorption onto cementitious materials with varying slag content. This testing began in FY2011 (SRNL-STI-2011-00716) and continued into FY2012 (SRNL-STI-2012-00596).

Pacific Northwest National Laboratory (PNNL) performed a column study where the waste form material was placed in a column and pore water simulant was passed through the waste matrix, and properties of interest were measured in the exiting fluid (PNNL-21723).

Expected Benefit: K_d values are commonly shown to be 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.

Actual Results: The results from SRNL-STI-2012-00596 and PNNL-21723 showed that technetium release from reducing saltstone should be modeled as a solubility release model versus a K_d model.

Future saltstone modeling will require a recommendation of solubility values to use under reducing conditions using testing data from the two reports. This report will be completed as part of the FY2013 SA development.

Deliverable: Technical Reports

Expected Completion Date: 4QFY2012 (Final Reports) (Complete)

Responsibility: SRR C&WDA

2.3.1.2 K_d Distributions in Saltstone

Description: This saltstone simulant study was intended to determine the range and distribution of cesium, strontium, iodine, and europium K_d values in saltstone. Cesium, strontium, and iodine K_d values were measured from a wide range of formulations of 22 archived saltstone materials, and distributions were provided for each. Europium K_d values could not be measured because europium precipitated or sorbed to glassware during the experiment.

Actual Results: This activity provided distributions for cesium, strontium, and iodine for saltstone simulants with a wide range of curing and mix parameters. These values will serve as additional input for stochastic modeling used in the PA.

Deliverable: Technical Report (SRNL-STI-2011-00672)

Expected Completion Date: 2QFY2012 (Complete)

Responsibility: SRR C&WDA

2.3.1.3 Measurement of Distribution Coefficients in SRS Subsurface Sediments

Description: This study will measure the distribution coefficients for various species under oxidizing and reducing conditions in actual subsurface sediments retrieved at SRS (actual SDF soils used). Additionally, we will measure the impact of high pH cement leachate on the subsurface sediments distribution coefficient.

Expected Benefit: To reduce the uncertainty in the Saltstone, FTF, and HTF PAs.

Deliverable: Technical Report

Expected Completion Date: 4QFY2013

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $145K

2.3.1.4 PA Property Testing of Saltstone Produced in the SPF Operating Window

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-premix ratio, dry feeds variability, and the curing temperature. [SRNL-STI-2009-00810, SRNL-STI-2009-00546] These studies are intended to define the operating conditions required to meet or exceed the materials performance properties used in the 2009 SDF PA.

Expected Benefit: These studies are intended to provide hydraulic properties of cured saltstone at actual SDU conditions to further understand the impact of actual cure temperature and humidity on performance properties.

FY2011: A statistically designed set of mixes was developed to determine key process and compositional factors that affect the performance properties of saltstone. A total of 27 mixes were batched and tested containing high and low concentrations of aluminate, varying water to premix ratios (w/p), and varying fly ash content in the premix. Each of the mixes was cured at 20, 40, and 60 °C. Additionally, gel time and bleed water were measured and found to be within the acceptable facility parameters. [SRNL-STI-2011-00665]

An additional study investigated the impact of high temperature curing on the moisture retention properties of Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit saltstone. Samples cured at 60^{o}C for 28 days were tested for moisture retention characteristics using pressure extraction, measured vapor pressure (chilled mirror hygrometer), and controlled vapor pressure (vapor equilibrium). The porosity and dry bulk density of each mix was measured, and particle density was calculated from the measurements of dry bulk density. Additionally, characteristic curves for high cure temperature samples were compared to those based on saltstone cured at room temperature. [SRNL-STI-2011-00661]

FY2012: The grout in the SDF does not cure at a single temperature, as in SRNL-STI-2011-00661; rather it is exposed to a variable temperature profile after it is placed. It has been recommended that in addition to curing under actual temperature profiles, samples be cured at high relative humidities in order to maintain saturated grout.

Further testing was performed in FY2012, where studies were undertaken to look at saltstone properties being cured in a high humidity, or saturated, environment, and under a temperature profile representing more realistic curing conditions of saltstone in SDF. The results indicated that saltstone cured under these conditions resulted in lower hydraulic conductivities than saltstone being dried out during curing at high constant temperature.

FY2013: Further testing will be performed to determine how curing environment affects the post-cured hydraulic conductivity of saltstone. Saltstone samples will be cured according to a time dependent temperature profile observed in SDU2B at three different relative humidities.

Deliverable: Technical Reports

Expected Completion Date: 4QFY2013

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $100K

2.3.1.5 Saltstone Osmotic Pressure Impacts on Contaminant Movement

Description: Recent study into the moisture retention properties of saltstone suggest that osmotic pressure from the high salt concentration in saltstone feed may play a potentially significant role in contaminant transport by altering moisture movement and permitting contaminant migration through semi-permeable membranes. This task would involve analysis of osmotic pressure on the 2009 SDF PA model for flow and transport.

Expected Benefit: This task would reduce uncertainty in water flow and advective contaminant release, and a more comprehensive representation of the physical processes dominating contaminant release for the SDF.

Deliverable: Technical Report

Expected Completion Date: FY2013

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $75K

2.3.1.6 Determination of Oxidation Front in Saltstone

Description: To consider various techniques for analyzing low concentrations (50 to 500 mg/kg) of Cr(VI) (formed via the oxidation of Cr(IV)) in cured saltstone grout samples. Previous studies have demonstrated that oxidation of water insoluble Cr(IV) to soluble Cr(VI) is analogous to the oxidation of insoluble Tc(IV) to soluble Tc(VII), and as such, chromium can be used as a non-radioactive surrogate for assessing the oxidation of technetium in saltstone when exposed to air.

FY2012: The task included development and validation of the measurement method. The methods under consideration include X-ray photoelectron spectroscopy (XPS), diffuse reflectance spectroscopy (DRS), X-ray absorption spectroscopy (XAS), redox indicators, and leaching. Samples were laboratory prepared and then cured under uncontrolled environmental conditions to simulate an exposed cementitious surface. Laboratory samples were prepared and cured as needed to validate the proposed analytical methods. [SRNL-STI-2012-00468]

FY2013: Feasible methods from the FY2012 development will be applied to additional lab prepared samples cured to actual SDU2 temperature profiles to experimentally measure the oxidation rate of cementitious materials. This experiment will measure sulfur and chromium oxidation state (X-ray Absorption Near Edge Structure; [XANES]) and chemical environment (X-ray Absorption Fine-Structure; [XAFS]) in four saltstone samples: 0 % slag, 45 % slag/ 1-month old, 45 % slag/ 5-month old, and 45 % slag/ 18-month (FY2014 testing).

Expected Benefit: This activity is expected to validate assumptions in the 2009 SDF PA concerning oxidation front movement in cementitious materials. The data provided from this effort will also inform the HTF and FTF PAs.

Deliverable: Technical Reports

Expected Completion Date: FY2013 - 1-month and 5-month cured sample results, FY2014 - 18 month cured sample results.

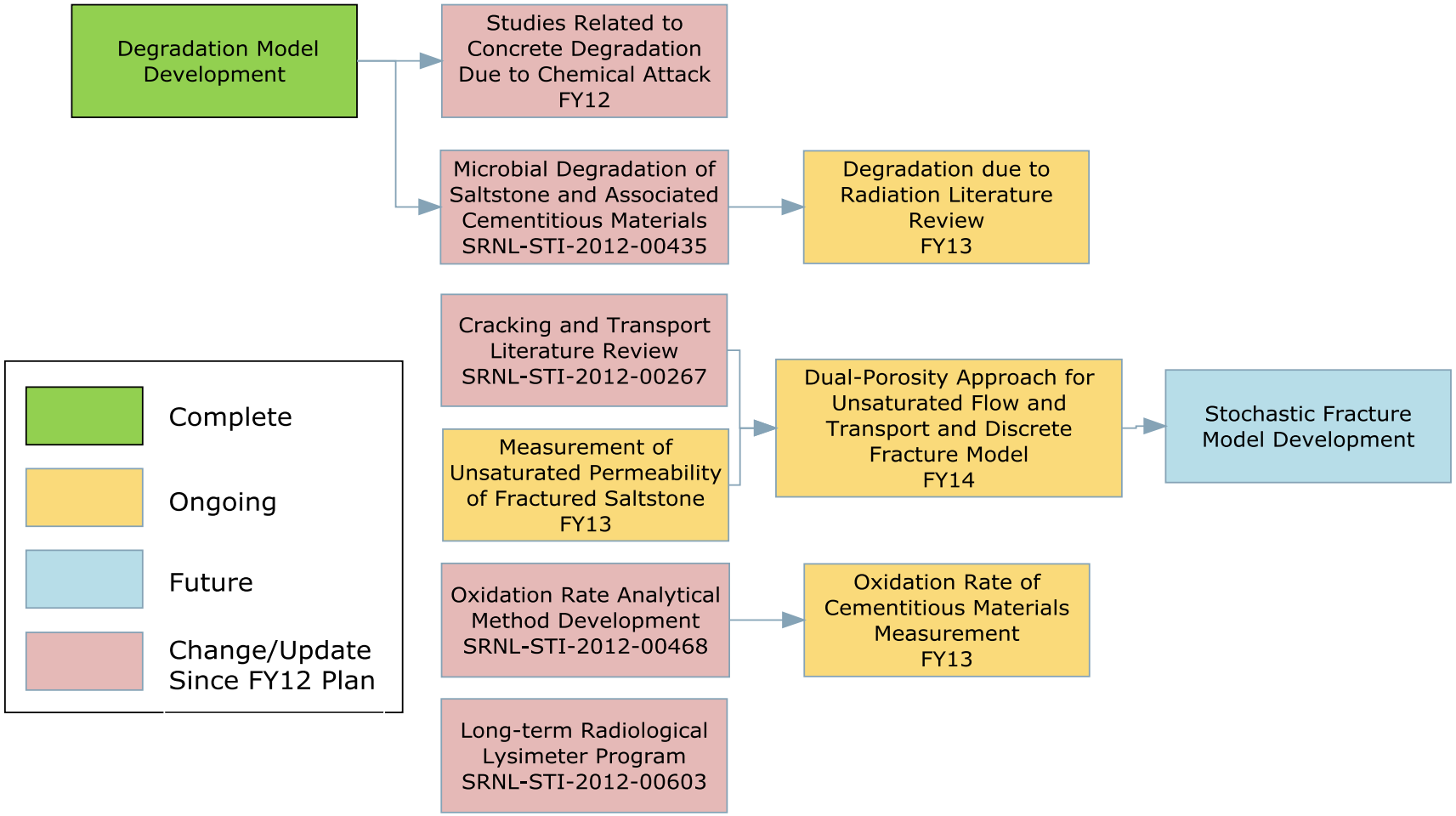
Responsibility: SRR C&WDA

Estimated Cost: FY2013 $280K, FY2014 $50K

2.3.2 Degradation Studies

Maintenance activities presented in this section will focus on meeting 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 2.3-3.

Figure 2.3-3: Degradation Studies



2.3.2.1 Continue Studies Related to Concrete Degradation Due to Chemical Attack

Description: Chemical (sulfate) attack is believed to be a primary degradation mechanism in cementitious materials. This activity continued previous long-term efforts to investigate degradation mechanisms through long-term exposure of cementitious materials to corrosive solutions and analysis of transport properties.

FY2012: This activity continued long-term studies investigating degradation mechanisms. [SRNS-STI-2008-00050, SRNS-STI-2008-00052, SRNL-STI-2010-00515] The activity included long-term exposure of cementitious materials to corrosive solutions and analysis of transport properties, development of a carbonation model based on existing SIMCO carbonation test data that can be used for subsequent STADIUM simulations on carbonation of disposal unit concrete and preparation of cementitious materials for subsequent exposure testing.

FY2012 Results:

Deliverable: Technical Reports

Expected Completion Date: 4QFY2012 (Report Revision) (Complete)

Responsibility: SRR C&WDA

2.3.2.2 Microbial Degradation of Saltstone and Associated Cementitious Materials

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

Expected Benefit: This activity is expected to produce a baseline of knowledge concerning on the impact of microbial organisms on the degradation of cementitious materials.

FY2012: This activity initiated a review of relevant literature currently published to assess the relevant microbial species, key variables, conditions, growth factors, and kinetics on cementitious materials. If justified, an experimental approach and path forward to address key issues may be developed. The literature review was be initiated in FY2012.

FY2012 Results: The review indicated that biodegradation of the saltstone is unlikely, however, biodegradation of concrete disposal cells is possible, but the rate of degradation is dependent on numerous physical, chemical, and biological parameters (SRNL-STI-2012-00435). No further testing is recommended at this time based on the report. Maturation of CBP tools will be the focus for informing future activities.

Deliverable: Technical Report

Expected Completion Date: FY2012 (Complete)

Responsibility: SRR C&WDA

2.3.2.3 Cracking and Transport Literature Review

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 2009 SDF PA.

Literature Review: This activity, which began in FY2011, involves a review of existing literature needed to understand the mechanisms of crack formation and propagation in cementitious materials. The literature review was performed by Purdue University and compliments the NRC sponsored literature and assessment of factors relevant to performance of grouted systems for radioactive waste disposal.

FY2012 Results: The review identified information on factors that can influence transport in cracked cementitious materials and that material specific and structure specific measurements would be necessary to characterize transport in existing systems (SRNL-STI-2012-00267).

Deliverable: Technical Report

Expected Completion Date: 2QFY2012 (Complete)

Responsibility: SRR C&WDA

2.3.2.4 Measurement of Unsaturated Permeability of Fractured Saltstone

Description: Concerns have been raised that the unsaturated hydraulic conductivity of fractured saltstone has not been measured. This task would involve development and validation of a lab-scale approach for measuring relative permeability of fractured cementitious materials. This would be accomplished by development of a method for generating representative fracture networks, a method for the characterization of said fracture networks, and a method for measurement of permeability under unsaturated conditions.

Expected Benefit: This effort will provide model support for unsaturated hydraulic conductivities of fractured saltstone.

Deliverable: Technical Report

Expected Completion Date: 3QFY2014

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $150K, FY2014 $200K

2.3.2.5 Long-term Radiological Lysimeter Program

Description: Understanding the long-term behavior of radionuclides in saltstone is essential to models that project this behavior over thousands of years. 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, plutonium, iodine, and technetium in lysimeters to be placed in an outside environment. Measurement will target solubility and K_d values in soil and cementitious materials, and colloidal transport of various radionuclides. The total exposure time is anticipated to be 10 years. Soils and cementitious materials will be placed in the lysimeters and the reduction capacity, K_d, and solubility will be determined from the extracted solid samples after environmental exposure. Liquid leachate will be continually gathered and analyzed.

Expected Benefit: This task is expected to provide K_d values in soil and cementitious materials and colloidal transport measurements for various radionuclides. It will provide

additional information about long-term geochemical and transport phenomena that will be used to support the waste release and transport models used in the SDF, FTF, and HTF PAs.

FY2012: Completed the installation of the lysimeter and initiation of the sample collection program.

FY2013 through FY2021: Collect quarterly liquid samples from the lysimeter and transport to Clemson University for applicable analysis. The possibility exists that for any given quarter, sufficient rainfall may not have occurred and that leachate samples will not have accumulated such that there will not be data for that quarter.

Deliverable: Annual Technical Reports

Expected Completion Date: After FY2021

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $100K, FY2014 through FY2018 $105K - $125K

2.3.2.6 Studies Related to Cementitious Materials Degradation Due to Radiation Damage

Description: Saltstone is a cementitious waste form. As such, damage to cementitious materials from radiolytic mechanisms must be understood. For FY2013, a literature search will be conducted by a university to gain a better understanding of the potential degradation of cementitious materials exposed to radiation.

Expected Benefit: This activity is expected to produce a baseline of knowledge concerning cementitious degradation due to radiolytic mechanisms over long periods to inform 2009 SDF PA degradation assumptions. The data provided from this effort will also inform the HTF and FTF PAs.

Deliverable: Technical Report

Expected Completion Date: FY2014

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $40K, FY2014 $40K

2.3.2.7 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 2009 SDF PA.

Literature Review: This activity, which will begin in FY2015, 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 SDF 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 2009 SDF PA.

Deliverable: Technical Report

Expected Completion Date: FY2015

Responsibility: SRR C&WDA

Estimated Cost: FY2015 $150K

2.3.2.8 Closure Cap Drainage Layer Long-Term Performance

Description: This task will involve initial research and development regarding the long-term performance of the closure cap sand drainage layer. The effort will involve development of a test plan, acquisition of representative materials, grain size/geochemical analysis, colloid batch tests to characterize colloid potential, and colloid impact screening tests to identify characteristics of reasonable disruptive events. The data provided from this effort will also inform the SDF, HTF, and FTF PAs.

Expected Benefit: This effort will validate assumptions in the PAs concerning the rate of pluggage of the closure cap drainage layer as well as the drainage layer above each SDF disposal unit.

Deliverable: Technical Report

Expected Completion Date: FY2018

Responsibility: SRR C&WDA

Estimated Cost: FY2016 $100K, FY2017-FY2018 $50K/yr

2.3.2.9 Hydraulic Conductivity Comparison

Description: Demonstrate the applicability of the centrifugation technique for measuring the saturated hydraulic conductivity of saltstone grout. Measure the hydraulic conductivity of equivalent samples of saltstone grout via (1) centrifugation and (2) flexible-wall permeameter techniques. All samples used for this comparison will be identically prepared and subjected to identical temperature/humidity curing profiles.

Expected Benefit: If the two different techniques yield similar hydraulic conductivity results, then future testing for hydraulic conductivity can be performed via centrifugation and the time and cost for testing saltstone grout will greatly reduce.

Deliverable: Technical Report

Expected Completion Date: 4QFY2013

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $40K

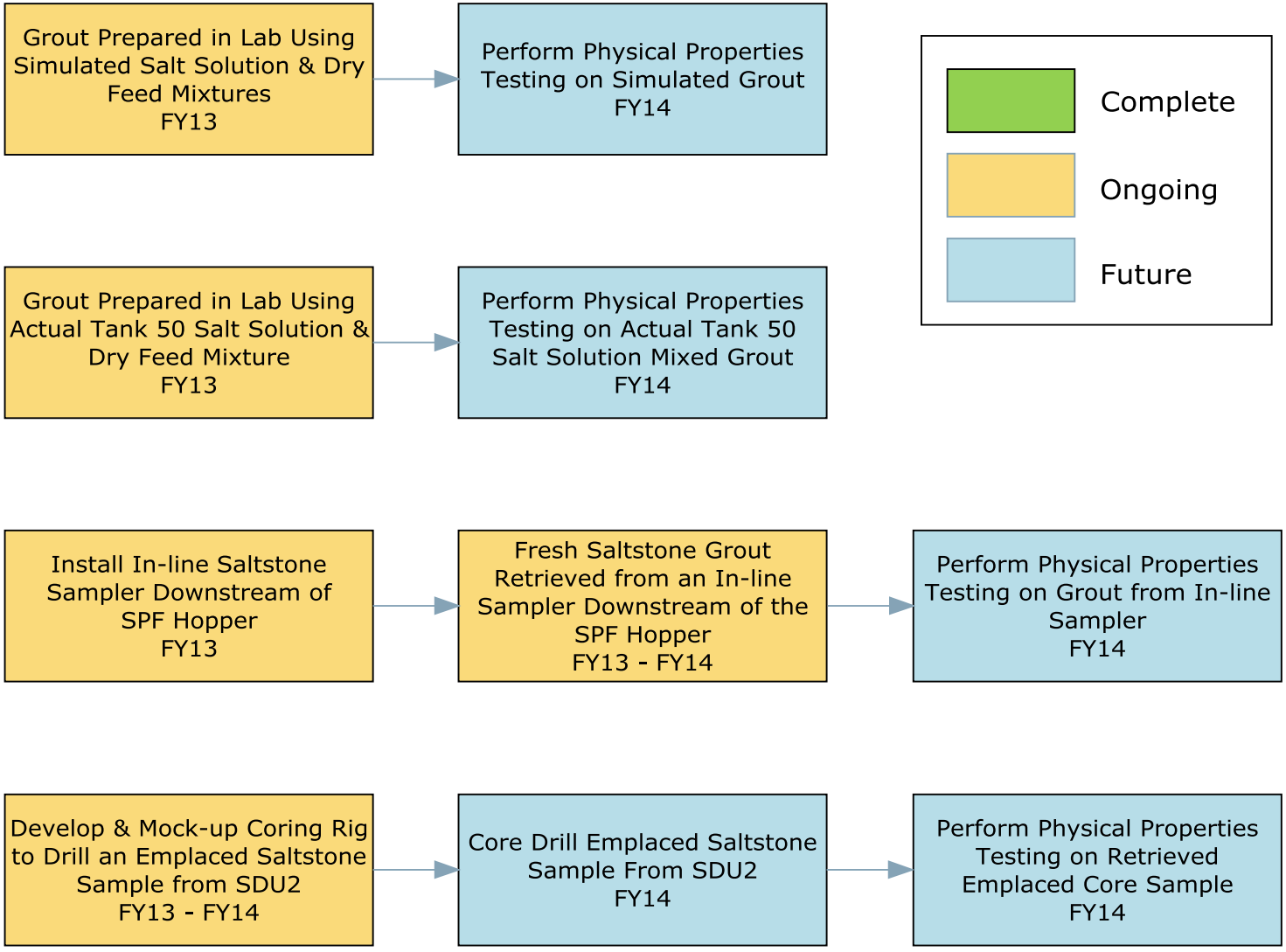
2.3.3 Emplaced Saltstone Sampling and Characterization

Maintenance activities presented in this section will establish the research and development programs in order to measure properties of emplaced saltstone samples. Saltstone samples collected from Vault 4 have undergone testing as described in Section 2.3.4.1. In the future, alternative sample collection methodologies will be employed that may have less impact on the sample itself.

A formed core-sampling device similar to that described in SRNL-STI-2010-00167 has been constructed and tested at full scale. The test included a comparison of hydraulic conductivity, porosity, and bulk density between the formed core simulant and cores drilled from a test apparatus. The results showed that there were differences in the hydraulic conductivity between the different sample types and this was attributed to the handling and storage of the samples (SRNL-STI-2012-00551). The bulk density and the porosity of the two samples were comparable.

During the design and mock-up testing of the formed core sampling device, it was determined that this sampling technique for emplaced saltstone sampling was not practical and that a different technique would be required to collect an emplaced saltstone sample from a SDU. Based on this determination, the current sampling strategy is shown in Figure 2.3-4 and is new for FY2013.

Figure 2.3-4: Emplaced Saltstone Testing Strategy



2.3.3.1 Measure Physical Properties of Laboratory Prepared Saltstone Simulant Samples, Actual Tank 50 Salt Solution Samples, Saltstone in-line Process Sample, and SDU2 Emplaced Core Sample

Description: Saltstone Engineering and the SRR Grout SME have developed a testing program that will compare laboratory prepared saltstone samples with actual emplaced saltstone samples taken from SDU2. This is a multi-year effort (Figure 2.3-4) with the collection and preparation of laboratory-simulated grout expected in FY2013 along with the installation of the saltstone in-line process sample tap. Additionally in FY2013, preliminary development of the saltstone core rig will be initiated for the eventual collection of an emplaced saltstone grout core sample from SDU2.

Laboratory prepared saltstone grout samples will produced from simulated salt solution and actual Tank 50 salt solution. Both sets of salt solution samples will be mixed with the appropriate amounts of saltstone dry feed materials at a 0.6 water to pre-mix ratio. The saltstone in-line process sample will be collected from the process control area downstream of the SPF hopper.

Preliminary design of the saltstone grout core rig will be initiated in FY2013 using outside expertise to determine the best design to retrieve the emplaced saltstone grout sample from SDU2.

In FY2014, the laboratory prepared samples will have physical properties testing performed to determine the hydraulic conductivity, distribution coefficient, bulk cured density, porosity, and micro structure/phase analysis. In FY2014, the wet sample from the in-line sampler will be poured and transferred to SRNL for curing and subsequent physical properties testing as described in the previous sentence.

In FY2014, the emplaced saltstone core rig will be developed and mocked-up for verification of suitability to be used for the collection of the emplaced core sample out of SDU2. Upon successful extraction of the core, the sample will be transported to SRNL for the same physical properties testing as described above.

Expected Benefit: This testing program will provide confidence that the laboratory prepared simulated saltstone grout has similar properties to the emplaced saltstone grout and that Performance Assessment assumptions can be made on laboratory prepared samples.

Deliverable: A final report that details all the physical properties testing for laboratory prepared and emplaced saltstone grout.

Expected Completion Date: FY2014

Responsibility: Saltstone Engineering and SRR Engineering

Estimated Cost: FY2013 $700K, FY2014 $2800K

2.3.4 To Be Determined Out Year Testing

Description: For FY2015 and beyond, testing has not been finalized however, for budget purpose estimated costs are included.

Responsibility: SRR C&WDA and SRR PA Maintenance IPT

Estimated Cost: FY2015 $240K, FY2016 $280K, FY2017 $330K, FY2018 $325K

3.0 F-AREA TANK FARM

3.1 FTF PA Annual Maintenance Activities

DOE M 435.1-1 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 are required every year in support of the FTF PA regardless of the status of any on-going or future PA revisions.

3.1.1 Maintain F-Area Tank Farm Performance Assessment Control through Unreviewed Waste Management Question Process

Description: Similar to the process set up for evaluating disposal related questions in SDF, a UWMQ process was established for FTF closure activities. The UWMQ process consists of providing UWMQEs 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 UWMQ process that a proposed activity or new information is outside the bounds of the approved NDAA Section 3116 Basis Document, PA, or CA, SAs are prepared to update the technical baseline. UWMQEs and SAs will continue to be required throughout the life of the facility. For planning purposes, the estimated cost assumes that 12 UWMQs will be prepared each year in the out-years. 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. The estimated cost will vary, up or down, depending on the actual number of UWMQEs 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 waste tank-specific SAs will be captured as part of the associated FTF Tier 2 closure plan as discussed in the Section 3.1.5 maintenance activity.

Deliverable: Provide UWMQEs, UWMQ procedure support, and SAs as needed to support closure of FTF.

Expected Completion Date: On-going

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2018 $85K/yr

3.1.2 Prepare Annual Performance Assessment Maintenance Program Implementation Plan

Description: The purpose of the LW PA Maintenance program is to confirm the continued adequacy of the current PA and to increase confidence in the results. Every year the annual LW 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.

Deliverable: Issue fiscal year LW PA Maintenance program implementation plan

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2013 through FY2018 $15K/yr

3.1.3 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.

Deliverable: 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: FY2013 through FY2018 $185K/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* (FFA), *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, EPA, CAB, and SCDHEC for review and comment. In FY2009, activities included initiation of comment resolution and preparation of PA comment response packages (SRR-CWDA-2009-00054, SRR-CWDA-2009-00055, and SRR-CWDA-2009-00056). Changes were incorporated into FTF PA Revision 0 and Revision 1 was issued March 31, 2010. In FY2011, the FTF PA, 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 were responded to in a comment response matrix SRR-CWDA-2009-00054. In FY2012 NRC issued a TER (ML112371715) with recommendations on waste-tank closure actions. Issuance of DOE's NDAA Section 3116 Waste Determination and supporting Basis

Document for FTF occurred in March 2012. In March 2012, following issuance of the Section 3116 determination for FTF closure (DOE-WD-2012-001), DOE approved the Tier 1 Closure Plan for FTF (SRR-CWDA-2010-00147) including its referenced FTF PA, Revision 1 (Tier 1 authorization letter, DOE_03-28-2012, was received March 28, 2012),. Along with approval of the FTF Tier 1 Closure Plan, DOE approved the Tanks 18/19 Tier 2 Closure Plan (SRR-CWDA-2011-00015), including its referenced Tanks 18/19 SA, Revision 0 (SRR-CWDA-2010-00124). Tanks 18 and 19 completed operational closure in FY2012 (September 2012).

Deliverable: Implementation of FTF PA

Expected Completion Date: Completed in FY2012

Responsibility: SRR C&WDA

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 FY2017. 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 UWMQEs completed to date
- Changes in site future land use plans or closure plans
- Changes to PA guidance documents requirements

Future FTF PA revisions will also consider the following:

- LFRG open items for the following four criteria: 3.1.6.5, 3.1.8.1, 3.1.8.2, and 3.1.8.3 (LFRG_08-13-2008)
- Comment Responses to SCDHEC and EPA on Revision 1 of the FTF PA (SRR-CWDA-2011-00164, SRR-CWDA-2011-00175)
- Responses to RAIs posed by the NRC (SRR-SWDA-2011-00054)
- NRC recommendations in the *U.S. Nuclear Regulatory Commission Plan for Monitoring Disposal Actions Taken by the U.S. Department of Energy at the Savannah River Site F-Area Tank Farm Facility* (ML12345A322), as discussed in detail in Section 3.3, F-Area Tank Farm Performance Assessment Testing & Research Activities.

Deliverable: Issue PA revision.

Expected Completion Date: FY2018

Responsibility: SRR C&WDA

Estimated Cost: FY2017 $1,500K, FY2018 $1,500K

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

Issuances of the FTF PA and the *Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site* (DOE/SRS-WD-2010-001) occurred in FY2012. After

approval and issuance of the FTF PA, additional PA-related testing and research activities identified as part of the on-going maintenance will be prioritized and performed per this Plan.

In the *U.S. Nuclear Regulatory Commission Plan for Monitoring Disposal Actions Taken by the U.S. Department of Energy at the Savannah River Site F-Area Tank Farm Facility* (ML12345A322), the NRC made recommendations, with respect to the various monitoring factors identified by the NRC, for DOE to consider during maintenance and monitoring of the FTF PA. These recommendations will require further evaluation to determine how and when they should be addressed. In the Monitoring Plan, the NRC recommendations (documented in Appendix A of ML12345A322) for select modeling factors include:

Monitoring Area 1 – Inventory

NRC recommends DOE better explain intratank waste variability that influences waste characterization and uncertainty evaluation. NRC's comments in this area were expressed in the context of Tank 18 sampling, but also pertain to future characterization of other tanks. Specifically, NRC commented on (i) lack of explanation regarding differences between past and current sample variability, (ii) potential lack of consideration and explanation of the unexpectedly high tank wall concentrations for Pu-238, and (iii) lack of basis for assumptions regarding normality of sample concentrations and volume estimates when calculating inventory multiplier to be used in the probabilistic analysis.

NRC recommends DOE consider improvements to residual material mapping and consideration of uncertainty in volume estimates.

Monitoring Area 2 – Waste Release

NRC recommends DOE perform experiments to verify validity of Geochemist's Workbench calculations used to determine solubility limiting phases, solubility limits, and chemical transition times. These experiments should study (i) pH and E_h evolution of the grout pore water over time, (ii) controlling solubility limiting phases, and (iii) static and dynamic leach tests to study the mobility of HRRs, including consideration of alteration of tank residuals following chemical cleaning with reagents, such as oxalic acid.

Monitoring Area 3 – Cementitious Material Performance

NRC recommends DOE consider uncertainty in initial conditions and performance lifetime of FTF concrete vaults, as they impact uncertainty in the calculated steel liner failure times.

NRC recommends DOE obtain greater support for its assumption regarding flow through the tank grout (i.e., fracture versus matrix) flow as it impacts the timing of chemical transition or time to release of HRRs at risk-significant solubility.

Given the wide range of values in the literature, NRC recommends DOE obtain additional support for basemat K_ds for plutonium and neptunium, including consideration of solubility affects from previous evaluations and representativeness of experimentally derived values for aged concrete.

Monitoring Area 4 – Natural System Performance

NRC recommended DOE evaluate appropriateness of averaging K_ds of multiple oxidation states to simulate the transport of plutonium in the natural system.

NRC recommends DOE continue to evaluate significance of calcareous zone dissolution on FTF flow and transport, including conduct of tracer studies and field mapping of seepage locations along Upper Three Runs.

Monitoring Area 5 – Closure Cap

NRC recommends DOE provide additional model support for (i) the long-term hydraulic conductivity of the upper foundation layer and lateral drainage layer and (ii) the long-term erosion of the topsoil layer.

NRC recommends DOE conduct a preliminary evaluation of erosion protection designs (e.g., assessment of an acceptable rock source, and the ability of an integrated drainage system to accommodate design features) prior to completing the final closure cap design.

Monitoring Area 6 – Performance Assessment Maintenance

NRC recommends DOE perform a systematic scenario analysis in which features, events, and processes (FEPs) are identified, screened, and dispositioned using transparent and traceable documentation of the FEPs considered, the screening arguments, and how FEPs are implemented in the models to support future, waste disposal efforts.

DOE should consider uncertainty in steel liner performance, including more aggressive service conditions and corrosion mechanisms than assumed in the PA, as well as a patch model for waste release, if deemed risk-significant.

NRC recommends DOE obtain additional support for probabilistic parameter distributions, including solubility limiting phases, cement K_ds (based on sediment variability), chemical transition times, basemat bypass, and configuration probability.

NRC recommends DOE acquire FTF specific data to support material property assignments, including hydraulic conductivity, moisture characteristic curves, and K_ds.

NRC recommends DOE address the significant amount of dispersion evident in its near-field and far-field PORFLOW models, including evaluation of the need for mesh refinement to ensure that contaminant plumes are not artificially dispersed over the volume of the cells in the far-field model. Nonphysical dispersion may be attributable to large changes in adjacent element size and large differences in element sizes between the vadose zone and far-field models. DOE should evaluate the adequacy of the time discretization of the model(s) for swiftly moving constituents such as Tc-99. NRC also recommends DOE evaluate appropriateness of the assumed level of physical dispersion in the FTF model (longitudinal and transverse vertical).

NRC recommends DOE provide greater transparency and traceability of far-field model calibration, including consideration of more extensive calibration focused strictly on the area of interest.

NRC recommends DOE evaluate plant transfer factor uncertainty in future updates to its PA. DOE should consider the appropriateness of excluding common vegetable types in its assignment of plant transfer factors (DOE only considers root vegetable data) based on production data rather than household data that might be more appropriate for a resident gardener.

NRC recommends DOE evaluate appropriateness of assumptions related to drinking water consumption in future updates to its PA, such as partitioning consumption rates based on use of both bottled and community water. Biosphere parameters should be reasonably conservative and reflect the behavior of the average member of the critical group.

NRC recommends DOE improve transparency and documentation of its benchmarking process. NRC recommends DOE apply a more methodical and systematic approach to the benchmarking process in future updates to its PA.

Monitoring Area 8 – Site Stability

NRC recommends DOE continue to evaluate closure cap settlement and stability, including consideration of (i) increased overburden from the waste tank grout and closure cap on settlement and (ii) potential for subsidence associated with ongoing dissolution of calcareous sediment in the Santee Formation. NRC concluded that assumed long-term compressive strength of the grout monolith is not adequately supported and may be optimistic based on observations of vault cracks. While cracking of the vault concrete and waste tank grout is not expected to result in significant structural waste tank collapse, the integrity of the vault concrete and waste tank grout is important to steel liner performance and waste release.

3.3.1 Tank Residual Characterization

These tasks involve measurements and methods that will improve upon current knowledge of materials remaining in the waste tanks at operational closure. Although these efforts are FTF activities, much of the information will also be used to inform the HTF PA described in Section 4.2. Additional maintenance items will be developed and performed as the FTF PA is implemented. Some maintenance activities established under the Z-Area SDF maintenance program (Section 2.0) also inform the FTF PA and HTF PA such as those concerning cementitious degradation, soil parameters, and fracture formation.

3.3.1.1 Improved Tank Residual Volume Measurements

Description: This task would focus on improvement of existing mapping and residual volume estimation techniques as well as investigation of alternative techniques.

FY2013: This task will involve finalizing improvement efforts to existing video/photograph residual volume estimation via training development initiated in FY 2012. Development of a training module will be completed and training of individuals will be performed. In addition, investigation of alternative techniques for residual volume estimation, to determine if an alternative method would add value to the current residual volume measurement techniques, initiated in FY2012 will continue. A field evaluation of laser mapping technology is anticipated to occur in FY2013.

Expected Benefit: This task is expected to improve residual volume mapping techniques that are used to inform plans for operational closure of the tank.

Deliverable: Issue Training Module and perform training for current methodology.

Issue Technical Report of field evaluation for laser technology

Expected Completion Date: 1QFY2013 (Perform training) - Complete

4QFY2013 (Issue technical report)

Responsibility: SRR Waste Removal and Closure Engineering

Estimated Cost: FY2013 $100K

3.3.1.2 Waste Release Studies

Description: Through the NDAA Section 3116(a) consultation process, the NRC observed that uncertainties associated with the FTF PA doses might prevent DOE from meeting the 10 CFR Part 61, Subpart C performance objectives, particularly with regard to plutonium-related modeling assumptions. The NRC staff's primary concern was that the timing of the FTF PA peak dose could be shifted into the period of performance. This peak dose is associated with the residual Pu-239 inventory in Tank 18. The NRC's TER (ML112371715) recommends that DOE provide additional model support to further reduce the uncertainty surrounding PA assumptions that, if found to be significantly non-conservative, could result in this peak dose shifting into the 10,000-year performance period.

FY2012: As a first step in addressing the NRC recommendations, DOE sought to determine if additional model support (focusing on plutonium solubility) existed outside of the DOE community, specifically within the DOE weapons laboratories. An expert panel was convened to provide technical advice relating to further documenting plutonium waste release and transport. The expert panel issued a *Plutonium Solubility Peer Review Report*, LA-UR-12-00079, containing several suggestions and opportunities for improvement regarding the plutonium modeling assumptions and Tank 18 residual waste experiments that would further strengthen the technical arguments. To implement the suggestions provided in the Peer Review Report and address the NRC recommendations, a series of new activities were completed that provides enhanced model support. These activities included:

1. Analyzing additional potential plutonium waste forms, including calculation of new plutonium solubility values utilizing the Nuclear Energy Agency – Thermochemical Database (NEA-TDB) for use in the waste release model
2. Issuing studies regarding potential areas of significant conservatism within the FTF PA conceptual model noted by the expert panel
3. Performing a series of new parametric barrier analyses for plutonium waste release (i.e., variability around plutonium solubility values) and plutonium transport (i.e., variability around plutonium sandy soil K_d values)
4. Utilizing updated plutonium K_d values that better reflect expected FTF soil conditions
5. Performing deterministic Base Case sensitivity runs showing the dose impact of uncertainty regarding both plutonium solubility and transport
6. Performing new probabilistic analysis incorporating the revised plutonium solubility values and updated plutonium K_d values
7. Testing of a Tank 18 waste sample using X-ray Diffraction and Scanning Electron Microscopy techniques.

The results of these analyses have been incorporated into the Tank 18/Tank 19 SA (described in Section 3.3.1.3).

Further tasks in FY2013 will involve development and implementation of an experimental plan to provide additional information and model support for the closure of Tank 18. The proposed task is intended to provide additional information regarding the residual waste solubility assumptions used in the FTF and HTF PA waste release models. This task will be performed in two parts, the first part being development of the test plan and methods and the second part being conducting the actual waste testing. The rate of performing activities will be dependent on analytical method maturity and budgetary constraints.

The overall objective of the task is to provide additional information regarding the residual waste solubility assumptions used in the FTF and HTF PA waste release models by developing a series of analytic methods to be used to test the solubility of plutonium, neptunium, uranium, and technetium under various simulated waste tank chemistry conditions using actual waste tank residuals. Contingent on successful validation of the analytic method developed and other concurrent LW PA Maintenance activities, a decision will be made as to whether to proceed with solubility testing using actual waste tank residuals for plutonium, neptunium, uranium, and technetium.

Deliverable: Technical Reports

Expected Completion Date: FY2014

Responsibility: SRR C&WDA

Estimated Cost: FY2013 $400K, FY2014 $900K

3.3.2 FTF Special Analyses

Description: SAs are performed to evaluate the significance of new information or new analytical methods to the results and associated conclusions of a PA. For the FTF, as waste tanks and ancillary equipment are cleaned, final residual inventories will be used to update the FTF fate and transport modeling performed as part of the FTF PA, allowing for evaluation of the difference between the projected and final waste tank inventories to determine if the results and conclusions of the FTF PA remain valid.

FY2012: The Tanks 18/19 SA used the FTF PA Base Case model to evaluate the final residuals that are planned to be grouted in-place in Tanks 18 and 19 (utilizing final residual characterization data). [SRR-CWDA-2010-00124] It also takes advantage of new information gathered/generated since Revision 1 of the FTF PA was developed, including information used to address Tank 18 observations and recommendations in the FTF TER. In September 2010, Revision 0a of the Tanks 18/19 SA was prepared and issued in support of operational closure of Tanks 18 and 19. Responses to the NRC RAIs, which utilized Revision 0a of the Tanks 18/19 SA, were provided to NRC in June 2011, and a TER for FTF (ML112371715) was issued in November 2011. Revision 0 of the Tanks 18/19 SA, addressing NRC TER issues and stakeholder comments, was issued in February 2012.

In FY2013, a Tanks 5 and 6 SA (SRR-CWDA-2012-00106) was prepared and issued in support of operational closure of Tanks 5 and 6. DOE comments on Revision 0 of the Tanks 5 and 6 SA will be incorporated and Revision 1 will be issued in FY2013.

Deliverable: SA for Tanks 18 and 19, SA for Tanks 5 and 6

Expected Completion Date: SA for Tanks 18/19 Complete (FY2012)

2QFY2013 (SA for Tanks 5 and 6) - Complete

Responsibility: SRR C&WDA

Estimated Cost: SA for Tanks 18 and 19 Complete, no additional costs

SA for Tanks 5 and 6 - FY2013 $200K

3.3.3 To Be Determined Out Year Testing

Description: For FY2015 and beyond, testing has not been finalized however, for budget purpose estimated costs are included.

Responsibility: SRR C&WDA and SRR PA Maintenance IPT

Estimated Cost: FY2015 through FY2018 $375K/yr

4.0 H-AREA TANK FARM

4.1 H-Area Tank Farm Performance Assessment Annual Maintenance Activities

DOE M 435.1-1 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 Waste Management Question Process

Description: The UWMQ process established for FTF will be applicable to HTF closure activities as well once the HTF PA is approved. 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 4.1.5.3

Deliverable: Provide UWMQEs, UWMQ procedure support and SAs as needed to support HTF closure.

Expected Completion Date: On-going

Responsibility: SRR C&WDA

Estimated Cost: FY2014 through FY2018 $85K/yr

4.1.2 Prepare Annual Performance Assessment Maintenance Program Implementation Plan

Description: The purpose of the LW PA Maintenance program is to confirm the continued adequacy of a facility PA and to increase confidence in the results. Every year the annual LW 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.

Deliverable: Issue fiscal year LW PA Maintenance program implementation plan.

Expected Completion Date: 2QFY (issued annually)

Responsibility: SRR C&WDA

Estimated Cost: FY2014 through FY2018 $15K/yr

4.1.3 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.

Deliverable: 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 FY2018 $185K/yr

4.1.4 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 (LFRG_01-14-2011).

Deliverable: Closure of LFRG secondary issue

Expected Completion Date: FY2014

Responsibility: SRR C&WDA

Estimated Cost: FY2014 $30K

4.2 H-Area Tank Farm Performance Assessment Development/Revisions

Initial planning for the HTF PA (SRR-CWDA-2010-00128) 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 submitted the HTF PA to SCDHEC and EPA by March 31, 2011. [Dispute Resolution_11-19-2007] The HTF PA provides the technical basis and results to be used in subsequent documents to demonstrate compliance with 10 CFR 61, DOE M 435.1-1, the FFA, and SCDHEC R.61-82 and R.61-67. Responses to SCDHEC (SRR-CWDA-2011-00135) and EPA (SRR-CWDA-2011-00134) comments have been issued to DOE, and HTF PA Revision 1 was issued to DOE in November 2012.

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

Description: The HTF PA was submitted for DOE review via an LFRG review team in November 2010. Revision 1 of the HTF PA, incorporating FTF PA lessons learned and comments on HTF PA Revision 0, was issued in 1QFY2013. DOE's Draft NDAA Section 3116 Basis Document for HTF was prepared in FY2013 and was provided, along with the HTF PA Revision 1, to the NRC to initiate HTF 3116 Consultation in FY2013. Completion of the review process is planned for 2QFY2013. Implementation is anticipated in FY2013.

Deliverable: Issue responses to NRC RAIs to DOE-SR for review.

Expected Completion Date:
2QFY2009 (Document modeling) – Complete
FY2010 (Draft PA to DOE) – Complete
2QFY2011 (LFRG approval of PA) – Complete
2QFY2011 (Issue PA to EPA and SCDHEC) – Complete
1QFY2012 (Comment responses to DOE) - Complete
2QFY2013 (Issue HTF PA Revision 1 to DOE) - Complete
FY2013 (RAI responses to NRC)

Responsibility: SRR C&WDA

Estimated Cost: 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 after FY2018. 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 UWMQEs completed to date
- Changes in site future land use plans or closure plans

- Changes to PA guidance documents requirements
- Modeling improvements as identified in the HTF QA report (SRR-CWDA-2012-00070)

Deliverable: Issue PA revision

Expected Completion Date: After FY2018

Responsibility: SRR C&WDA

Estimated Cost: After FY2018

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

This section of the LW 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 in FY2011 and Revision 1 was provided to DOE in 2QFY2013. Following completion Revision 1 comment resolution, testing and research activities will be identified for the HTF PA.

4.3.1 HTF Special Analyses

Description: SAs are performed to evaluate the significance of new information or new analytical methods to the results and associated conclusions of a PA. For the HTF, as waste tanks and ancillary equipment are cleaned, final residual inventories will be used to update the HTF fate and transport modeling performed as part of the HTF PA, allowing for evaluation of the difference between the projected and final waste tank inventories to determine if the results and conclusions of the HTF PA remain valid.

Deliverable: Issue waste tank specific SAs

Expected Completion Date: FY2014 (Tank 16 SA)

FY2015 (Tank 12 SA)

Responsibility: SRR C&WDA

Estimated Cost: FY2014 $200K, FY2015 $200K

4.3.2 Waste Tank Grout Free-Fall Physical Properties Testing

Description: For waste tank grouting, tremie tubes are currently used to facilitate short-fall placement of grout. If it can be shown that allowing the free fall of grout from the waste tank top and eliminating the need for tremies, then the time to grout a waste tank could be shortened and exposure to workers would be reduced.

Expected Benefit: Reduce the total time to grout a waste tank and reduce worker exposure.

Deliverable: Technical Report

Expected Completion Date: 4QFY2014

Responsibility: SRR C&WDA and SRR Tank Closure Engineering

Estimated Cost: FY2014 $100K

4.3.3 Waste Tank Grout Slump Loss over Distance of the Pump Run

Description: For waste tank grouting, the distance that the mixer truck can be positioned relative to the waste tank being grouted will greatly increase in HTF. Testing is required to verify that the current slump specification will allow suitable flow of grout over these increased distances.

Expected Benefit: Current grout formula will be acceptable for increase grout flows from the mixer truck to the waste tank.

Deliverable: Technical Report

Expected Completion Date: 4QFY2014

Responsibility: SRR C&WDA and SRR Tank Closure Engineering

Estimated Cost: FY2014 $100K

4.3.4 To Be Determined Out Year Testing

Description: For FY2014 and beyond testing has not been finalized however, for budget purpose estimated costs are included.

Responsibility: SRR C&WDA and SRR PA Maintenance IPT

Estimated Cost: FY2014 $175K, FY2015 through FY2018 $375K/yr

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APPENDIX A

Summary Tables for the Liquid Waste Facilities Performance Assessment Maintenance Program FY2013 Implementation Plan

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

Tables A.1-1 through A.1-3 summarizes the estimated expenditures by activity and fiscal year. Table A.1-4 contains a summary of the combined estimated expenditures for all the LW 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 SDF PA Maintenance Program ($K)

Section	Maintenance Activity	FY13	FY14	FY15	FY16	FY17	FY18
	Task Performed Annually						
2.1.1	Maintain SDF PA Control Through UWMQ Process	85	85	85	85	85	85
2.1.2	Conduct Annual SDF PA Validation	15	15	15	15	15	15
2.1.3	Prepare Annual PA Maintenance Program Implementation Plan	15	15	15	15	15	15
2.1.4	Maintain SDF Closure Plan	5	5	5	5	5	5
2.1.5	Maintain SDF PA Monitoring Plan	5	5	5	5	5	5
2.1.6	Provide General Technical Support on SDF PA Issues	575	575	575	575	575	575
	Annual Tasks Total	700	700	700	700	700	700
	Performance Assessment Development/Revisions						
2.2.1	PA Development for In-Progress SDF PA Revision	625	0	0	0	0	0
2.2.2	Prepare Out-year SDF PA Revisions	0	0	1,500	1,500	0	0
	PA Development/Revisions Total	625	0	1,500	1,500	0	0
	Testing and Research Activities						
2.3.1.3	Measurement of Distribution Coefficients is SRS Subsurface Sediments and Cement Leachate	145	0	0	0	0	0
2.3.1.4	PA Property Testing of Saltstone Produced in the SPF Operating Window	100	0	0	0	0	0
2.3.1.5	Saltstone Osmotic Pressure Impacts on Contaminant Movement	75	0	0	0	0	0
2.3.1.6	Determination of Oxidation Front in Saltstone	280	50	0	0	0	0
2.3.2.4	Measurement of Unsaturated Permeability of Fractured Saltstone	150	200	0	0	0	0
2.3.2.5	Long-term Radiological Lysimeter Program	100	105	110	115	120	125
2.3.2.6	Studies Related to Concrete Degradation Due to Radiation damage	40	40	0	0	0	0
2.3.2.7	Develop and Implement a Refined Stochastic Fracture Model	0	0	150	0	0	0
2.3.2.8	Closure Cap Drainage Layer Long-Term Performance	0	0	0	100	50	50
2.3.2.9	Hydraulic Conductivity Comparison	40	0	0	0	0	0
2.3.3.1	Measure Physical Properties of Laboratory and Field Emplaced Saltstone Grout	700	2,800	0	0	0	0
2.3.4	To Be Determined Out Year Testing	0	0	240	285	330	325
	Testing and Research Total	1,630	3,195	500	500	500	500
Z-AREA SDF PA COMPILED TOTAL		**2,955**	**3,895**	**2,700**	**2,700**	**1,200**	**1,200**

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

Section	Maintenance Activity	FY13	FY14	FY15	FY16	FY17	FY18
	Tasks Performed Annually						
3.1.1	Maintain FTF PA Control Through UWMQ Process	85	85	85	85	85	85
3.1.2	Prepare Annual PA Maintenance Program Implementation Plan	15	15	15	15	15	15
3.1.3	Provide General Technical Support on FTF PA Issues	185	185	185	185	185	185
	Annual Tasks Total	285	285	285	285	285	285
	Performance Assessment Development/Revisions						
3.2.2	Prepare Out-year FTF PA Revisions	0	0	0	0	1,500	1,500
3.3.2	FTF Special Analysis	100	0	0	0	0	0
	PA Development/Revisions Total	100	0	0	0	1,500	1,500
	Testing and Research Activities						
3.3.1.1	Improved Tank Residual Volume Measurements	100	0	0	0	0	0
3.3.1.2	Release Studies	400	900	0	0	0	0
3.3.3	To Be Determined Out Year Testing	0	0	375	375	375	375
Testing and Research Total		500	900	375	375	375	375
FTF PA COMPILED TOTAL		**885**	**1185**	**660**	**660**	**2160**	**2160**

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

Section	Maintenance Activity	FY13	FY14	FY15	FY16	FY17	FY18
	Tasks Performed Annually						
4.1.1	Maintain HTF PA Control Through UWMQ Process	0	85	85	85	85	85
4.1.2	Prepare Annual PA Maintenance Program Implementation Plan	0	15	15	15	15	15
4.1.3	Provide General Technical Support on HTF PA Issues	185	185	185	185	185	185
4.1.4	Develop Performance Assessment Model Archive and Revision Control	0	30	0	0	0	0
	Annual Tasks Total	170	315	285	285	285	285
	Performance Assessment Development/Revisions						
4.2.1	PA Development for In-Progress HTF PA	100	0	0	0	0	0
4.2.2	Prepare Out-year HTF PAs	0	0	0	0	0	0
	PA Development/Revisions Total	100	0	0	0	0	0
	Testing and Research Activities						
4.3	Future HTF PA Test and Research Activities To be Determined After Final PA Approval	0	0	0	0	0	0
4.3.1	HTF Special Analysis	0	200	200	0	0	0
4.3.2	Waste Tank Grout Free Fall Physical Properties Testing	0	100	0	0	0	0
4.3.3	Waste Tank Grout Slump Loss Over Distance of Pump Run	0	100	0	0	0	0
4.3.4	To Be Determined Out Year Testing	0	175	375	375	375	375
	Testing and Research Total	0	575	575	375	375	375
HTF PA COMPILED TOTAL		**270**	**890**	**860**	**660**	**660**	**660**

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

Liquid Waste Facility PA Maintenance Program	FY13	FY14	FY15	FY16	FY17	FY18
Z-Area SDF PA Maintenance Program Totals	**2,955**	**3,895**	**2,700**	**2,700**	**1,200**	**1,200**
FTF PA Maintenance Program Totals	**885**	**1,185**	**660**	**660**	**2160**	**2160**
HTF PA Maintenance Program Totals	**270**	**890**	**860**	**660**	**660**	**660**
COMPILED TOTAL	**4,110**	**5970**	**4,220**	**4,020**	**4,020**	**4,020**