SRR-CWDA-2012-00045
Revision 1

Nuclear Regulatory Commission's F-Tank Farm Technical Evaluation Report's Recommendations – Department of Energy's Activity Summary Matrix

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1.0 BACKGROUND

On September 30, 2010, the Department of Energy (DOE) issued the *Draft Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site* for Nuclear Regulatory Commission (NRC) consultative review, as part of DOE's consultation with NRC under the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), Section 3116(a). [DOE/SRS-WD-2010-001] On October 27, 2011, NRC issued its *Technical Evaluation Report for F-Area Tank Farm Facility, Savannah River Site, South Carolina.* [M112371715] The Technical Evaluation Report (TER) presents NRC's consultative observations and recommendations to DOE for consideration.[1]

2.0 PATH FORWARD ON NRC RECOMMENDATIONS

Attachment 1 of this document contains a matrix that lists the respective NRC recommendation/ observation, the DOE path forward, the technical justification for the path forward, as applicable, and the status at the time of issuance of this document. Many of the recommendations also are discussed in further detail in the *Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site* (hereinafter referred to as FTF 3116 Basis Document). [DOE/SRS-WD-2012-001]

This Attachment is intended to depict DOE's thorough and thoughtful consideration of the NRC TER. Additional recommendations, not reflected on the attached matrix, are discussed in the FTF 3116 Basis Document and associated references, which together with Attachment 1 show careful consideration by DOE of all of the recommendations and observations in the TER and Transmittal Letter.

Several of the recommendations in the TER address matters that are not specified in Section 3116(a) of the NDAA. To take full advantage of the consultation with NRC, DOE has nevertheless considered and addressed such recommendations.

Attachment 1 identifies the NRC recommendations included in the TER and associated Transmittal Letter, as well as other observations noted by the NRC, and the Department's path forward to address the recommendations.

The recommendations are arranged by how they appear in the documentation in the following order:

1. Transmittal Letter
2. TER Executive Summary
3. TER Section 5 (page 179)
4. Remainder by order they appear in the TER

The recommendation/observation number located in the first column of the matrix was not assigned by the NRC and has been included simply as a way to identify the recommendations to support discussions.

The columns titled "NRC Risk Significance" and "NRC Timing" represent terms assigned to the recommendations by the NRC in the TER. If the NRC did not assign a risk significance or timing to the recommendation it is denoted as "N/A".

The NRC defines these terms in footnote 7 on page 95 of the TER as:

> "Items of low risk-significance may reduce safety margin but are not expected to be able to alter compliance conclusions alone, while items of high risk-significance are expected to impact the compliance demonstration. Short term recommendations are expected to occur in the next couple of years, intermediate recommendations are expected to occur prior to tank farm closure, and long-term/maintenance recommendations are expected to be either (i) optional or (ii) contingent on results of other analyses."

[1] On page 8 of the TER, the NRC notes, "NRC's review results and recommendations are being provided to DOE for consideration only and are not intended to represent any regulatory authority related to DOE's waste determination (WD) activities. DOE is solely responsible for determining whether the waste streams addressed in the draft basis are not HLW and therefore, satisfy the requirements in Section 3116 of the NDAA."

For Recommendations #37-40 of this matrix, NRC further defines these terms on page 134 of the TER as, "High Risk-Significance, Short Term (Tank 18) and Intermediate-Term (other tanks)." Importantly, DOE has already addressed all recommendations which NRC designated in the TER as being "high risk significance", "short term" recommendations. In some instances, DOE has used enhanced alternative means to address the recommendations. In particular, for NRC Recommendation #5, NRC recommended waste release experiments related to plutonium solubility; DOE obtained information from the Nuclear Energy Agency Thermochemical Database (NEA-TDB) – an internationally recognized, peer-reviewed, experimentally based database – to meet this recommendation in a more comprehensive and scientifically enhanced manner.

Cells contained in the matrix that do not contain any information have intentionally been left blank because they are, for example, observations agreeing with DOE's approach, and there are no specific path forward activities needed to address the observation.

3.0 REFERENCES

DOE G 435.1-1, *Implementation Guide for use with DOE M 435.1-1*, U.S. Department of Energy, Washington DC, July 9, 1999.

DOE M 435.1-1, Chg. 1, *Radioactive Waste Management Manual,* U.S. Department of Energy, Washington DC, June 19, 2001.

DOE O 435.1, Chg. 1, *Radioactive Waste Management*, U.S. Department of Energy, Washington DC, August 28, 2001.

DOE/SRS-WD-2010-001, *Draft Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, September 30, 2010.

DOE/SRS-WD-2011-001, *Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization*, Savannah River Site, Aiken, SC, June 16, 2011.

DOE/SRS-WD-2012-001, *Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, March 2012.

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LWO-RIP-2009-00009, Birk, M.B., *Industrial Wastewater General Closure Plan for F-Area Waste Tank Systems*, Savannah River Site, Aiken, SC, Rev. 3, January 24, 2011.

ML112371715, *Technical Evaluation Report for F-Area Tank Farm Facility, Savannah River Site, South Carolina*, U.S. Nuclear Regulatory Commission, Washington DC, October 27, 2011.

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SRNL-L3100-2012-00017, Hay, M.S., et al., *Summary of XRD and SEM Analysis of Tank 18 Samples*, Savannah River Site, Aiken, SC, Rev. 0, February 23, 2012.

SRNL-L3200-2011-00011, Millings, M. et al., *Summary Dissolved Oxygen in Water Table Wells at SRS*, Savannah River Site, Aiken, SC, December 21, 2011.

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SRNL-STI-2012-00040, Dien, L. and Kaplan, D.I., *Literature Review on the Sorption of Plutonium, Uranium, Neptunium, Americium, and Technetium to Corrosion Products on Waste Tank Liners*, Savannah River Site, Aiken, SC, Rev. 0, February 2012.

SRNL-STI-2012-00079, Amidon, M.B., et al., *Alternative Risk Reduction Technologies in Support of F-Tank Farm Closure*, Savannah River Site, Aiken, SC, February 2012.

SRNL-STI-2012-00087, Denham, M., *Evolution of Chemical Conditions and Estimated Plutonium Solubility in the Residual Waste Layer During Post-Closure Aging of Tank 18*, Savannah River Site, Aiken, SC, Rev. 0, February 2012.

SRNL-STI-2012-00106, Hobbs, D.T., *Form and Aging of Plutonium in Savannah River Site Waste Tank 18*, Savannah River Site, Aiken, SC, Rev. 0, February 2012.

SRR-CWDA-2010-00124, Layton, M., *Tank 18/Tank 19 Special Analysis for the Performance Assessment for the F-Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 0, February 2011.

SRR-CWDA-2011-00005, *Tank 6 History of Waste Removal 1964 through 2010*, Savannah River Site, Aiken, SC, Rev. 1, June 16, 2011.

SRR-CWDA-2011-00015, F-Tank Farm Tanks 18 and 19 DOE Manual 435.1-1 Tier 2 Closure Authorization, Savannah River Site, Aiken, SC, Rev. 0, final issuance date to be determined.

SRR-CWDA-2011-00005, *Tank 6 History of Waste Removal 1964 through 2010*, Savannah River Site, Aiken, SC, Rev. 1, June 16, 2011.

SRR-CWDA-2011-00033, *Tank 5 History of Waste Removal 1959 through 2010*, Savannah River Site, Aiken, SC, Rev. 1, June 16, 2011.

SRR-CWDA-2011-00091, *Documentation of Removal of Highly Radioactive Radionuclides in Waste Tanks 18 and 19*, Savannah River Site, Aiken, SC, Rev. 0, June 2011.

SRR-CWDA-2012-00020, *Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program—FY2012 Implementation Plan,* Savannah River Site, Aiken, SC, Rev. 0, March 2012.

SRR-CWDA-2012-00022, *Evaluation of Features, Events, and Processes in the F-Area Tank Farm Performance Assessment*, Savannah River Site, Aiken, SC, Rev. 0, February 15, 2012.

SRR-CWDA-2012-00026, *Cost–Benefit Analysis for Removal of Additional Highly Radioactive Radionuclides From Tank 18*, Savannah River Site, Aiken, SC, Rev. 1, March 2012.

SRS-REG-2007-00002, *Performance Assessment for the F-Tank Farm at the Savannah River Site*, Savannah River Site, Rev. 1, March 31, 2010.

WSRC-OS-94-42, *Federal Facility Agreement for the Savannah River Site*, http://www.srs.gov/general/programs/soil/ffa/ffa.pdf, Savannah River Site, Aiken, SC, March 9, 2010.

Table 1: Nuclear Regulatory Commission's F-Tank Farm Technical Evaluation Report Recommendations Matrix

Rec/Obs #	TER Page #	TER Section (Evaluation)	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Current Status
1	Transmittal Letter, 9 & 29	2.2	3116(a)(1) [Deep Geologic Repository]	Transmittal Letter *With regard to Criterion 1, provided that DOE can meet remaining NDAA criteria (Criteria 2 and 3), there is no indication that other considerations would warrant the disposal of the waste in a geologic repository.* TER page 9 *Because there appears to be no special properties of the waste and there are no proliferation concerns that would necessitate deep geologic disposal, NRC staff notes that NDAA Criterion 1 can be met for all tanks. That is, the cleaned tanks do not require exhumation and disposal in a geologic repository.* TER page 29 *Provided that DOE can meet the remaining NDAA criteria (Criteria 2 and 3), there is no indication that other considerations would warrant disposal of the waste in a geologic repository because there appears to be no special properties of the waste and there are no proliferation concerns. The NRC believes that DOE can meet Criterion 1.*	N/A	N/A			• Added a footnote to the FTF 3116 Basis Document (Section 4) stating that NRC believes, provided Criteria 2 and 3 can be met, DOE can meet Criterion 1.
2	Transmittal Letter, 11, 80 & 81	3.8.1	3116(a)(2) [HRR Removal to MEP]	Transmittal Letter, TER page 11 and 81 (emphasis added—bold) *Given its risk-significance, the NRC staff thinks that DOE should more fully evaluate the practicality of additional radionuclide removal from Tank 18 and* ***explore options for delaying final closure (i.e., grouting) of Tank 18*** *for the reasons listed below.* ***It is important to note that the risk associated with a short delay in the grouting of Tank 18 on the order of a few years is not expected to be significant*** *given ongoing operation and maintenance of the FTF and the fact that a large portion of the residual liquid waste has been removed; however, a decision to delay the grouting of Tank 18 should consider any associated short term risks.* TER page 80 *The next stage of the process for Tanks 18 and 19 is to fill the tanks with a cement-based grout. DOE states that this will have several advantages. . . . The staff* [NRC] *thinks these advantages are realized in the longer time frame. . . .* *If adhering to the schedule in the FFA is the primary concern, NRC staff has not been provided sufficient information to conclude that approval from SCDHEC and*	N/A	N/A	• DOE previously delayed the closure of Tank 18 and Tank 19 by more than five years to perform additional waste removal risk reduction activities (i.e., deployment of Mantis) • DOE is also delaying issuance of the FTF 3116 Basis Document and other supporting closure documentation, and therefore stabilization of Tank 18, as it takes into consideration the recommendations of the NRC provided within the TER	As shown within this matrix, DOE has performed a number of activities to provide additional information prior to the Secretary of Energy making a determination pursuant to NDAA 3116(a). DOE has undertaken the following activities to address recommendations made by the NRC: ► Prepared a more rigorous cost-benefit analysis of the benefits of additional waste removal from Tank 18 versus the costs and risks associated with additional removal and delaying of closure of Tank 18 with an associated new Systems Engineering Evaluation (SEE) on options for additional waste removal from Tank 18 [SRR-CWDA-2012-00026] ► Performed a formal Features, Events, and Processes (FEPs) review for FTF [SRR-CWDA-2012-00022] ► Plutonium experts from around the DOE Complex performed a peer review of the plutonium solubility model utilized in the FTF Performance Assessment [LA-UR 12-00079] ► Based on results of the Plutonium Solubility Peer Review, the inputs to the	• Added a new subsection to the FTF 3116 Basis Document in Section 1 acknowledging the NRC statement about delaying of Tank 18, describing the NDAA Section 3116(a) consultation process and describing the activities and resulting conclusions supporting moving forward with stabilizing Tanks 18 and 19.

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				EPA for a delay in the FFA schedule for Tank 18 could not be obtained. Note: This entry in the matrix is addressing the NRC recommendation to "explore options for delaying final closure" and the statement that "the risk associated with a short delay . . . is not expected to be significant". The "reasons listed below" are addressed in the matrix entry for Recommendation #3.				waste release model were revised to incorporate new solubility information [SRNL-STI-2012-00087] ► Performed studies on impact of dissolved oxygen on waste release [SRNL-L3200-2011-00011], Tank 18 plutonium speciation [SRNL-STI-2012-00106], degraded tank liner [SRNL-STI-2012-00040], and plutonium soil K_ds [SRNL-STI-2011-00672] ► Testing of Tank 18 waste samples using X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) analysis was performed in an attempt to better understand plutonium speciation in Tank 18 [SRNL-3100-2012-00017] ► The Tank 18/Tank 19 Special Analysis (i.e., supplement to the FTF Performance Assessment) was revised to include several new sensitivity cases concerning plutonium solubility and plutonium transport [SRR-CWDA-2010-00124] ► Documented technologies available for post-operational closure installation under RCRA/CERCLA for additional risk-reduction opportunities [SRNL-STI-2012-00079]	
3	Transmittal Letter, 11 & 81	3.8.1	3116(a)(2) [HRR Removal to MEP]	Transmittal Letter, TER page 11 and 81 (emphasis added—bold) *Given its risk-significance, the NRC staff thinks that DOE should more fully evaluate the practicality of additional radionuclide removal from Tank 18 and explore options for delaying final closure (i.e., grouting) of Tank 18* ***for the reasons listed below*** *. . .* *1. Insufficient information was provided to the NRC staff related to the costs and benefits of additional radionuclide removal and other factors influencing the decision regarding practicality of additional HRR removal from Tank 18. The NRC staff recommends that DOE provide additional information or perform additional analysis to support the Criterion 2 demonstration for Tank 18.* *2. Significant technical uncertainties exist with respect to DOE's ability to meet the performance objectives in 10 CFR Part 61, Subpart C, that the NRC staff thinks can be addressed in the near-term (e.g., solubility studies). Permanent closure activities such as grouting of the waste tank may make it more difficult for DOE to evaluate or reduce the risks associated with this waste tank in the future, if risk reduction is deemed necessary pending results of future research. Additionally, the results of the*	N/A	N/A	• DOE is performing a Tank 18 cost-benefit analysis supported by a Tank 18-specific SEE to evaluate technologies that may have emerged or became "practical" since the completion of cleaning efforts in Tank 18 in 2009. The SEE will include evaluation criteria consistent with NDAA Section 3116 Criterion 2 (e.g., HRR removal effectiveness) and the FTF Performance Assessment, as will the subsequent cost-benefit analysis. Results of the Tank 18/Tank 19 Special Analysis (discussed below) will be utilized to support the cost-benefit analysis. • DOE will develop new sensitivity cases that will utilize peer-reviewed and internationally accepted thermodynamic data for plutonium solubility in the waste release model. The sensitivity cases will be documented in a revision to the Tank 18/Tank 19 Special Analysis. • DOE will develop a document describing technologies available for post-operational closure installation under RCRA/CERCLA for	The new Tank 18 SEE and cost-benefit analysis will address reasons 1 and 3 noted in the NRC recommendation. On page 12 of the TER, NRC summarizes, in part, its "key review results related to Criterion 3" with the following statement: "Although DOE's overall approach to modeling waste release is reasonable, DOE assumptions regarding solubility limiting phases, solubility limits, and chemical transition times are particularly risk significant and have not been confirmed through waste characterization and experimentation." Revisions to the Tank 18/Tank 19 Special Analysis address reason 2 of the NRC recommendation. Although the path forward is not specifically "solubility studies", the activities supporting the Tank 18/Tank 19 Special Analysis address the NRC concern relative to uncertainty of the timing of the peak dose associated with Tank 18 Pu-239. More detailed discussion is available under Recommendations #37-40.	• Added wording to technology discussions in the FTF 3116 Basis Document concerning cost-benefit associated with previous technology selections. • Issued a Tank 18 cost-benefit analysis with associated SEE, SRR-CWDA-2012-00026. • New Tank 18 cost-benefit analysis with associated SEE is summarized in the FTF 3116 Basis Document and Tank 18/Tank 19 Tier 2 Closure Authorization. [SRR-CWDA-2011-00015] • Tank 18/Tank 19 Special Analysis, SRR-CWDA-2010-00124, contains results of new sensitivity cases and is summarized and referenced in the FTF 3116 Basis Document and Tank 18/Tank 19 Tier 2 Closure Authorization. It includes a discussion of the revised waste release model incorporating the thermodynamic data from the NEA-TDB, additional science studies and plutonium speciation

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				near term studies could reduce the extent to which other uncertainties will need to be addressed to support Criterion 3 of the NDAA for tank farm closure. *3. A delay in Tank 18 grouting could provide additional time for alternative technologies to be developed (e.g., the improved Mantis design that is anticipated to be used on the H-Tank Farm, Type IV tanks), that could result in greater removal of HRRs from Tank 18, if additional HRR removal is deemed practical.* Note: Reasons listed are numbered only in the Transmittal Letter, items are denoted by bullets on TER pages 11 & 81.			additional risk-reduction opportunities, if needed to protect human health and the environment. • Tank 18 residual waste samples have been archived for future testing, if appropriate. • XRD and SEM testing of Tank 18 samples will be performed for plutonium speciation insights.	Path forward is consistent with recommendations from the Plutonium Solubility Peer Review Team which recommended use of internationally recognized peer reviewed Nuclear Energy Agency Thermochemical Database (NEA-TDB) and archiving of Tank 18 samples adequate to proceed with closure (i.e., grouting) activities.	experiments on Tank 18 samples (i.e., XRD and SEM). • Prepared an alternative post-operational closure technologies document [SRNL-STI-2012-00079] and referenced the document in the FTF 3116 Basis Document.
4	Transmittal Letter, 11 & 81	3.8.1	3116(a)(2) [HRR Removal to MEP]	Transmittal Letter *While similar information is provided to support DOE's assessment of NDAA Criterion 2 for Tank 19, considering the lower residual inventory and risk associated with this tank, NRC staff agrees that DOE can proceed with final closure of Tank 19 as planned.* TER page 11 *Although the information provided for Tank 19 under Criterion 2 is similar to that provided for Tank 18, given the lower inventory and risk associated with Tank 19, NRC staff thinks that final closure of Tank 19 can proceed as planned.* TER page 81 *Although the quality of information provided for Tank 19 is similar to that provided for Tank 18, given the lower risk-significance of Tank 19, NRC staff thinks that final closure of Tank 19 can proceed as planned.*	N/A	N/A			• NRC's conclusion has been noted in the FTF 3116 Basis Document.

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5	Transmittal Letter, 13 & 178	4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	Transmittal Letter, TER page 13 and 178 (emphasis added—bold) *The NRC staff recommends that DOE conduct waste release experiments to increase support for key modeling assumptions related to: (i) the evolution of pH and Eh in the grouted tank system over time; (ii) identification of HRR association with solid phases comprising the residual wastes; and (iii) expected solubility of HRRs,* ***such as plutonium,*** *under a range of environmental or service conditions that the residual wastes in the contaminated zone are expected to be exposed to over time.* Note: Bold text shown above is added for emphasis, this portion of the text is not included on pages 13 and 178 of the TER.	High	Short to Intermediate	• The path forward for items (i), (ii), and (iii) are discussed in detail in the matrix entries for Recommendations 37-40.	The technical justification for path forward for items (i), (ii), and (iii) are discussed in detail in the matrix entries for Recommendations 37-40.	• Alternative activities consistent with the recommendations of the Plutonium Solubility Peer Review team have been implemented. The results of these activities, as described in the FTF 3116 Basis Document, provide further reasonable assurance that the 10 CFR 61, Subpart C, 61.41 performance objective will be met in the 10,000-year performance period.
6	10 & 79	3.2.2	3116(a)(2) [HRR Removal to MEP]	*NRC staff recommends that DOE explore methods to improve the process by which residual waste volumes and associated uncertainty are estimated.*	N/A	N/A	• DOE will evaluate this recommendation as part of the performance assessment (PA) maintenance under DOE Manual 435.1-1. • DOE will share information in this area with the NRC as available under NDAA 3116 monitoring.		• Added a footnote to the FTF 3116 Basis Document (Section 2) noting that DOE will continue to evaluate methods to enhance tank residual volume estimation and associated uncertainty under DOE Manual 435.1-1 pursuant to DOE's responsibility under the Atomic Energy Act of 1954, as amended. • This activity has been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan, SRR-CWDA-2012-00020, and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.

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7	10 & 79	3.4	3116(a)(2) [HRR Removal to MEP]	*NRC staff recommends that DOE continue to evaluate its HRR list as additional information becomes available, to the extent that the list of HRRs is used to inform decisions such as the selection of radionuclides characterized in residual waste, selection of treatment technologies, and screening of radionuclides for the purpose of Performance Assessment (PA) calculations.*	N/A	N/A	• DOE will continue to characterize and confirm the actual residuals after cleaning, with an emphasis on HRRs. These evaluations will be performed through the development of special analyses, future revisions to the FTF PA and the tank-specific Tier 2 authorization documents following final residual characterization. These activities will be performed under DOE Manual 435.1-1, pursuant to DOE responsibilities under the Atomic Energy Act of 1954, as amended. • DOE will share information in this area with the NRC as available under NDAA 3116 monitoring	Continued confirmation of the list of HRRs following a NDAA Section 3116(a) Secretarial determination is not required by NDAA Section 3116(a) and is not part of NRC's statutorily- prescribed monitoring, in coordination with the State of South Carolina, under NDAA Section 3116(b), Nevertheless, DOE will continue to characterize and confirm the actual residuals after cleaning, with emphasis on HRRs, under DOE Manual 435.1-1, pursuant to DOE responsibilities under the Atomic Energy Act of 1954, as amended.	• NRC's conclusion regarding DOE's process for identification of HRRs (e.g., "DOE's process for identification of HRRs is reasonable . . ." NRC TER page 10) has been noted in the FTF 3116 Basis Document. • Added a footnote to the FTF 3116 Basis Document (Section 5) noting that DOE will continue to characterize and confirm the actual residuals after cleaning, with an emphasis on HRRs. These evaluations will be performed through the development of special analyses, future revisions to the FTF PA and the tank-specific Tier 2 authorization documents following final residual characterization. These activities will be performed under DOE Manual 435.1-1, pursuant to DOE responsibilities under the Atomic Energy Act of 1954, as amended.
8	10 & 79	3.6 & 3.8.2	3116(a)(2) [HRR Removal to MEP]	*As practical, NRC staff recommends that DOE continue to participate in technology exchanges and continuously evaluate new cleaning technologies as they become available, rather than defaulting to previously selected technologies, or relying on previous evaluations for technology selection.*	N/A	N/A	• DOE will continue to participate in technology exchanges and consider how to better assess and optimize the effectiveness of selected technologies, as appropriate. These activities will be performed under DOE Manual 435.1-1, pursuant to DOE responsibilities under the Atomic Energy Act of 1954, as amended. • DOE will share information in this area with the NRC as available under NDAA 3116 monitoring		• Documentation of technology reviews will be developed and presented to the South Carolina Department of Health and Environmental Control consistent with agreements set forth in the FTF General Closure Plan. [LWO-RIP-2009-00009] • Added a footnote to the FTF 3116 Basis Document (Section 2) noting that DOE will continue to participate in technology exchanges and consider how to better assess and optimize the effectiveness of selected technologies. These activities will be performed under DOE Manual 435.1-1, pursuant to DOE responsibilities under the Atomic Energy Act of 1954, as amended.

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9	10 & 79	3.8.2	3116(a)(2) [HRR Removal to MEP]	*NRC staff recommends that DOE consider how it might better assess and optimize the effectiveness of selected technologies (e.g., obtain better baseline information).*	N/A	N/A	• The content of Approach for Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001, will be added to the FTF 3116 Basis Document as a new appendix. Note: DOE/SRS-WD-2011-001 was provided to the NRC as part of the DOE response package to NRC Request for Additional Information (RAIs) during the NDAA Section 3116(a) consultation.		• The content of DOE/SRS-WD-2011-001 has been added to the FTF 3116 Basis Document as a new appendix, Appendix B. • Added a footnote to the final FTF 3116 Basis Document (Section 2) noting that DOE will continue to participate in technology exchanges and consider how to better assess and optimize the effectiveness of selected technologies. These activities will be performed under DOE Manual 435.1-1, pursuant to DOE responsibilities under the Atomic Energy Act of 1954, as amended.
10	10 & 79	3.8.2	3116(a)(2) [HRR Removal to MEP]	*NRC staff recommends that DOE provide more emphasis on removal of HRRs in its technology selection process and provide a clearer linkage between the Criterion 2 evaluation and the PA results, including consideration of long-term risks associated with the FTF facility.*	N/A	N/A	• Future technology selection/optimization will be informed by the FTF Performance Assessment and DOE will take into consideration specific radionuclides to possibly target HRR removal as described in Approach for Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001. • The content of DOE/SRS-WD-2011-001, will be added to the FTF 3116 Basis Document as a new appendix.		• Added a footnote to the FTF 3116 Basis Document (Section 2) noting that future technology selection/optimization will be informed by the FTF Performance Assessment and DOE will take into consideration specific radionuclides to possibly target HRR removal as described in Approach for Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001. • The content of DOE/SRS-WD-2011-001, has been added to the FTF 3116 Basis Document as a new appendix, Appendix B.
11	11 & 80	3.8.2	3116(a)(2) [HRR Removal to MEP]	*NRC staff recommends that DOE provide additional detail on the methods to be used to demonstrate removal to the MEP to ensure consistent (non-arbitrary) application of the criterion.*	N/A	N/A	• For future tank cleaning activities and subsequent documentation of radionuclide removal, DOE and its contactor will be consistent with Approach for Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001 • The content of DOE/SRS-WD-2011-001 will be added to the FTF 3116 Basis Document as a new appendix.	Approach for Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001, outlines and describes the approach used by DOE for each of the Savannah River Site waste tanks or ancillary structures to document removal of radionuclides with emphasis on HRRs.	• The content of DOE/SRS-WD-2011-001 has been added to the FTF 3116 Basis Document as a new appendix, Appendix B.

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12	11	3.8.1	3116(a)(2) [HRR Removal to MEP]	*Using the cost-benefit analysis performed for Tanks 18 and 19 as an example, NRC staff recommends that DOE perform a more rigorous cost-benefit analysis that includes consideration of the long-term benefits associated with additional radionuclide removal, to demonstrate removal to the MEP for FTF tanks that will be cleaned in the future.* Note: Recommendation #25 speaks specifically to Tank 18 cost-benefit analysis.	N/A	N/A	• Add text to Section 5 of the FTF 3116 Basis Document specifying that cost-benefit analyses will be done as described in Approach for Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001.	This is a recommendation for future tanks, not Tank 18 or 19 specific. See Recommendation #25 for Tank 18 specific recommendation.	• In alignment with DOE/SRS-WD-2011-001, cost-benefit analyses will include specific criteria that is informed by the FTF Performance Assessment and targeted HRR removal. • The content of DOE/SRS-WD-2011-001 has been added to the FTF 3116 Basis Document as a new appendix, Appendix B, and text addressing these actions was added to FTF 3116 Basis Document (Section 5). • Documentation of cost-benefit analyses will be provided in the HRR Removal Report for each tank or ancillary structure consistent with DOE/SRS-WD-2011-001 and Appendix B of FTF 3116 Basis Document.
13	13, 151, 178 & 179	4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	TER page 13 & 178 (emphasis added—bold) *NRC staff recommends that DOE conduct waste release experiments . . .* ***Implementation of this recommendation is deemed crucial for NRC staff to have reasonable assurance that the performance objectives in 10 CFR Part 61, Subpart C can be met.*** *Given the risk-significance of Tank 18 . . .* TER page 151 *NRC staff considers DOE's use of 0.25 mSv (25 mrem) TEDE to demonstrate compliance with 10 CFR 61.41 without specific consideration of individual organ doses acceptable for incidental waste determinations. DOE's PA indicates that compliance with 10 CFR 61.41 for the protection of the public can be demonstrated. However, NRC staff provides several recommendations in this document where enhanced model support would be needed prior to tank closure to provide reasonable assurance that the closure activities would comply with requirements for the protection of the public at 10 CR 61.41. It is important to note that DOE modeling suggests that if assumptions regarding the timing of the degradation of the waste tanks and the release of radionuclides from the CZ within 10,000 years prove invalid, then the peak doses that currently occur outside the period of performance in DOE's PA may exceed 0.25 mSv (25 mrem) TEDE within 10,000 years.* *TER page 179* *NRC staff suggests that at a minimum, implementation of a subset of its recommendations (e.g., high risk, short*	**High**	**Short** to Intermediate	• DOE will develop new sensitivity cases that will utilize peer-reviewed and internationally accepted thermodynamic data for plutonium solubility in the waste release model. The sensitivity cases will be documented in a revision to the Tank 18/Tank 19 Special Analysis.	Based on discussions with DOE plutonium solubility experts held in November 2011, additional model support in the form of a peer-reviewed database is already available (i.e., thermodynamic data used by NEA for assessing repository placement and impacts). This data will be used to determine revised solubility values for plutonium which will be used in the FTF Performance Assessment PORFLOW model to develop new sensitivity cases. It is believed, based on the input of the plutonium solubility experts, that the peak dose from Tank 18 will be significantly attenuated and shifted even later in time (i.e., beyond 40,000 years). The database, which is based in large part on peer-reviewed experimental data, increases support for plutonium solubility data and associated waste release model without the need to conduct the suggested experiments prior to grouting Tank 18. This data is expected to further confirm that there is reasonable assurance that performance objectives will be met.	• Tank 18/Tank 19 Special Analysis has been revised to contain results of new sensitivity cases. • The revised Tank 18/Tank 19 Special Analysis has been summarized and referenced in FTF 3116 Basis Document and Tank 18/Tank 19 Tier 2 Closure Authorization. The new text includes a discussion of the revised waste release model incorporating the thermodynamic data from the NEA-TDB, additional science studies and plutonium speciation experiments on Tank 18 samples.

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				term recommendations) is needed for NRC staff to have reasonable assurance that performance objectives in 10 CFR Part 61, Subpart C can be met. Note: NRC TER recommendations noted as "high risk, short term recommendations" by the NRC are highlighted with red text within this matrix.					
14	13, 14, 78 & 178	4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	TER page 13 & 178 *NRC staff recommends that DOE conduct waste release experiments . . .* *Given the risk-significance of Tank 18 to the overall PA and the short timeline for closure of this tank, DOE should initiate discussions with NRC staff regarding implementation of this recommendation for Tank 18 as soon as practical. Experiments to address this recommendation should be conducted prior to final closure of this single tank. Results of the Tank 18 residual waste experiments will be evaluated by NRC staff to determine the need for additional data collection, experiments, modeling, etc. for Tank 18, as well as other FTF tanks. Additional information regarding NRC staff's recommendations in this area, including details on the suggested implementation of other recommendations listed below will be provided in NRC staff's plan for monitoring the FTF later in FY2012.* TER page 14 *If, in the future, DOE determines it is necessary to revise its assumptions, analysis, design, or waste management approach and those changes are important to meeting the criteria of the NDAA, DOE should consult once again with the NRC.* TER page 79 *NRC recommends that DOE continue to consult with NRC as tank farm closure progresses.*	N/A	N/A	• Given the expected results of updating the waste release model and planned revisions to the Tank 18/Tank 19 Special Analysis and consistent with recommendations of the Plutonium Solubility Peer Review team, waste release experiments are not required at this time to move forward with a FTF waste determination and operational closure of Tanks 18 and 19. DOE will continue to provide information to the NRC during monitoring under NDAA Section 3116(b). • Add a note to the FTF 3116 Basis Document stating that DOE did consult with the NRC in preparing the FTF 3116 Basis Document and will continue to provide information to the NRC and the State of South Carolina during monitoring under NDAA Section 3116(b).	As noted by the NRC within the TER, "DOE is solely responsible for determining whether the waste streams addressed in the draft basis are not HLW and therefore, satisfy the requirements in Section 3116 of the NDAA." (page 8) and "DOE is responsible for determining whether the waste is HLW, in consultation with NRC." (page 179) Although consultation under NDAA Section 3116(a) necessarily ends with a Section 3116(a) determination by the Secretary, DOE will continue to share information with the NRC and the State of South Carolina to support their monitoring role under NDAA Section 3116(b).	• Added text to the FTF 3116 Basis Document (Section 1) stating that, consistent with NDAA 3116(a), DOE did consult with the NRC on the FTF 3116 Basis Document and will continue to provide information to the NRC to support the NRC monitoring role, in coordination with the State of South Carolina, under NDAA 3116(b).

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15	14, 95 & 178	4.2.3.2 & 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	*NRC recommends that DOE perform a systematic scenario analysis process in which 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 determination efforts.*	Medium	Intermediate	• DOE is preparing a listing of potentially applicable features, events and processes (FEPs) that could be considered for FTF. These FEPs will then be compared against the configurations, scenarios and sensitivity cases in the FTF Performance Assessment to provide additional clarity and transparency to outside organizations.	Path forward is in alignment with NRC recommendation. Note: The FEP process of determining potential scenarios to be evaluated in a performance assessment is not required nor described in DOE Order/Manual/Guidance. In addition, the use of a FEP process was not discussed in the NRC/DOE Generic Technical Issues discussions that laid the foundation for integrating the DOE and NRC performance assessment practices. Instead, DOE used a series of model configurations to address potential future conditions of the closure site.	• A stand-alone reference document, SRR-CWDA-2012-00022, has been prepared to document the FEP review for FTF. • The new FEP document has been summarized/referenced in the FTF 3116 Basis Document (Section 7).
16	14, 107 & 178	4.2.7] & 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	*NRC supports DOE's commitment to sample each tank following waste retrieval activities and will follow-up with DOE on sampling and analysis of cleaned tanks during the monitoring period.*	High to Moderate	Short & Intermediate	• Recommendation has been implemented for Tanks 18, 19, 5 and 6. • Implementation of Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001 will support this recommendation. • The content of DOE/SRS-WD-2011-001 will be added to the FTF 3116 Basis Document as a new appendix.	This recommendation has been completed for Tank 18, 19, 5 and 6. These tanks were sampled and, for Tanks 18 and 19, characterized with final residual inventories being documented in final characterization documents and evaluated in the Tank 18/Tank 19 Special Analysis (Tanks 5 and 6 analyses is in-progress). A reference to these activities is included in the FTF 3116 Basis Document in Sections 2 and 5. Relative to other tanks, this recommendation will be carried out once SCDHEC, EPA and DOE agree to enter the sampling and analysis phase of waste removal on a tank-by-tank basis.	• Documentation of final sampling and analysis will be prepared consistent with DOE/SRS-WD-2011-001. • The content of DOE/SRS-WD-2011-001 has been added to the final FTF 3116 Basis Document as a new appendix, Appendix B.

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17	14, 149 & 178	4.2.11.6 & 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	*DOE should consider how it might improve far-field model calibration and transparency in future updates to its PA.*	Medium	Intermediate	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1.	It should be noted that the far-field model accounts for areas beyond the 100-meter compliance point.	• Added a footnote to the FTF 3116 Basis Document (Section 7) noting that the NRC TER included several recommendations in Chapter 4 regarding potential model refinements or model support, which NRC recommended DOE consider in future PA revisions. DOE will evaluate these recommendations under DOE Manual 435.1-1 pursuant to DOE's responsibility under the Atomic Energy Act of 1954, as amended. • This activity has been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan [SRR-CWDA-2012-00020] and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.
18	14, 149 & 178	4.2.11.6 & 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	*DOE should continue to evaluate the appropriateness of selected transport parameters (e.g., dispersivities and Kds, particularly for calcareous zones) and selection of sorption models (see discussion in Section 4.2.9.4 on Pu transport) during the monitoring period.*	Medium **(Pu Sorption-High)**	Intermediate **(Pu Sorption-Short)**	• Plutonium sorption, along with other elemental K_d values applicable to the FTF cementitious barriers and surrounding soils, have been the subject of additional analyses at the Savannah River National Laboratory. The newly developed and recommended K_d values for plutonium are higher than those used in the Base Case of the FTF PA. A technical report documenting this review will be issued. • The results of the K_d report will be utilized to develop additional sensitivity runs in the Tank 18/Tank 19 Special Analysis. • DOE will evaluate this recommendation relative to other radionuclides as part of PA maintenance under DOE Manual 435.1-1.	Plutonium sorption is specifically called out as a high risk with short-term timing and is being addressed by additional study and additional Tank 18/Tank 19 Special Analysis sensitivity runs. Remaining elemental transport parameters will be evaluated through future maintenance and monitoring activities, consistent with NRC designation as "Intermediate-term" Note: The wording of the recommendation states that this would be expected to occur during the monitoring period.	• Results of the SRNL review of K_d values have been documented in a technical report, SRNL-STI-2011-00672. • The Tank 18/Tank 19 Special Analysis includes sensitivity runs based on updated plutonium K_d values and is referenced /summarized in the FTF 3116 Basis Document. • This activity, relative to other radionuclides, has been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.

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19	14, 149 & 178	4.2.11.2 & 4.2.11.5	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	*DOE should consider additional data collection related to calcareous zone outcrop locations and tracer tests to provide further support for the adequacy of its modeling treatment of the Upper Three Runs-Lower Zone (UTR-LZ) aquifer.*	Medium	Short to Intermediate	• Add a footnote to the FTF 3116 Basis Document (Section 2) noting that "NRC staff is convinced that large voids do not currently exist in the subsurface along FTF flow paths . . ." • DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. As noted by the NRC on page 149 of the TER, tracer studies could be considered as a follow-up if calcareous zone seeps are identified.	NRC timing differs between page 149 and 178. Page 149 lists the timing as "short to intermediate" where as the same recommendation is listed in the section roll-up on page 178 as "intermediate" timing. On page 146 and 149 of the TER, NRC notes that "DOE progress in this area will be evaluated during the monitoring period."	• This activity has been captured in <u>The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan</u> and will be evaluated as part of PA maintenance under DOE Manual 435.1. • Added a footnote to the FTF 3116 Basis Document (Section 2) noting that "NRC staff is convinced that large voids do not currently exist in the subsurface along FTF flow paths . . ."
20	14, 150 & 178	4.2.11.5	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	*Finally, DOE should evaluate the need for additional vertical or horizontal mesh refinement to ensure that contaminant plumes are not artificially dispersed over the volume of the cells in the far-field model and that time discretization is adequate. Comparisons of plume spread in the FTF model to actual observations of contaminant plumes for more mobile and less mobile plumes would be instructive with respect to the adequacy of the FTF models in predicting contaminant concentrations at a down-gradient well.* <u>Note:</u> Second sentence is added only on page 150.	Medium	Intermediate	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. • Consider addition of a footnote or modifying existing footnote in Section 7 of the FTF 3116 Basis Document to cover several recommendations (e.g., "DOE will continue model refinement as part of PA maintenance under DOE M 435.1-1 . . .").	On page 148 of the TER, NRC notes that this recommendation should be addressed "...in future updates to the PA or justify why the modeling approach is acceptable given the expected level of dispersion in a potential groundwater well." <u>Note:</u> The far-field model provides transport information of materials beyond the 100-meter compliance point and, therefore, has insignificant impact on the estimation of peak dose at the compliance point. Fortunately, there have NOT been significant enough spills within the FTF to allow the recommended comparisons between actual dispersion of contaminant plumes and the FTF models.	• Added a footnote to the FTF 3116 Basis Document (Section 7) noting that the NRC TER included several recommendations in Chapter 4 regarding potential model refinements or model support, which NRC recommended DOE consider in future PA revisions. DOE will evaluate these recommendations under DOE Manual 435.1-1 pursuant to DOE's responsibility under the Atomic Energy Act of 1954, as amended. • This activity has been captured in <u>The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan</u> and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.
21	42	4.2.19.1 & 4.2.19.5	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	<u>TER page 42</u> *NRC staff agrees that the inventory of Tc-99 for Type I tanks is likely significantly lower than assumed in the Rev. 1 PA.*	N/A	N/A			• NRC statement regarding technetium has been noted in the FTF 3116 Basis Document (Section 7).

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22	43	3.2.1	3116(a)(2) [HRR Removal to MEP]	*Additionally, because final inventories have not been provided for Type I, III, and IIIA tanks (only Type IV final inventories have been provided), the Criterion 2 determination cannot be made for Type I, III, and IIIA tanks.*	N/A	N/A	• Add a footnote to the FTF 3116 Basis Document discussing why DOE is able to make a determination at this time. • Add a reference to the Tank 5 and Tank 6 history documents in FTF 3116 Basis Document. • Add a reference to the Tank 18/19 HRR Removal Report in FTF 3116 Basis Document. [SRR-CWDA-2011-00091] • The content of Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001, will be added to the FTF 3116 Basis Document as a new appendix.	Discussion will be added to the FTF 3116 Basis Document noting why DOE is able to make a determination at this time. DOE determination is based on: - Information contained in DOE/SRS-WD-2011-001 -Three-agency agreement (DOE, SCDHEC, EPA) -Process recognized in NUREG-1854 (p. 3-8) -Cleaning of Tanks 5/6 -Cleaning of Tanks 18/19 Implementation of Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001 will support this recommendation. The referenced document outlines and describes the approach used by DOE for each of the Savannah River Site waste tanks or ancillary structures to document removal of radionuclides with emphasis on HRRs.	• Added text to the FTF 3116 Basis Document (Section 1) discussing why DOE is able to make a determination at this time. • Added reference to Tank 5 and Tank 6 history documents in FTF 3116 Basis Document. [SRR-CWDA-2011-00033, SRR-CWDA-2011-00005] • Added reference to Tank 18/19 HRR Removal Report in FTF 3116 Basis Document. • The content of Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001, has been added to the FTF 3116 Basis Document as a new appendix, Appendix B.
23	48	3.2.2	3116(a)(2) [HRR Removal to MEP]	*DOE has attempted to properly characterize the final inventory of the residual material in Tanks 18 and 19. . . . However, NRC staff has remaining concerns with the approach, specifically with regard to quantification of volume uncertainty, the lack of explanation in the difference between the 2009 and 2010 sample results, the unexpected Pu-238 concentrations in the tank walls, and the assumptions surrounding development in inventory multipliers for the probabilistic analysis.*	N/A	N/A	• Review NRC TER Section 3.2.2 and if applicable address NRC concerns within the revised Tank 18/Tank 19 Special Analysis.	The NRC noted a few concerns within the evaluation of Tank 18 and Tank 19 final inventory determination, however, the NRC did not make any specific recommendations for the final determinations.	• The Tank 18/Tank 19 Special Analysis contains extensive discussion related to new science work and associated model support associated with plutonium waste release and transport. Discussion of this work has been added to the FTF 3116 Basis Document (Sections 1 and 7).

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24	74 & 75	3.2.1	3116(a)(2) [HRR Removal to MEP]	TER page 74 *Mantis travel limitations may also have hampered efforts to remove large quantities of material remaining in the western portion of the tank, although the NRC staff was unable to confirm this with DOE prior to finalization of this TER.* TER page 75 *DOE does not draw a link between Mantis travel limitations and cleaning effectiveness.* TER page 75 *Furthermore, the Tank 18 travel limitations may have put additional constraints on waste retrieval.*	N/A	N/A	• Add a footnote to the FTF 3116 Basis Document to make it clear that the Mantis did not have travel limitations during cleaning.	During waste removal activities utilizing the Mantis in Tank 18, the Mantis was able to reach all portions of the waste tank, therefore, travel was not limited as noted by the NRC in their TER. The Tank 18/19 HRR removal report provides the details showing the Mantis was able to move throughout the entire tank. The Tank 18/19 HRR Removal Report, SRR-CWDA-2011-00091, was provided to the NRC as part of the RAI response package. The Mantis did encounter travel limitations when DOE was utilizing the Mantis to support volume determinations that were being conducted several months after waste removal activities had been completed.	• Added a footnote to the FTF 3116 Basis Document (Section 5) to make it clear that the Mantis did not have travel limitations during cleaning. • Added reference to Tank 18/19 HRR Removal Report, SRR-CWDA-2011-00091, in the FTF 3116 Basis Document.
25	80	3.8.1	3116(a)(2) [HRR Removal to MEP]	*NRC staff recommends that DOE perform a more rigorous cost-benefit analysis related to additional HRR removal for Tank 18.*	N/A	N/A	• DOE is performing an additional Tank 18 cost-benefit analysis supported by a Systems Engineering Evaluation (SEE) to evaluate technologies that may have emerged or may have became "practical" since the completion of cleaning efforts in Tank 18 in 2009. The SEE will include evaluation criteria consistent with 3116 Criterion 2 (e.g., HRR removal effectiveness).	Path forward is in alignment with NRC recommendation	• Issued a Tank 18 cost-benefit analysis with associated SEE. • New Tank 18 Cost-Benefit Analysis with associated SEE is summarized in the FTF 3116 Basis Document and Tank 18/Tank 19 Tier 2 Closure Authorization.

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26	81	3.8.2	3116(a)(2) [HRR Removal to MEP]	*NRC staff recommends, to the extent practical, that DOE develop documentation of the following for Type I tanks: HRR inventory before OA, HRR inventory after OA, HRR inventory after MFB.*	N/A	N/A	• The recommendation will be implemented as appropriate in future cleaning activities for Tanks 1, 2, 3, 4, 7 and 8, and the Type III and Type IIIA tanks if chemical cleaning is utilized. • Implementation of Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001 will support this recommendation. • The content of DOE/SRS-WD-2011-001 will be added to the final FTF 3116 Basis Document as a new appendix.	This recommendation is provided for future tank cleaning activities that utilize chemical cleaning (e.g., oxalic acid) as a specific phase of heel removal within a waste tank. DOE/SRS-WD-2011-001 outlines and describes the approach used by DOE for each of the Savannah River Site waste tanks or ancillary structures to document removal of radionuclides with emphasis on HRRs. DOE's process for characterizing waste includes consideration of dose to workers, among other considerations, versus the benefit of the information gained. As described in the matrix entry for Recommendation #16, DOE is committed to sampling each tank following waste retrieval activities. However, inventory determinations between cleaning activities will be performed as practical to support waste removal efforts and may include process history or limited sampling versus full characterization based on extensive sampling efforts.	• The content of Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001, has been added to the FTF 3116 Basis Document as a new appendix, Appendix B. .
27	81	3.9	3116(a)(2) [HRR Removal to MEP]	*With respect to Tanks 5 and 6, absent a final inventory, NRC staff does not have sufficient information on the effectiveness of OA or MFB cleaning technologies to make a determination on Criterion 2.*	N/A	N/A	• Final inventory values and HRR removal effectiveness will be documented in the HRR Removal Reports for Tank 5 and Tank 6 consistent with DOE's process outlined in Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001, once final characterization is complete.	Final sampling and characterization for Tank 5 and Tank 6 is currently in progress and therefore, as noted by the NRC, was not available during the NRC review. NRC was provided waste removal history documents for both Tank 5 and Tank 6 which covered all activities up to and including the agreement, as required by the FTF General Closure Plan, between DOE, SCDHEC and EPA to suspend waste removal activities and move into final sampling and analysis. As outlined in DOE/SRS-WD-2011-001, DOE will be documenting final tank inventories and HRR removal effectiveness in the HRR Removal Report for each tank.	• Final inventory values and HRR removal effectiveness will be documented in the HRR Removal Reports for Tank 5 and Tank 6 consistent with DOE's process outlined in Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization, DOE/SRS-WD-2011-001. • Clarification of Tank 5 and Tank 6 cleaning status has been added to the FTF 3116 Basis Document.

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28	82	4	3116(a)(3)(A)(ii) & 3116(a)(3)(B)(ii) [State-Approved Closure Plan]	*A South Carolina Department of Health and Environmental Control (SCDHEC) industrial waste water construction permit governs tank waste storage and removal operations for FTF closure. Stabilization of the FTF waste tanks and ancillary structures will be carried out pursuant to the FTF General Closure Plan approved by the State of South Carolina for all FTF tanks and ancillary structures. DOE will also develop a specific Closure Module for each tank or ancillary structure or groupings of tanks and ancillary structures and submit it to the State of South Carolina for approval. Final tank stabilization activities will not proceed until the State approves the closure documentation.*	N/A	N/A	• DOE will continue with current plan to develop/submit Closure Modules for each tank or ancillary structure, or grouping of tanks or ancillary structures, to the State of South Carolina for approval.		• NRC acknowledgement of DOE process to meet NDAA Criteria 3116(a)(3)(A)(ii) has been noted in Section 8 of the FTF 3116 Basis Document.
29	85	4.1.1	3116(a)(3)(A) & 3116(a)(3)(B) [Class C Concentration Limits]	*NRC staff has evaluated DOE's methodology for classifying waste and finds the approach an acceptable application of Category 3 in NUREG-1854.*	N/A	N/A	• DOE will continue with current plan that waste concentration calculations will be developed after final characterization and will be included as part of Tier 2 authorization document for each waste tank or ancillary structure.		• Waste concentration calculations will be developed after final characterization of each tank/ancillary structure and will be included as part of Tier 2 authorization document. • NRC conclusion concerning acceptability of DOE methodology has been noted in the FTF 3116 Basis Document (Section 6).
30	85	4.1.1	3116(a)(3)(B)(iii) [Exceeds Class C Concentration Limits]	*NRC has reviewed DOE's disposal plans for the FTF waste as part of the extensive consultation process that is documented in this TER, thereby satisfying the requirements of Section 3116(a)(3)(B)(iii). Consequently, no additional DOE consultation with NRC is required for tanks containing residual waste that might exceed Class C concentrations following final sampling and inventory development.*	N/A	N/A			• This NRC conclusion has been noted in the FTF 3116 Basis Document.

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31	93	4.2.3	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.42]	*Once issues are resolved related to groundwater pathways under 10 CFR 61.41, NRC staff expects issues related to the inadvertent intruder analysis will also be resolved.*	N/A	N/A	• Path forward activities described in matrix entries denoted with " . . .[61.41]" in the "NDAA Criterion" column address this NRC statement.	The NRC does not make any specific recommendations relative to 10 CFR 61.42. Path forward activities described in matrix entries denoted with " . . . [61.41]" in the "NDAA Criterion" column address this NRC statement. No additional activities specific to 10 CFR 61.42 are necessary.	• This NRC observation has been noted in the FTF 3116 Basis Document, along with cross-references to the section in the FTF 3116 Basis Document where groundwater pathway issues were addressed.
32	93	4.2.3	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41 & 10 CFR 61.42]	*Provided all of DOE's key modeling assumptions are met, results of DOE's PA indicate that the performance objectives will most likely be met considering a 10,000 year compliance period*	N/A	N/A			• Added a footnote to the FTF 3116 Basis Document (Section 7) noting this statement.
33	95	4.2.3.2	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*With respect to DOE's PA approach NRC staff makes the following recommendations, along with a rating of risk-significance and priority:* *• NRC staff recommends DOE initiate additional follow-up work during the monitoring period to provide support for key modeling assumptions and barriers relied on for long-term performance in DOE's PA as discussed in more detail in the Sections that follow (see individual recommendations for risk-significance and timing information).*	N/A	N/A	• Path forward is addressed in matrix entries for the individual recommendations.	No specific recommendations provided; covered in individual recommendations	• Added a footnote to the final FTF 3116 Basis Document (Section 7) noting that the NRC TER included several recommendations in Chapter 4 regarding potential model refinements or model support, which NRC recommended DOE consider in future PA revisions. DOE will evaluate these recommendations under DOE Manual 435.1-1 pursuant to DOE's responsibility under the Atomic Energy Act of 1954, as amended.
34	96 & 97	4.2.3	3116(a)(3)(A)(i) &3116(a)(3)(B)(i) [10 CFR 61 41 & 10 CFR 61 42]	*Table 4-3 Summary of DOE Performance Assessment Results (values in red text are over the compliance limit)*	N/A	N/A	• Address each of the NRC "Notes" contained within Table 4-3 of the NRC TER. Provide DOE's position relative to each of the dose results provided and what they represent.	It is DOEs opinion that the information provided within Table 4-3 of the TER warrants additional information concerning what the doses represent and why DOE believes, that given the doses shown, DOE concludes there is reasonable assurance that performance objectives will be met.	• Added a new table to the FTF 3116 Basis Document that reproduces information from NRC Table 4-3 and provides additional information containing DOE's response to each of the NRC "Notes". This table has been added as a new appendix, Appendix C.

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35	105	4.2.5.3	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*With respect to infiltration and erosion, NRC staff notes the following:* *1. DOE's approach to assessing closure cap performance is reasonable for planning purposes.* *2. DOE has provided sufficient information regarding long-term erosion protection of the closure cap.* *Notwithstanding 1 and 2 above, NRC staff would also note that the processes being modeled are highly uncertain. Therefore, adequate justification is needed to ensure that the modeling has appropriately accounted for these uncertainties. DOE will need to demonstrate that model predictions for the final cover design are sufficiently conservative, based on the amount of model support provided.* *Recommendations for infiltration and erosion include the following, along with a rating of risk-significance and priority (see footnote in Section 4.2.3.2 for a description of the risk significance and priority of the recommendations):* *1. Additional model support should be provided 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.* *2. Prior to completing the final closure cap design, a preliminary evaluation of erosion protection designs (e.g., assessment of an acceptable rock source, the ability of an integrated drainage system to accommodate design features, etc.) should be conducted.*	Low	Intermediate	• DOE will evaluate these recommendations as part of PA maintenance under DOE Manual 435.1-1. This recommendation will be considered in the future when the final closure cap is being designed. • DOE will share information in this area with the NRC as available under NDAA 3116(b) monitoring.	As noted in the Draft FTF 3116 Basis Document, "The closure cap design described in the FTF Performance Assessment is based on the best information available at the time the FTF Performance Assessment was developed. [SRS-REG-2007-00002] The design information utilized is for planning purposes sufficient to support evaluation of the closure cap as part of the integrated site conceptual model evaluated in the FTF Performance Assessment. Any actual closure cap design will be finalized closer to the time of FTF closure in accordance to the FFA for SRS (e.g., Section IX.E.(2).) (WSRC-OS-94-42), to take advantage of possible advances in materials and closure cap technology that could be used to improve design. . . ."	• Added a footnote to the FTF 3116 Basis Document (Section 7) noting that the NRC TER included several recommendations relevant to site stability that NRC recommends DOE continue to evaluate during the monitoring period. DOE will evaluate these recommendations under DOE Manual 435.1-1 pursuant to DOE's responsibility under the Atomic Energy Act of 1954, as amended. • These activities have been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.
36	120	4.2.9.2	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*The limited information that is available on the condition of the concrete vaults may not be consistent with the base case assumptions in the steel liner corrosion modeling or the assignment of probabilities to the various configurations within the PA with respect to steel liner failure.*	N/A	N/A	• DOE will evaluate this recommendations as part of PA maintenance under DOE Manual 435.1-1. • DOE will share information in this area with the NRC as available under NDAA 3116(b) monitoring.	NRC notes on page 121 of the TER "Pending results of solubility or leaching experiments recommended in Section 4.2.9.3, NRC staff may also recommend additional experiments or alternative modeling treatment of the steel liner to strengthen the compliance demonstration."	• This activities have been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.

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37	134	4.2.9.5	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*NRC staff recommends DOE conduct waste release experiments:* *1. To increase experimental support for key modeling assumptions about behavior of grout over time including evolution of pH and Eh.*	**High**	**Short (Tank 18)** to Intermediate	• DOE has obtained the thermodynamic data used by the National Energy Agency (NEA) for assessing repository placement and impacts. This data will be used in association with the Geochemist Workbench to determine revised solubility values for plutonium which are based on peer-reviewed experimental data. The revised solubility data will be input into the FTF Performance Assessment model and documented in the Tank 18/Tank 19 Special Analysis. •DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. .	On page 134 of the TER, NRC classifies this recommendation as "(High Risk-Significance, Short Term (Tank 18) and Intermediate-Term (other tanks))." In the FTF PA Base Case, it was assumed that the plutonium transitioned over time from a highly insoluble state to a relatively soluble state based on the Eh and pH changes within the grout. Based on information gleaned from discussions with plutonium solubility experts, it is expected that utilization of the new database will show that pH and Eh values in the ranges expected in the FTF system do not significantly impact plutonium solubility values. It is expected that uncertainty surrounding the doses associated with Tank 18 Pu-239 can be bounded and will provide additional support for DOE's conclusion of reasonable assurance that performance objectives can be met.	• Utilizing the NEA database information, pursuant to the Pu Solubility Peer Review, the waste release model relative to plutonium has been updated and documented in SRNL-STI-2012-00087. • Added text to the FTF 3116 Basis Document that discusses recommendations from Pu Solubility Peer Review and how the recommendations were addressed. • The Tank 18/Tank 19 Special Analysis has been revised to contain new sensitivity case results. • The revised Tank 18/Tank 19 Special Analysis is summarized and referenced in the FTF 3116 Basis Document and Tank 18/Tank 19 Tier 2 Closure Authorization. • This activity has been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan. The need for additional experimental support will be evaluated as part of PA maintenance under DOE Manual 435.1-1.
38	134	4.2.9.5	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*NRC staff recommends DOE conduct waste release experiments:* *1. . . .* *2. To identify key radionuclide association with solid phases comprising the residue in representative tanks to support key modeling assumptions.*	Medium/ High	Intermediate	• DOE will conduct solid phase experiments, specifically XRD and SEM, using residual Tank 18 samples. • DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. • Tank 18 residual waste samples have been archived to support future studies/analyses, if appropriate.	On page 134 of the TER, NRC classifies recommendations as "(High Risk-Significance, Short Term (Tank 18) and Intermediate-Term (other tanks))." This recommendation is specifically classified as "(High Risk-Significance and Intermediate-Term (other tanks))". However, DOE is moving forward with some studies, SEM and XRD, to understand solid phases in Tank 18. Because of the low concentrations in the samples it is possible that concentrations will be below the detection limits for these tests.	• Results of solid phase experiments have been documented in a technical report, SRNL-L3100-2012-00017. • The Tank 18/Tank 19 Special Analysis includes a discussion of the impacts of the results on model uncertainty relative to assumed plutonium solubility in the Base Case. • The new Special Analysis and technical report results are briefly summarized and referenced in the FTF 3116 Basis Document. • This activity has been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.

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39	134	4.2.9.5	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61.41]	*NRC staff recommends DOE conduct waste release experiments:* *1. . . .* *2. . . .* *3. Leach tests on multiple samples from each tank. Tests should consist of:* *a) Static tests to determine constant concentrations of elements of concern under conditions of exposure to local ground water and to grout leachate.*	High	Short & Intermediate	• DOE has obtained the thermodynamic data used by the National Energy Agency (NEA) for assessing repository placement and impacts. This data will be used in association with the Geochemist Workbench to determine revised solubility values for plutonium which are based on existing experimental data. The revised solubility data will be input into the FTF Performance Assessment model and documented in the Tank 18/Tank 19 Special Analysis. • DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. • Tank 18 residual waste samples have been archived to support future studies/analyses, if appropriate.	On page 134 of the TER, NRC classifies this recommendation as "(High Risk-Significance, Short Term (Tank 18) and Intermediate-Term (other tanks))." In the FTF PA Base Case, it was assumed that the plutonium transitioned over time from a highly insoluble state to a relatively soluble state based on the Eh and pH changes within the grout. Based on information gleaned from discussions with plutonium solubility experts, it is expected that utilization of the new database will show that pH and Eh values in the ranges expected in the FTF system do not significantly impact plutonium solubility values. It is expected that uncertainty surrounding the doses associated with Tank 18 Pu-239 can be bounded and will provide additional support for DOE's conclusion of reasonable assurance that performance objectives can be met.	• Utilizing the NEA database information, pursuant to Pu Solubility Peer Review, the waste release model relative to plutonium has been updated and documented in SRNL-STI-2012-00087. • Added text to the FTF 3116 Basis Document that discusses recommendations from Pu Solubility Peer Review and how the recommendations were addressed. • The Tank 18/Tank 19 Special Analysis has been revised to contain new sensitivity case results. • The revised Tank 18/Tank 19 Special Analysis has been summarized and referenced in the FTF 3116 Basis Document and Tank 18/Tank 19 Tier 2 Closure Authorization. • This activity has been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.

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40	134	4.2.9.5	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*NRC staff recommends DOE conduct waste release experiments:* *1. . . .* *2. . . .* *3. Leach tests on multiple samples from each tank. Tests should consist of:* *a) . . .* *b) Semi-dynamic leach tests to try to distinguish releases from high solubility compounds from those of low solubility compounds.*	Medium to High	Intermediate	• DOE has obtained the thermodynamic data used by the National Energy Agency (NEA) for assessing repository placement and impacts. This data will be used in association with the Geochemist Workbench to determine revised solubility values for plutonium, which are based on existing experimental data. The revised solubility data will be input into the FTF Performance Assessment model and documented in the Tank 18/Tank 19 Special Analysis. • DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. • Tank 18 residual waste samples have been archived to support future studies/analyses, if appropriate.	On page 134 of the TER, NRC classifies this recommendation as "(High Risk-Significance and Intermediate-Term (other tanks))". This recommendation will be addressed under performance assessment maintenance and monitoring. In the FTF PA Base Case, it was assumed that the plutonium transitioned over time from a highly insoluble state to a relatively soluble state based on the Eh and pH changes within the grout. Based on information gleaned from discussions with plutonium solubility experts, it is expected that utilization of the new database will show that pH and Eh values in the ranges expected in the FTF system do not significantly impact plutonium solubility values. It is expected that uncertainty surrounding the doses associated with Tank 18 Pu-239 can be bounded and will provide additional support for DOE's conclusion of reasonable assurance that performance objectives can be met.	• Utilizing the NEA database information, pursuant to Pu Solubility Peer Review, the waste release model relative to plutonium has been updated and documented in SRNL-STI-2012-00087. • Added text to the FTF 3116 Basis Document that discusses recommendations from Plutonium Solubility Peer Review and how the recommendations were addressed. • The Tank 18/Tank 19 Special Analysis has been revised to contain new sensitivity case results. • The revised Tank 18/Tank 19 Special Analysis has been summarized and referenced in the FTF 3116 Basis Document and referenced in the Tank 18/Tank 19 Tier 2 Closure Authorization. • This activity has been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.
41	147-148	4.2.11.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*Nonetheless, it is NRC's position—as stated in FTF scoping—that Gordon Aquifer concentrations should not be used to assess compliance because the point of maximum exposure should not be dependent on the probability of well completion if higher concentrations are observed in a viable aquifer unit that could support the groundwater dependent pathways evaluated in the biosphere modeling.*	N/A	N/A	• Address this topic within new table responding to Table 4-3 of the NRC TER.	Table 4-3 provides two dose values for Probabilistic results "(i) considering well completion uncertainty in either the UTR or Gordon Aquifers (GA) or (ii) assuming wells are only completed at the point of maximum exposure in UTR..." It is DOE's opinion that the information provided within Table 4-3 warrants additional information concerning what the doses represent and why DOE believes that the doses represented by case "(i)" should be utilized. DOE considered the well depth (i.e., aquifer source) to be a valid and appropriate variable for probabilistic modeling of the FTF system.	• Added a new table to the FTF 3116 Basis Document that reproduces information from NRC Table 4-3 and provides additional information containing DOE's response to each of the NRC "Notes". This table has been added as a new appendix, Appendix C.

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42	168	4.2.19.1	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*NRC thinks that an uncertainty of this magnitude should not be described as "highly unlikely" and a meaningful discussion regarding the peak doses in DOE's probabilistic analysis should be communicated in the PA and basis document.*	N/A	N/A	• Address this topic within new table responding to Table 4-3 of the NRC TER.	Table 4-3 provides dose values for Probabilistic results, among others, contained in the FTF Performance Assessment. It is DOE's opinion that the information provided within Table 4-3 warrants additional information concerning what the doses represent and why DOE believes that given the doses shown DOE concludes there is reasonable assurance that performance objectives will be met.	• Added a new table to the FTF 3116 Basis Document that reproduces information from NRC Table 4-3 and provides additional information containing DOE's response to each of the NRC "Notes". This table has been added as a new appendix, Appendix C.
43	169	4.2.19.1	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 41]	*Thus, although DOE provides detailed analysis of the doses that occur within 10,000 and sometimes 20,000 years, considerably less attention it paid on the peak doses that almost always occur without exception later in time.*	N/A	N/A	• Additional wording will be provided in the FTF 3116 Basis Document discussing analysis that have been run out to 100,000 years.		• Additional text has been added to the FTF 3116 Basis Document (Section 7) discussing that DOE has run analysis out to 100,000 years. New figures have been added showing results of analyses out to 100,000 years.
44	176	4.3.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 44]	*NRC staff recommends DOE continue to evaluate the following areas during the monitoring period:* *1. Closure cap settlement and stability analyses (Medium Risk-Significance, Intermediate Term) including the following:* *2. Site-specific settlement analysis for FTF, that includes the increased overburden from tank grout and the closure cap.* *3. Evaluation of vault and grout integrity that is consistent with observations and reasonable expectations of future degradation of cementitious materials.* *4. Assessment of the potential subsidence due to ongoing dissolution of calcareous sediment in the Santee formation.*	Medium	Intermediate	• DOE will evaluate these recommendations as part of PA maintenance under DOE Manual 435.1-1.	Recommendation specifically points to activities during the NDAA 3116(b) monitoring period. Only item 1 was provided with risk significance and timing. As was documented in DOE's RAI response to RAI-FF-1 to the NRC [SRR-CWDA-2011-00054], there is no evidence of the existence of voids in the soil structure below FTF that would lead to significant subsidence. In fact, the TER states that "NRC staff is convinced that large voids do not currently exist in the subsurface along FTF flow paths to the 100 m (330 ft) point of compliance ..." DOE will consider the value of such studies through future Performance Assessment Maintenance Program evaluations and prioritizations.	• These activities have been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2012 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.
45	177	4.3.2	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR 61 43]	*DOE can demonstrate compliance with protection of individuals during operations (10 CFR 61.43).*	N/A	N/A			• NRC conclusion has been noted in the FTF 3116 Basis Document.