SRR-CWDA-2014-00080
Revision 0

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

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1.0 BACKGROUND

On February 6, 2013, the Department of Energy (DOE) issued the *Draft Basis for Section 3116 Determination for Closure of H-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-2013-001] On June 17, 2014, NRC issued its *Technical Evaluation Report for H-Area Tank Farm Facility, Savannah River Site, South Carolina.* [ML14094A496] The H-Tank Farm Technical Evaluation Report (HTF 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 NRC recommendations included in the HTF TER and associated Transmittal Letter, the recommended path forward, the technical justification for the path forward, as applicable, and the impact; if any, to *Basis for Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site*, DOE/SRS-WD-2014-001. This Attachment is intended to depict a thorough and thoughtful consideration of the NRC HTF TER including all of the recommendations in the HTF TER and Transmittal Letter. Italicized entries in the matrix represent direct quotes from the TER.

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

1. Transmittal Letter
2. Key NRC recommendations as provided in the HTF TER Executive Summary
    - Included as sub-entries to each key recommendation, as applicable, are recommendations/wording throughout the TER that represent that particular key recommendation as located in various places throughout the document and/or more specific recommendations which were considered to be part of the key recommendation.
3. Remainder by order they appear in the HTF TER
    - Included as sub-entries to each recommendation, as applicable, are more specific recommendations throughout the TER that were considered to be part of the same overall recommendation.

With the exception of the key NRC recommendations (i.e., ES-2.1 through ES-2.8 and ES-3.1 through ES-3.6), the recommendation 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 HTF TER. If the NRC did not assign a risk significance or timing to the recommendation it is denoted as "N/A".

[1] On page xiv of the TER, the NRC notes, "The NRC staff'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 WD activities. The Secretary of Energy, in consultation with the NRC, is 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." Additionally, on page 5-1 of the TER, the NRC states, "It should be noted that the NRC staff is providing consultation to DOE as required by Section 3116 of the NDAA, and the NRC staff is not providing regulatory approval in this action. DOE is responsible for determining whether the waste is HLW, in consultation with the NRC."

The NRC defines these terms in footnote 2 on page xx of the HTF 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."

In the Executive Summary of the TER, the NRC summarizes its findings and provides a series of recommendations they call "key recommendations." As noted previously, the NRC designated these key recommendations as ES-2.1 through ES-2.8 (i.e., key recommendations related to NDAA 3116 Criterion 2) and ES-3.1 through ES-3.6 (i.e., key recommendations related to NDAA 3116 Criterion 3). The NRC highlighted recommendation ES-3.1, referring to it as the NRC staff's "primary recommendation" and stating that it "is similar to the primary recommendation that was identified by the NRC staff in the FTF TER." This primary recommendation "reiterates its FTF recommendation that DOE conduct waste release experiments."

The NRC TER includes several recommendations regarding potential model refinements or model support for the *Performance Assessment for the H-Area Tank Farm at the Savannah River Site*, SRR-CWDA-2010-00128, which NRC recommended DOE consider in future HTF Performance Assessment (PA) revisions. NRC suggested that the recommendations be considered in the "intermediate term" or as part of "long-term/maintenance", and designated such recommendations as "low" or "medium-risk significance". As noted within Attachment 1, DOE will evaluate the recommendations as part of PA maintenance under DOE Manual 435.1-1. Any new information regarding PA model assumptions regarding Liquid Waste facilities at the Savannah River Site will be analyzed utilizing the Liquid Waste Unreviewed Waste Management Question process. [S4 Manual, Procedure ENG.46]

A number of the recommendations contained in the HTF TER are the same, or similar, to those identified by the NRC Staff in *Technical Evaluation Report for F-Area Tank Farm Facility, Savannah River Site, South Carolina.* [ML112371715] DOE addressed the NRC Staff's recommendations/observations from the F-Tank Farm Technical Evaluation Report (FTF TER) in *Nuclear Regulatory Commission's F-Tank Farm Technical Evaluation Report's Recommendations – Department of Energy's Activity Summary Matrix.* [SRR-CWDA-2012-00045]

3.0 REFERENCES

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

DOE/SRS-WD-2013-001, *Draft Basis for Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 0, February 6, 2013.

DOE/SRS-WD-2014-001, *Basis for Section 3116 Determination for Closure of H-Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 0, December 2014.

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

ML12212A192, *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 in Accordance With the National Defense Authorization Act for Fiscal Year 2005*, U.S. Nuclear Regulatory Commission, Washington DC, January 2013.

ML14094A496, *Technical Evaluation Report for Draft Waste Determination for Savannah River Site H Area Tank Farm*, U.S. Nuclear Regulatory Commission, Washington DC, June 17, 2014.

NDAA_3116, *Public Law 108-375, Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Section 3116*, Defense Site Acceleration Completion, October 28, 2004.

S4 Manual, Procedure ADM.53, *Maximum Extent Practical (MEP) Documentation Process*, Savannah River Site, Aiken, SC, Rev. 0, November 13, 2012.

S4 Manual, Procedure ENG.46, *LW Unreviewed Waste Management Question (UWMQ)*, Savannah River Site, Aiken, SC, Rev. 2, March 23, 2012.

S4 Manual, Procedure ENG.50, *LW Project & Closure Operating Plans*, Savannah River Site, Aiken, SC, Rev. 2, September 26, 2013.

SRR-CWDA-2010-00128, *Performance Assessment for the H-Area Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 1, November 2012.

SRR-CWDA-2011-00022, *Industrial Wastewater General Closure Plan for H-Area Waste Tank Systems*, Savannah River Site, Aiken, SC, Rev. 0, May 2012.

SRR-CWDA-2011-00050, *SRS Liquid Waste Tank Residual Sampling and Analysis Program Plan,* Savannah River Site, Aiken, SC, Rev. 2, July 2013.

SRR-CWDA-2011-00117, *SRS Liquid Waste Tank Residual Sampling-Quality Assurance Program Plan,* Savannah River Site, Aiken, SC, Rev. 1, July 2013.

SRR-CWDA-2012-00045, *Nuclear Regulatory Commission's F-Tank Farm Technical Evaluation Report's Recommendations – Department of Energy's Activity Summary Matrix*, Savannah River Site, Aiken, SC, Rev. 0, January 2014.

SRR-CWDA-2012-00138, *Documentation of Removal of Highly Radioactive Radionuclides in Waste Tanks 5 and 6*, Savannah River Site, Aiken, SC, Rev. 0, May 13, 2013.

SRR-CWDA-2013-00133, *Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program—FY2014 Implementation Plan*, Savannah River Site, Aiken, SC, Rev. 1, March 2014.

SRR-CWDA-2014-00003, Cantrell, J., *SRR Waste Removal and Operational Closure Strategy*, Savannah River Site, Aiken, SC, Rev. 0, June 2014.

V-ESR-G-00003, Caldwell, T., *Waste Removal Technology Baseline: Technology Development Description*, Savannah River Site, Aiken, SC, Rev. 1, June 15, 2011.

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, August 16, 1993.

Attachment 1: Nuclear Regulatory Commission's H-Tank Farm Technical Evaluation Report Recommendations Matrix

Transmittal Letter

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
TL-1	Transmittal Letter	Chapter 2	3116(a)(1) [Deep Geologic Repository]	*With regard to Criterion 1, provided that the DOE can meet the 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.*	N/A	N/A	• NRC's conclusion relative to Criterion 1 has been noted in the HTF 3116 Basis Document.	• The NRC provided no recommendations relative to Criterion 1.	• This NRC conclusion has been incorporated into the text in Section 1.4 of the HTF 3116 Basis Document and a footnote has been added to the HTF 3116 Basis Document (Section 4) stating that NRC believes, provided Criteria 2 and 3 can be met, DOE can meet Criterion 1. • Relative to Criterion 1, with the exception of the two sub-entries listed below, there are no additional entries contained within this matrix.
TER page xv *Because there appears to be no special properties of the waste and there are no proliferation concerns that would necessitate deep geologic disposal, the NRC staff notes in Chapter 2 of this TER that it believes that DOE can meet Criterion 1 provided Criteria 2 and 3 are demonstrated for the HTF. That is, the cleaned tanks do not require exhumation and disposal in a geologic repository.* TER page 2-1 *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 for the waste at HTF.*									
TL-2	Transmittal Letter	Chapter 3	3116(a)(2) [HRR Removal to MEP]	*Criterion 2 requires that waste has had Highly Radioactive Radionuclides (HRRs) removed to the Maximum Extent Practical (MEP). The NRC staff notes that DOE has robust processes for identification and characterization of HRRs. Furthermore, the DOE has identified strategies for HRR removal to MEP for future tank cleaning. However, because most of the tanks have yet to be cleaned, the information is prospective. In the enclosed TER, the NRC staff, in its consulting role, presents its evaluation results and notes several areas where the DOE could provide additional information to support its conclusions regarding the ability of the HTF to meet the NDAA Section 3116 criteria as the tank cleaning process continues*	N/A	N/A	• The NRC's key recommendations relative to Criterion 2 are addressed in the matrix entry for Key Recommendations ES-2.1 through ES-2.8.	• This is a general statement within the Transmittal Letter, specific details are captured by the NRC in its recommendations.	• This general statement has been incorporated into the text in Section 1.4 of the HTF 3116 Basis Document. Changes to the HTF 3116 Basis Document relative to specific recommendation are captured in the matrix entries for Key Recommendations ES-2.1 through ES-2.8.

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TL-3	Transmittal Letter	Chapter 4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*Criterion 3 states that waste will be disposed of in compliance with 10 CFR Part 61, Subpart C, performance objectives. Subpart C provides for site stability and sets requirements for protection of the public, the inadvertent intruder, and individuals during operations. As was the case with (FTF), the NRC staff is not making a conclusion at this time on the ability of the HTF to meet the requirements of the performance objectives in 10 CFR Part 61, Subpart C due to uncertainty in the final inventories for the remaining tanks as well as uncertainties associated with contaminants that have breached primary containment in several tanks.*	N/A	N/A	• The NRC's key recommendations relative to Criterion 3 are addressed in the matrix entry for Key Recommendations ES-3.2 through ES-3.6.	• This is a general statement within the Transmittal Letter, specific details are captured by the NRC in its recommendations.	• This general statement has been incorporated into the text in Section 1.4 of the HTF 3116 Basis Document. Changes to the HTF 3116 Basis Document relative to specific recommendation are captured in the matrix entries for Key Recommendations ES-3.2 through ES-3.6.
TL-4	Transmittal Letter	Chapter 4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*The NRC staff recommends that the 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.*	N/A	N/A	• This is the NRC's primary recommendation relative to Criterion 3 and is addressed in the matrix entry for Key Recommendation ES-3.1.	• The identification of this recommendation as the "primary recommendation" is provided by the NRC in the Executive Summary as noted in the matrix entry for Key Recommendation ES-3.1	• The identification of waste release testing has been incorporated into the HTF 3116 Basis Document as noted in the matrix entry for Key Recommendation ES-3.1.

Key Recommendations

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-2.1	xvii	3.2.1.7, 3.2.4, 3.9	3116(a)(2) [HRR Removal to MEP]	*The NRC staff recommends that DOE explore methods to improve the process by which residual waste volumes and associated uncertainty are estimated. The NRC staff also recommends that DOE evaluate and clearly communicate the relative contributions of various forms of uncertainty related to the radionuclide sampling process.*	N/A	N/A	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. • DOE will share information in this area with the NRC as available.	• This recommendation relates to the approach used for final inventory estimates and how future information (e.g., final characterization results) is utilized to improve inventory estimates for tanks not yet cleaned. Relative to the HTF PA Revision 1 inventory, the NRC notes, *DOE's approach to developing inventories for tanks that have not been cleaned is reasonable and appears to be generally conservative (tends to over- rather than under- predict inventory).*	• Footnote #42 of the Draft HTF 3116 Basis Document (Section 2) notes 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. The footnote has been revised to tie-in reference to the NRC HTF TER wording. (Footnote #50 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, final characterization information and the potential impacts on the conclusions of the HTF PA, including potential impacts on inventory multiplier assumptions, will be evaluated utilizing Special Analyses as described in Appendix B of the HTF 3116 Basis Document. • This activity relative to FTF (i.e., recommendations provided as part of FTF Monitoring) has been captured in The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2014 Implementation Plan, SRR-CWDA-2013-00133. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.

TER page 3-55

1. The NRC staff recommends that DOE explore methods to improve the process by which residual waste volumes and associated uncertainty are estimated. The NRC staff also recommends DOE evaluate and clearly communicate the relative contributions of various forms of uncertainty related to the sampling process on estimates of confidence bounds on average concentrations for individual radionuclides. DOE should analyze trends in projections versus actual inventories by radionuclide to update the multiplier assumptions for the probabilistic analysis.

TER page 3-55

…DOE's approach to developing inventories for tanks is reasonable, although the approach to managing and quantifying uncertainty in sampling and volume estimates, could be improved (Barr, 2013a [ML13085A291]; Barr, 2013b [ML13273A299]).

TER page 3-21

As more sample data are available from tanks that have been cleaned, DOE should analyze trends in projections versus actual inventories by radionuclide to update the multiplier assumptions for the probabilistic analysis.

TER page 3-25

DOE's approach to developing the volume estimates for Tanks 5 and 6 appears to be technically sound and adequately executed. However, it is less clear that volume uncertainty is adequately managed in this area. The NRC staff provided the following recommendations as part of FTF Monitoring, which are also relevant to HTF because the process will be largely similar to what was used at FTF (Barr, 2013a [ML13085A291]):

- *DOE should better understand the accuracy of mapping team height estimates through additional field validation activities for a range of solid material heights.*
- *DOE should clearly communicate how it delineates the size of areas of similar height that are mapped, and how it manages uncertainty related to height estimates for discretized areas in its deterministic analysis. Likewise, DOE should clarify how it represents uncertainty in the assignment of high and low end heights to these areas (e.g., does it use a height that is clearly below/above the non-uniform surface of the delineated areas).*
- *DOE should consider uncertainty in the volume estimates resulting from the transfer of data from photographic and video evidence to hand contoured maps (and then to Excel spreadsheets with a finer discretization).*
- *DOE should be more transparent with respect to its approach to (1) mapping annular volumes, including the use of a crawler to inspect internal surfaces, and (2) estimating residual waste volumes in ventilation ducts. DOE should consider uncertainty in annulus volume estimates.*
- *Alternatively, volume mapping uncertainty could be managed through the use of estimates that are biased towards higher volumes.*

TER page 3-26

In the future, DOE should consider FTF technical review (Barr, 2013a [ML13085A291]) comments that were discussed during an August 27-28, 2013, onsite observation visit (Mohseni, 2013b [ML13267A452]). The NRC staff provided the following comments (Barr, 2013a [ML13085A291]):

- *DOE should consider, in its tank sampling design, historical information on tank waste receipts and information related to the alteration and redistribution of waste due to cleaning operations that may impact horizontal and vertical waste heterogeneity.*
- *DOE should evaluate the option to composite samples within segments (or strata) to preserve information about segment (or strata) variance.*
- *DOE should evaluate and present information on the relative contributions of various forms of uncertainty in its estimation of mean tank concentrations.*
- *DOE should clarify the statistical approach used to estimate the 95th percentile upper confidence limit (e.g., treatment of all nine measurements as independent when computing the upper confidence limit).*
- *DOE should also consider how it can better ensure sample representativeness by improving tank sampling designs, collection tools, and instructions.*
- *Alternatively, DOE could manage sampling and analysis uncertainty through the use of estimates that are biased towards higher inventories.*

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-2.2	xvii	3.4, 3.9	3116(a)(2) [HRR Removal to MEP]	*The NRC staff recommends that DOE continue to evaluate its HRR list and provide sufficient justification for any changes as additional information becomes available. The HRR list should be evaluated especially where it is used to inform decisions, such as the selection of radionuclides characterized in residual waste, selection of treatment technologies, and the screening of radionuclides for the purpose of detailed 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 HTF 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.	• 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* on page 3-55 of the NRC TER) has been noted in the HTF 3116 Basis Document. • Footnote #50 of the Draft HTF 3116 Basis Document (Section 5), which notes that DOE will continue to characterize and confirm the actual residuals after cleaning, has been revised to incorporate specific wording from the NRC HTF TER. (Footnote #61 of the HTF 3116 Basis Document) • As part of the PA Maintenance Program under DOE Manual 435.1-1, final characterization information and any appropriate update to the HTF PA will be evaluated utilizing Special Analyses as described in Appendix B of the HTF 3116 Basis Document.

TER page 3-55

2. The NRC staff recommends that DOE continue to evaluate its HRR list for HTF as additional information becomes available. The HRR list should be evaluated especially where it 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 detailed PA calculations.

TER page 3-31

The NRC staff evaluated DOE's selection of HRRs and the staff concludes that the combination of approaches used by DOE to identify HRRs in the context of the draft basis for the WD for HTF is reasonable. However, as discussed in Section 3.1 and Chapter 4, as DOE continues to evaluate assumptions for the HTF PA and its inventory as a result of consultation and monitoring activities, DOE should concurrently re-evaluate its list of HRRs as new information that could significantly change the results of its HRR evaluation becomes available.

TER page 3-30

NRC staff notes that the amount of thorium fuel processed at HTF was relatively small. However, if the initial sampling of HTF tanks shows Ra-226 to be present in greater quantities than projected, DOE should reconsider listing it as an HRR.

TER page 3-31

The NRC staff recommends that if the initial sampling for HTF shows that concentrations of these curium isotopes are higher than expected, DOE should reconsider adding these curium isotopes to the list of HRRs.

Note: NRC staff is specifically referring to Cm 244, Cm-245, Cm-247, and Cm-248.

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ES-2.3	xvii	3.2.1.4, 3.9	3116(a)(2) [HRR Removal to MEP]	*The NRC staff acknowledges DOE's efforts in understanding unexpected final inventory results (e.g., larger than expected inventory of zirconium in FTF Tanks 5 and 6) and recommends that DOE continue to examine the reasons for unexpected results, should they occur, and attempt to trace them back to known waste streams or processes that might reveal other radionuclides that could have been underestimated by the projections based on the waste characterization system data. The NRC staff recommends that DOE assess, through future tank residual characterization, the validity of prior assumptions and the resulting impacts to the list of HRRs.*	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 HTF 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.	• 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* on page 3-55 of the NRC TER) has been noted in the HTF 3116 Basis Document. • Footnote #50 of the Draft HTF 3116 Basis Document (Section 5), which notes that DOE will continue to characterize and confirm the actual residuals after cleaning, has been revised to incorporate specific wording from the NRC HTF TER. (Footnote #61 of the HTF 3116 Basis Document) • As part of the PA Maintenance Program under DOE Manual 435.1-1, final characterization information and any appropriate update to the HTF PA will be evaluated utilizing Special Analyses as described in Appendix B of the HTF 3116 Basis Document.

TER page 3-55

3. The NRC staff acknowledges DOE's efforts in understanding unexpected results and recommends that DOE continue to examine the reasons for such, should they occur, and attempt to trace them back to known waste streams or processes that might reveal other radionuclides that could have been underestimated by the projections based on WCS data. DOE should assess, through future tank residual characterization, the validity of prior assumptions and the resulting impacts to the list of HRRs.

TER page 3-20

DOE should continue to sample for Zr- 93 (even though Zr-93 is not an HRR), given the unexpected results in FTF Tanks 5 and 6, to reduce uncertainty in the Zr-93 projections.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-2.4	xviii	3.6, 3.9	3116(a)(2) [HRR Removal to MEP]	*As practical, the NRC staff recommends that DOE continue to participate in technology exchanges and 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.	• The Path Forward activities are noted in previous column.	• Footnote #34 of the Draft HTF 3116 Basis Document (Section 2) noting that DOE will continue to participate in technology exchanges has been revised to tie-in reference to the NRC HTF TER. (Footnote #41 of the HTF 3116 Basis Document) • 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 HTF General Closure Plan. [SRR-CWDA-2011-00022]

TER page 3-55

4. As practical, the NRC staff recommends that DOE continue to participate in technology exchanges and evaluate new cleaning technologies as they become available, rather than defaulting to previously selected technologies or relying on previous evaluations for technology selection.

TER page 3-37

The NRC staff recommends DOE to continue evaluating new technologies for future use as tank closure progresses, especially if previously used technologies are no longer practical to use. Furthermore, for those tanks in which conditions are dissimilar (e.g., Tank 48) the NRC staff would expect DOE to re-evaluate technologies as opposed to relying on previously performed technology evaluations.

TER page 3-51

The NRC staff recommends that DOE continue its efforts to participate in technology exchanges so that it can stay informed of potential new cleaning technologies.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-2.5	xviii	3.6, 3.9	3116(a)(2) [HRR Removal to MEP]	*The NRC staff recommends that DOE provide more emphasis on removal of HRRs in its technology selection process and provide a clear linkage between the HTF PA results, including information regarding the long-term risks associated with the HTF facility, and the demonstration that HRRs have been removed to the MEP per Criterion 2.*	N/A	N/A	• Future technology selection will take into consideration specific radionuclide removal effectiveness, with emphasis on HRR removal, as described in Appendix B of the HTF 3116 Basis Document. • As described in Appendix B of the HTF 3116 Basis Document, the final Removal Report for each waste tank or ancillary structure will include a cost-benefit analysis informed, in part, by the qualitative dose impact results and conclusions of the associated performance assessment with the final radionuclide inventory considered. • The process outlined in Appendix B is controlled by two site procedures, Manual S4, ADM.53 (Maximum Extent Practical (MEP) Documentation Process) and Manual S4, ENG.50 (LW Project & Closure Operating Plans) which will be implemented for HTF once Tier 1 approval is granted by DOE. • The most recent technology selection document, SRR Waste Removal and Operational Closure Strategy, SRR-CWDA-2014-00003, has been added as a new reference to the HTF 3116 Basis Document.	• This NRC key recommendation is addressed through implementation of the process outlined in Appendix B of the HTF 3116 Basis Document which includes development of a Special Analysis based on final residual characterization and a final Removal Report which is informed by, among other things, the results of the Special Analysis including impact on long-term dose to a hypothetical member of the public.	• Footnote #33 from the Draft HTF 3116 Basis Document (Section 2), noting that future technology selection/optimization will be informed by the HTF PA and DOE will take into consideration specific radionuclides to possibly target HRR removal as described in Appendix B, has been revised to note NRC's recommendation and otherwise remains unchanged. (Footnote #40 of the HTF 3116 Basis Document) • Appendix B of the HTF 3116 Basis Document remains as provided in the Draft HTF 3116 Basis Document. • SRR Waste Removal and Operational Closure Strategy, SRR-CWDA-2014-00003, has been added as a reference to the HTF 3116 Basis Document as an update to Waste Removal Technology Baseline: Technology Development Description, V-ESR-G-00003.

TER page 3-55

7. The NRC staff recommends that DOE provide more emphasis on removal of HRRs in its technology selection process and provide a clear linkage between the Criterion 2 evaluation and the PA results, including consideration of long-term risks associated with the HTF facility.

TER page 3-38

The NRC staff thinks that DOE can place more emphasis on the development of technologies, such as an alternative to oxalic acid that would have less downstream impacts. New technologies such as the mixing models, robotic arm, and jet spray technologies may help facilitate removal of low volume but high specific activity material. The NRC staff acknowledges the inherent challenges in removing the last increments of material that add significantly to the residual source term. The NRC staff is aware that the "cost-benefit" process that drives decisions to continue or terminate waste retrieval activities is driven by a variety of factors many of which are independent of the drivers associated with Criterion 3. At the same time, it is the position of the NRC staff that technology selection should consider the long-term risk from HRRs left in HTF tanks at closure.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-2.6	xviii	3.8.1, 3.9	3116(a)(2) [HRR Removal to MEP]	*The 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	• Evaluation of technology effectiveness will take into consideration specific radionuclide removal effectiveness, with emphasis on HRR removal, as described in Appendix B of the HTF 3116 Basis Document. • As described in Appendix B of the HTF 3116 Basis Document, Operating Plans will be developed and will include, among other things, identification of specific metrics and/or process sampling that provide indication of effectiveness to track progress during waste removal evolutions. • The process outlined in Appendix B is controlled by two site procedures, Manual S4, ADM.53 (Maximum Extent Practical (MEP) Documentation Process) and Manual S4, ENG.50 (LW Project & Closure Operating Plans) which will be updated and subsequently implemented for HTF once Tier 1 approval is granted by DOE. • The most recent technology selection document, SRR Waste Removal and Operational Closure Strategy, SRR-CWDA-2014-00003, has been added as a new reference to the HTF 3116 Basis Document.	• This NRC key recommendation will be incorporated by implementation of the process outlined in Appendix B of the HTF 3116 Basis Document which includes development of a an Operating Plan to support decisions regarding technology effectiveness. • Addition of SRR-CWDA-2014-00003 as a reference to the HTF 3116 Basis Document will demonstrate DOE's commitment to continue evaluating effectiveness of technologies being deployed/considered.	• Footnote #34 of the Draft HTF 3116 Basis Document (Section 2) noting that DOE will continue to participate in technology exchanges and assess how to optimize selected technologies has been revised to tie-in reference to the NRC HTF TER. (Footnote #41 of the HTF 3116 Basis Document) • Appendix B of the HTF 3116 Basis Document remains as provided in the Draft HTF 3116 Basis Document. • SRR Waste Removal and Operational Closure Strategy, SRR-CWDA-2014-00003, has been added as a reference to the HTF 3116 Basis Document.

TER page 3-55

5. The NRC staff recommends that DOE consider how it might better assess and optimize the effectiveness of selected technologies (e.g., obtain better baseline information).

TER page 3-49

The NRC staff notes that, although the results from mapping contain uncertainties, performing the tank mapping methodology during multiple cleaning phases will provide additional information on the effectiveness of specific technologies. As such, the NRC staff recommends that DOE perform the tank mapping consistently and as frequently as practical throughout the cleaning process.

TER page 3-50

To help overcome the limitations encountered with cleaning Tanks 5 and 6 for the cleaning of future tanks, the NRC staff recommends that DOE evaluate the effectiveness of the SMPs with respect to bulk sludge removal versus residual heel removal. The NRC staff also recommends that DOE compare the efficiency and effectiveness of the SMP to previously used technologies or readily available technologies.

TER page 3-51

…the NRC staff supports DOE's efforts to re-evaluate oxalic acid cleaning against downstream impacts to determine the future role of oxalic acid cleaning, as opposed to relying on previous evaluations of oxalic acid technology.

TER page 3-51

The NRC staff recommends that, to the extent practical, DOE consider obtaining data on HRR inventories prior to and following major cleaning campaigns (e.g., before and after treatment of Type I tanks with oxalic acid) to provide effectiveness measurements for chemical cleaning and mechanical feed-and-bleed (Mohseni, 2013a [ML13196A135]).

TER page 3-52

The NRC staff notes that DOE improved the operating plan for Tank 12 by requiring the availability of the transfer receipt tank to be confirmed prior to acid addition. The NRC staff encourages DOE to continue to analyze the lessons learned from these prior cleaning campaigns to prevent limitations of the liquid waste system from unexpectedly influencing the effectiveness of future cleaning campaigns.

TER page 3-52

DOE should try to optimize operational parameters for existing technologies and technologies to be developed in the future to ensure that removal of HRRs is not hampered or made more difficult because of poor planning or lack of investment in waste characterization.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-2.7	xviii	3.8.1, 3.9	3116(a)(2) [HRR Removal to MEP]	*The NRC staff recommends that DOE continue to better define the documented process to be used to demonstrate removal to the MEP to ensure consistent (non- arbitrary) application of the criterion.*	N/A	N/A	• Appendix B of the HTF 3116 Basis Document outlines the process used to document removal to the MEP. The process outlined in Appendix B is controlled by two site procedures, Manual S4, ADM.53 (Maximum Extent Practical (MEP) Documentation Process) and Manual S4, ENG.50 (LW Project & Closure Operating Plans) which will be implemented for HTF once Tier 1 approval is granted by DOE. • Based on lessons learned and information gained during future waste removal efforts, DOE will continue to refine the metrics and documentation supporting waste removal efforts. • Future cost-benefit analyses will follow a similar approach to that performed for Tanks 5/6 as documented in Documentation of Removal of Highly Radioactive Radionuclides in Waste Tanks 5 and 6, SRR-CWDA-2012-00138.	• This NRC key recommendation will be incorporated by implementation of the process outlined in Appendix B of the HTF 3116 Basis Document. As additional waste tanks are cleaned, DOE will be in the position to better refine/standardized the metrics which prove to be most effective at determining when end-states are achieved.	• Appendix B of the HTF 3116 Basis Document remains as provided in the Draft HTF 3116 Basis Document. • Footnote #74 of the Draft HTF 3116 Basis Document (Section 5) concerning cost-benefit analysis has been revised to note that future cost-benefit analyses will follow a similar approach to that used for FTF Tanks 5 and 6. (Footnote #91 of the HTF 3116 Basis Document)

TER page 3-55

8. The NRC staff recommends that DOE continue to refine the methods to be used to demonstrate removal to the MEP to ensure consistent (non-arbitrary) application of the criterion.

Note: DOE notes that continued demonstration of removal to the MEP 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 use the process, outlined in Appendix B of the HTF 3116 Basis Document, to document removal to the MEP in a consistent (non-arbitrary) manner.

TER page 3-55

With regard to tanks that have not yet been cleaned, DOE has a general process in place to demonstrate removal of HRRs to the MEP. DOE has refined the approach since it was first developed, but this process could still benefit from additional detail as DOE gains experience cleaning the tanks.

TER page 3-51

In Appendix B of the draft basis for the WD for HTF (DOE/SRS-WD-2013-001, Rev. 0), DOE outlines a general approach to demonstrate that the HRRs will be removed to the MEP. Over the course of FTF monitoring activities and the HTF consultation, the NRC staff believes that DOE has improved the level of detail regarding the specific implementation of the process….However, DOE could still improve the standardization of metrics for determining that the anticipated end states have been reached.

TER page 3-52

It remains unclear to the NRC staff if DOE will follow a consistent format with the appropriate content for the future cost-benefit analyses.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-2.8	xviii	3.8.2.1, 3.9	3116(a)(2) [HRR Removal to MEP]	*Given the potential risk significance of the waste remaining in the Tank 16 annulus, the NRC staff recommends that DOE more fully evaluate the practicality of additional radionuclide removal from the Tank 16 annulus versus the long-term benefit of reduced risk considering uncertainty in the releases of radionuclides from the Tank 16 annulus. While DOE's HTF PA demonstrates that the risk from waste remaining in the annulus is reasonable, alternative waste release models may lead to higher risk estimates.* Note: This recommendation focuses on the practicality of additional radionuclide removal from the Tank 16 annulus as it relates to Criterion 2. Recommendation ES-3.2 provides additional information relative to Criterion 3.	N/A	N/A	• The HTF 3116 Basis Document includes Appendix B as in the Draft HTF 3116 Basis Document. • As with all future waste tank closure activities in HTF, the process outlined in Appendix B of the HTF 3116 Basis Document will be followed to support DOE Tier 2 Closure Authorization prior to grouting Tank 16. • Final residual characterization for Tank 16, including residuals in the annulus, will be developed and documented based on final tank characterization. • Utilizing the final residual characterization, a Special Analysis will be prepared to evaluate the impacts of the final inventory. The Special Analysis will include, among other things, analysis of the sensitivity of HTF results to Tank 16 annulus/sand pad modeling variability. More detail regarding the Special Analysis is provided in the matrix entry for NRC Key Recommendation ES-3.2. • A final Removal Report, including a more rigorous cost-benefit analysis, will be prepared for Tank 16. The cost-benefit analysis will utilize the results of the Tank 16 Special Analysis. • The Tank 16 Special Analysis and final Removal Report, among other things, will support DOE Tier 2 Closure Authorization which is required prior to grouting Tank 16.	• Path forward is in alignment with Appendix B of the HTF 3116 Basis Document and the NRC key recommendation. Following the Appendix B process will address the NRC concern. It should be noted that at the time of NRC's review, Tank 16 had just entered the sample and analysis phase of the waste removal process, and is currently still in that phase. Therefore, the NRC did not have all the information necessary to reach a conclusion regarding Tank 16.	• A footnote has been added to the HTF 3116 Basis Document (Section 5) noting the NRC's recommendation and that DOE will use the process outlined in Appendix B of the HTF 3116 Basis Document. (Footnote #88 of the HTF 3116 Basis Document) • Appendix B of the HTF 3116 Basis Document remains as provided in the Draft HTF 3116 Basis Document. • Additional text has been added to Sections 1.4 and 5.3 of the HTF 3116 Basis Document to update the Tank 16 status and emphasize the activities, as described in Appendix B, that will be completed prior to grouting of Tank 16. • A Tank 16 Special Analysis will be prepared as described in Appendix B of the HTF 3116 Basis Document.

TER page 3-51

As discussed below in Section 3.8.2, the NRC staff does not have confidence that DOE has adequately evaluated the risk associated with the projected inventory of the Tank 16 annulus (see Section 4.2.9.3). The NRC staff acknowledges that the final characterization may show an inventory much less than what was projected. However, the NRC staff recommends that DOE appropriately evaluate the risk of that final inventory even if it is less than what was projected.

TER page 3-54

DOE will provide more detailed documentation on the practicality of removing additional waste from the Tank 16 annulus in a Tank 16 Removal Report that will be issued after the completion of final residual characterization and subsequent cost-benefit analysis. The NRC staff recommends that DOE evaluate a waste release scenario due to groundwater in-leakage into and out of the annular region and contacting the high-solubility waste in the annuli of those tanks with residual material in the annulus and sandpads, including Tank 16. The NRC staff also acknowledges that it may be impractical to further clean the annulus of Tank 16 due to the recalcitrant nature of some of the annular contamination and nuclear safety concerns. As part of its monitoring responsibility, the NRC staff will review the Tank 16 final characterization data and documentation of removal to the MEP to ensure that DOE has adequately weighed the potential risk of this material against the practicality of additional removal.

Note: DOE notes that cost-benefit analyses are not required by NDAA Section 3116(a). Likewise, monitoring of HRR removal to the MEP following a NDAA Section 3116(a) Secretarial determination is not part of the statutorily-prescribed NRC monitoring, in coordination with the State of South Carolina, under NDAA Section 3116(b). Nevertheless, DOE will continue to implement the process described in Appendix B of the HTF 3116 Basis Document to support DOE's Tier 2 closure process, including characterization of the residuals in Tank 16 and its annulus, preparation of a Removal Report with emphasis on HRRs, and preparation of a rigorous cost-benefit analysis. DOE also will continue to monitor the HTF, and maintain and update the HTF PA, pursuant to DOE Manual 435.1-1 and DOE's authority and responsibilities under the Atomic Energy Act of 1954, as amended, in a manner that is fully protective of health, safety and the environment.

TER page 3-56

…the NRC staff recommends that DOE should more fully evaluate the practicality of additional radionuclide removal from the Tank 16 annulus versus the long-term benefit of reduced risk…

TER page 3-56

…the NRC staff is not confident that DOE has adequately evaluated the potential dose to a future member of the public from the remaining material should it escape the near-field environment. The NRC staff acknowledges that projected inventory does not reflect the final characterization. However, even if the final inventories are lower than the projected inventory, the final inventories will not be significantly lower as to eliminate the potential risk should the annulus inventory be released into the environment.

TER page 3-56

The final volume and characterization information will be utilized by DOE to support a final decision on the practicality of additional waste removal from the Tank 16 waste tank system. DOE will document the final Tank 16 inventory, radionuclide removal effectiveness (with emphasis on HRRs), and final cost-benefit analysis in a final removal report. The final removal report is required before DOE would provide Tier 2 authorization and approval to stabilize (i.e., grout) Tank 16.

TER page 3-56

At this stage DOE has provided a rough order of magnitude cost-benefit analysis of additional HRR removal from the Tank 16 annulus to the NRC staff (U-ESR-H-00107, Rev. 0). The NRC staff acknowledges that DOE is still preparing the final removal report and recommends that DOE provide a more detailed cost benefit analysis to support the Criterion 2 demonstration for Tank 16 in the final removal report. The NRC staff would like to obtain a copy of the final removal report when it is complete.

TER page 5-1

Given that Tank 16 will be one of the first HTF tanks to be closed, the extent of contamination in its annulus, and the previous release of waste from secondary containment, the NRC staff recommends that DOE should conduct a more comprehensive analysis of contaminant release from the annulus prior to grouting Tank 16

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ES-3.1	xx	4.2.9.3, 4.2.9.5, 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*As its primary recommendation, the NRC staff reiterates its FTF recommendation that DOE conduct waste release experiments. The NRC staff began monitoring activities related to this recommendation for FTF as part of its monitoring responsibilities. The NRC staff will continue to monitor DOE's activities to address this recommendation when it combines monitoring activities for both FTF and HTF (High Risk Significance, Short and Intermediate Term).*	High	Short & Intermediate	• This recommendation is captured in the Liquid Waste DOE PA Maintenance Program and DOE is currently performing activities to address this recommendation. Note: Method development for waste release experiments (utilizing Tank 18 waste) are currently in-progress under the PA Maintenance Program.	• The Path Forward activities are noted in previous column. • The current HTF PA utilizes the best available information regarding the waste release model. Experiments utilizing Tank 18 waste are currently in-progress. Any new information obtained from the current or future experiments will be evaluated and incorporated into the HTF PA, as appropriate, as part of maintenance of the HTF PA under DOE Manual 435.1-1, pursuant to DOE's authority under the Atomic Energy Act of 1954, as amended. Note: The wording of the recommendation states that this would be expected to occur during the monitoring period.	• This key recommendation along with current DOE activities relative to this recommendation have been identified in the text in Section 1.4 of the HTF 3116 Basis Document. • A footnote has been added to the HTF 3116 Basis Document (Section 7) noting the NRC's recommendation and that DOE is performing activities to address this recommendation. (Footnote #119 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative to the waste release model/assumptions and the potential impacts on the conclusions of the HTF PA will be evaluated and incorporated into the HTF PA, as appropriate, as part of maintenance of the HTF PA under DOE Manual 435.1-1, pursuant to DOE's authority under the Atomic Energy Act of 1954, as amended. • This activity will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.

TER page 4-167 & 4-84

1. As a primary recommendation, the NRC staff recommends DOE conduct waste release experiments to:

a. Increase experimental support for key modeling assumptions related to the behavior of tank fill grout over time, including the evolution of pH and Eh (High Risk Significance, Short-to-Intermediate Term);
b. Identify key radionuclide association with solid phases comprising the residue in representative tanks to support key modeling assumptions (Medium-to-High Risk Significance, Intermediate Term);
c. Determine constant concentrations of elements of concern under conditions of exposure to local groundwater and grout leachate via static tests (High Risk Significance, Short and Intermediate Term); and
d. Distinguish between releases from high solubility compounds and low solubility compounds via semi-dynamic leach tests (Medium-to-High Risk Significance, Intermediate Term).

These experiments would consider the effects of reagents (e.g., oxalic acid) used to remove radionuclides from the tank residue, including the formation of new compounds that may alter the leachability of radionuclides.

Note: DOE notes that NDAA Section 3116 and the performance objectives referenced therein do not mandate waste release experiments, and such experiments are not specified as part of the statutorily-prescribed monitoring by NRC, in coordination with the State of South Carolina, under 3116(b). Nevertheless, DOE has considered NRC's suggestions, and has resumed, and plans to continue, appropriate waste-release activities pursuant to DOE's authority and responsibilities under the Atomic Energy Act of 1954, as amended, in a manner that is fully protective of health, safety, and the environment. DOE will incorporate updated information into the HTF PA, as part of DOE's PA maintenance under DOE Manual 435.1-1, and plans to use best efforts to keep both NRC and the State of South Carolina informed.

TER page 4-73

In summary, the NRC staff continues to recommend that the SRS tank closure programs perform careful characterization of tank residues to assess the potential long-term leachability of the waste, including analysis of key radionuclide association with solid phases comprising the waste residue and leach tests. Ideally, characterization of tank residues following waste retrieval operations will be performed to ensure representativeness of experimental results. The NRC staff also recommends experiments to study the pH and Eh evolution of grouts proposed for SRS tank facility closure. In combination with data gathering, DOE should continue to refine the technical bases for model and parameter selections and associated uncertainty analyses.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-3.2	xx	4.2.9.3, 4.2.9.5, 4.4, 5	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*DOE should conduct a more comprehensive analysis of contaminant release from the annular regions of Type I and II tanks (Medium-to-High Risk Significance, Short and Intermediate Term).*	Medium-to-**High**	**Short** and Intermediate	• As with all future waste tank closure activities in HTF, the process outlined in Appendix B of the Draft HTF 3116 Basis Document will be followed to support DOE Tier 2 Closure Authorization prior to grouting Tank 16. • Final residual characterization for Tank 16, including residuals in the annulus, will be developed and documented based on final tank characterization. • Utilizing the final residual characterization, a Special Analysis will be prepared to evaluate the impacts of the final inventory. The Special Analysis will include, among other things: - Modeling revisions to address discrete inventory segmentation (e.g., primary and annulus inventory modeled separate) for all tanks. - Analysis of the sensitivity of HTF results to Tank 16 annulus/sand pad modeling variability (e.g., Tank 16 vault preferential pathway) • The Tank 16 Special Analysis, among other things, will support DOE Tier 2 Closure Authorization which is required prior to grouting Tank 16.	• Path forward is in alignment with Appendix B of the HTF 3116 Basis Document and DOE Manual 435.1-1. • Although not specifically stated, it is assumed that the NRC assignment of High Risk Significance and Short Term timing is associated with an evaluation of Tank 16 prior to grouting. Other tanks are assumed to fall under the Medium Risk Significance and Intermediate Timing. The specific impact of Tank 16 will be evaluated as part of the Tank 16 Special Analysis supporting Tier 2 Closure Authorization. The Tank 16 Special Analysis will also include an evaluation of contaminant release from the Type I and Type II annuli.	• Appendix B of the HTF 3116 Basis Document remains as provided in the Draft HTF 3116 Basis Document. • Additional text has been added to Sections 1.4 and 5.3 of the HTF 3116 Basis Document to update the Tank 16 status and emphasize the activities, as described in Appendix B, that will be completed prior to grouting of Tank 16. • A Tank 16 Special Analysis will be prepared as provided in Appendix B of the HTF 3116 Basis Document. • A footnote has been added to the HTF 3116 Basis Document (Section 7) noting the NRC's recommendation and that DOE will be performing activities to address this recommendation as part of the Tank 16 Special Analysis. (Footnote #119 of the HTF 3116 Basis Document)

TER page 4-168

2. DOE should conduct a more comprehensive analysis of contaminant release from the annular regions of Type I and II tanks (Medium-to-High Risk Significance, Short and Intermediate Term).

TER page 4-85

2. DOE should conduct a more comprehensive analysis of contaminant release from the annuli and sand pads in the Type I and II tanks. This analysis should include well supported assumptions for (a) the assumed release scenario; (b) the chemical composition of the infiltrating water; (c) the volumetric flow rate through grouted tanks, including shrinkage gaps and cracks; and (d) the solubility of the annulus and sand pad waste (Medium-to-High Risk Significance, Short and Intermediate Term).

TER page 4-75

The NRC staff is concerned that risk from the radionuclide inventories outside of the primary liners is not adequately accounted for in DOE's analyses. The NRC staff recommends that DOE conduct a more comprehensive analysis of the potential release of radionuclides from the annuli and sand pads in the Type I and Type II tanks. Implementation of this recommendation is necessary for the NRC staff to have reasonable assurance that the performance objectives in 10 CFR Part 61, Subpart C can be met. Dose projections from the potential release of the radionuclides in the annuli and sand pads are likely to be very sensitive to several key assumptions, which should be well supported. These assumptions include, but are not limited to (1) the assumed release scenario; (2) the chemical composition of the infiltrating water; (3) the volumetric flow rate through grouted tanks, including shrinkage gaps and cracks; and (4) the solubility of the annulus and sand pad waste. If the possibility of rise and fall of the water table in the vicinity of the Type I and II tanks cannot be excluded, DOE should evaluate a scenario where water drains from any gaps in the annulus and sand pad regions.

TER page 5-1

Given that Tank 16 will be one of the first HTF tanks to be closed, the extent of contamination in its annulus, and the previous release of waste from secondary containment, the NRC staff recommends that DOE should conduct a more comprehensive analysis of contaminant release from the annulus prior to grouting Tank 16.

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ES-3.3	xx	3.8.1, 4.2.7, 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*DOE should continue to sample each tank following waste retrieval activities and will follow-up with the NRC staff on sampling and analysis of cleaned tanks during the monitoring period (High-to-Medium Risk Significance, Short and Intermediate Term).*	High-to-Medium	Short and Intermediate	• For all future waste tank closure activities in HTF, the process outlined in Appendix B of the HTF 3116 Basis Document will be followed to support DOE Tier 2 Closure Authorization prior to grouting. •The final residual radionuclide inventory for each waste tank will be developed and documented based on final tank characterization as described in Appendix B of the HTF 3116 Basis Document. • The HTF 3116 Basis Document includes Appendix B as provided in the Draft HTF 3116 Basis Document, no changes to the process have been made. • Appendix B of the HTF 3116 Basis Document outlines the process used to document removal to the MEP. The process outlined in Appendix B is controlled by two site procedures, Manual S4, ADM.53 (Maximum Extent Practical (MEP) Documentation Process) and Manual S4, ENG.50 (LW Project & Closure Operating Plans) which will be revised and subsequently implemented for HTF once Tier 1 approval is granted by DOE. • Consistent with agreements set forth in the HTF General Closure Plan, SRR-CWDA-2011-00022, final characterization will be carried out per the SRS Liquid Waste Tank Residuals Sampling and Analysis Program Plan, SRR-CWDA-2011-00050, and the Liquid Waste Tank Residuals Sampling-Quality Assurance Program Plan, SRR-CWDA-2011-00117.	• Path forward is in alignment with Appendix B of the HTF 3116 Basis Document and the NRC key recommendation. • This recommendation is being carried out for HTF Tank 16 and Tank 12. Tank 16 has been sampled and analysis is in-progress. Sampling of Tank 12 is currently in-progress. 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.	• Appendix B of the HTF 3116 Basis Document remains as provided in the Draft HTF 3116 Basis Document. • Additional text has been added to Section 5.3 of the HTF 3116 Basis Document to update the Tank 16 and Tank 12 status to emphasize the activities, as described in Appendix B, that have been completed to date. • Tank 16 has been sampled and final analysis is in-progress. A Tank 16 Special Analysis will be prepared, based on the final characterization as provided in Appendix B of the HTF 3116 Basis Document. The same process will be followed for future tanks.

TER page 4-168

3. DOE should continue to sample each tank following waste retrieval activities and will follow-up with the NRC staff on sampling and analysis of cleaned tanks during the monitoring period (High-to-Medium Risk Significance, Short and Intermediate Term).

TER page 4-36

The NRC staff finds that DOE's approach to developing inventories for tanks that have yet to be cleaned is reasonable for the purposes of assessing HTF risk, prior to development of final inventories following waste retrieval activities. As a result of the NRC staff's finding, the NRC staff recommends that DOE continue its commitment to sample each tank following waste retrieval activities. NRC staff will follow-up with DOE on the sampling and analysis of cleaned tanks during the monitoring period (High-to-Moderate Risk Significance, Short and Intermediate-Term).

TER page 3-51

If DOE elects to reduce the number of analytes (i.e., radionuclides and metals) in the final characterization of a given tank based on prior analyses that indicated that certain non-risk significant, hard-to-detect radionuclides were not present in a another tank, DOE would need to provide evidence to support why the previous waste streams represent the waste for the tanks under evaluation. The NRC staff finds this process acceptable as long as DOE follows its commitment to analyze all HRRs in the future, and provides justification if the number of analytes is reduced. Also, each final characterization should be accompanied by a Technical Task Request and a Quality Assurance and Quality Control Plan.

Note: This recommendation was captured by NRC under Criterion 2.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-3.4	xx	4.2.9.4, 4.2.9.5, 4.2.11.2, 4.2.11.6, 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*DOE should continue to evaluate the appropriateness of selected transport parameters (e.g., cementitious material and soil Kds) and the selection of sorption models during the monitoring period (Medium Risk Significance, Intermediate Term).*	Medium	Intermediate	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1.	• DOE has a robust program for maintenance of the HTF PA as described in the Path Forward, which includes consideration of any new information concerning transport parameters and sorption models.	• A footnote has been added to the HTF 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. (Footnote #116 of the HTF 3116 Basis Document) • As part of the PA Maintenance Program, any new information relative to transport parameters or changes in sorption models and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.

TER page 4-168

4. DOE should continue to evaluate the appropriateness of selected transport parameters (e.g., cementitious material and soil Kds) and the selection of sorption models during the monitoring period (Medium Risk Significance, Intermediate Term).

TER page 4-85 (Near-Field)

3. DOE should continue to evaluate the appropriateness of selected transport parameters (e.g., cementitious material and soil Kds) and the selection of sorption models during the monitoring period (Medium Risk Significance, Intermediate Term).

TER page 4-79

The NRC staff concludes DOE should further consider the appropriateness of using the sediment statistics to define cementitious material Kds uncertainty (i.e., as more data become available). In addition, as discussed later in this section, the NRC staff thinks more analyses are needed to refine the statistical approach to constraining Kd uncertainty.

TER page 4-80

The sandy sediment Kd for plutonium of 650 mL/g is derived from SRNL-STI-2011-00672…The NRC staff does not find the argument for the 650 mL/g to be well supported, and thinks it does not account for different oxidation states as discussed in the following paragraph.

…The NRC staff still thinks a more accurate representation of the transport of multivalent plutonium would be to treat the two species separately, assuming the oxidation state distribution could be reasonably quantified. The NRC staff will follow this technical issue and DOE's efforts to address this issue during the monitoring period.

TER page 4-80

Some factors apparent from the values in the HTF PA (Table 4.2-25; SRR-CWDA-2010-00128, Rev. 1), do not follow the guidance in SRNL-STI-2009-00473, Rev. 0. The deviations from SRNL-STI-2009-00473, Rev. 0 (e.g., uranium and plutonium) do tend to vary in the conservative low-Kd direction. Nevertheless, DOE should explain in future documents the rationales for specific deviations from the originally recommended factors.

TER page 4-115 (Far-Field)

The NRC staff concludes that in future PA updates, DOE could improve the current far-field model to reduce uncertainty in dose modeling predictions. For example:
…
4. DOE should continue to evaluate the appropriateness of selected transport parameters (e.g., soil Kds) and the selection of sorption models during the monitoring period (Medium Risk Significance, Intermediate Term).

As a result of the uncertainty in the far-field model, the NRC staff will monitor these items when the HTF PA is revised as part of DOE's PA maintenance program. DOE can address this monitoring area by making appropriate revisions during future HTF PA updates.

TER page 4-114

Long-term lysimeter experiments (as referenced in Kaplan et al., 2006) indicate that although most plutonium is in the (IV) oxidation state, there is a small component that at times is much more mobile. Additional detail is provided in Appendix E of the FTF Monitoring Plan (Camper, 2013a [ML12345A322]). Recognizing that plutonium chemistry is especially complex and disproportionation presents a difficult problem, the NRC staff continues to evaluate the appropriateness of plutonium Kd values used in the HTF PA, as well as the Kd values for other key radionuclides.

TER page 4-105

However, the role of soft zones on contaminant transport is uncertain, and more work is required to evaluate the potential impacts of these zones on contaminant transport. DOE progress in this area will be evaluated during the monitoring phase.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-3.5	xx	4.2.11.3, 4.2.11.6, 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*DOE should improve the calibration of the far-field model, particularly local to H-Area and continue to study uncertainty in calibration targets (Medium Risk Significance, Intermediate Term).*	Medium	Intermediate	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1.	• DOE has a robust program for maintenance of the HTF PA as described in the Path Forward, which includes consideration of new data and information related to calibration of the far-field model.	• A footnote has been added to the HTF 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. (Footnote #116 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative to calibration of the far-field model or changes in calibration targets and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.

TER page 4-168

5. DOE should improve the calibration of the far-field model, particularly local to H-Area and continue to study uncertainty in calibration targets (Medium Risk Significance, Intermediate Term).

TER page 4-115

The NRC staff concludes that in future PA updates, DOE could improve the current far-field model to reduce uncertainty in dose modeling predictions. For example:

1. Model calibration could be improved particularly local to H-Area to provide confidence that the modeled level of dilution and dispersion in the HTF PA is not overstated.

The success of this activity may be dependent on the collection of additional data (e.g., pumping test data) in the area of interest to constrain parameter values; DOE should also continue to study uncertainty in calibration targets. These activities are necessary to improve the fidelity of contaminant flow and transport simulations in the HTF PA. (Medium Risk Significance, Intermediate Term)

…

As a result of the uncertainty in the far-field model, the NRC staff will monitor these items when the HTF PA is revised as part of DOE's PA maintenance program. DOE can address this monitoring area by making appropriate revisions during future HTF PA updates.

TER page 4-107

Given (1) the significant errors in hydraulic head residuals in H-Area and (2) the unsupported, low hydraulic conductivities assigned to elliptical regions in the UTRA in order to achieve the existing calibration, more extensive calibration is desirable to assure realistic flow and transport model performance. DOE should consider using parameter estimation and inverse modeling techniques to improve the existing model calibration. Model adjustments should be supported by data, and therefore, if pumping tests in the vicinity of H-Area are needed to better define hydraulic conductivity fields at H-Area, then these studies should be conducted.

TER page 4-110

The hydrogeological conceptual model at HTF remains ambiguous and it is clear that additional data collection is needed to better understand natural system performance.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
ES-3.6	xx	4.3.4.2, 4.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*DOE should perform a closure cap settlement and stability analysis during the monitoring period (Medium Risk Significance, Intermediate Term).*	Medium	Intermediate	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1.	• As described in the Path Forward, DOE has a robust program for maintenance of the HTF PA to incorporate new information. DOE plans to perform updated closure cap and stability analysis, as updated information on the final closure cap design becomes available. Note: The wording of the recommendation states that this would be expected to occur during the monitoring period.	• A footnote has been added to the HTF 3116 Basis Document (Section 7) noting that the NRC TER included several recommendations regarding closure cap settlement and stability. 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. (Footnote #133 of the HTF 3116 Basis Document) • As part of the PA Maintenance Program, any new information relative to closure cap settlement and stability and the potential impacts on the conclusions of the HTF PA will be evaluated. • This will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.

TER page xx

6. DOE should perform a closure cap settlement and stability analysis during the monitoring period (Medium Risk Significance, Intermediate Term).

TER page 4-164

Similar to what is noted in the NRC staff's FTF TER (Camper, 2011 [ML112371751]) and FTF Monitoring Plan (Camper, 2013a [ML12345A322]), the NRC staff notes the following for HTF:

- *DOE has provided sufficient information for the NRC staff to perform a preliminary review of site stability.*
- *The NRC staff thinks that additional information is needed with respect to the site stability analysis, as noted below. Additional analyses can be conducted during the monitoring period.*

The NRC staff recommends that DOE perform closure cap settlement and stability analyses during the monitoring period which includes the following (Medium Risk Significance, Intermediate Term):

- *Site-specific settlement analysis for HTF that includes the increased overburden from tank grout and the closure cap*
- *Evaluation of vault and grout integrity that is consistent with observations and reasonable expectations of future degradation of cementitious materials*
- *Assessment of the potential subsidence due to ongoing dissolution of calcareous sediment in the Santee formation*

Other Recommendations

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
1	3-20	3.2.1.4	3116(a)(2) [HRR Removal to MEP]	*The NRC staff recommends that DOE analyze the impact of correcting the Pu-238 Tank 35 inventory.*	N/A	N/A	• The HTF inventory that will be utilized for the Tank 16 Special Analysis will use a revised Pu-238 inventory for Tank 35. • The Tank 16 Special Analysis, among other things, will support DOE Tier 2 Closure Authorization which is required prior to grouting Tank 16.	• The impact of this change in Tank 35 inventory will be included as part of the Tank 16 Special Analysis.	• This recommendation does not impact the HTF 3116 Basis Document. • The Tank 16 Special Analysis will include an evaluation, among other things, of the revised Tank 35 inventory
2	3-21	3.2.1.6	3116(a)(2) [HRR Removal to MEP]	*…the NRC staff notes that if oxalic acid is not available to be used for cleaning future tanks and a technology with similar proven effectiveness is not used as an alternative, DOE may need to reconsider the validity of assuming that the cooling coil and tank wall surface inventory is negligible.*	N/A	N/A	• For all future waste tank closure activities in HTF, the process outlined in Appendix B of the HTF 3116 Basis Document will be followed to support DOE Tier 2 Closure Authorization prior to grouting. • The final residual radionuclide inventory for each waste tank will be developed and documented based on final tank characterization as described in Appendix B of the HTF 3116 Basis Document and will include final characterization of the cooling coil and tank wall surfaces. • Utilizing the final residual characterization, a Special Analysis will be prepared to evaluate the impacts of the final inventory. If new information impacting assumed inventories for any of the waste tanks is discovered, that new information will be evaluated as part of the Special Analysis. • Appendix B of the HTF 3116 Basis Document outlines the process used to document removal to the MEP. The process outlined in Appendix B is controlled by two site procedures, Manual S4, ADM.53 (Maximum Extent Practical (MEP) Documentation Process) and Manual S4, ENG.50 (LW Project & Closure Operating Plans) which will be revised and subsequently implemented for HTF once Tier 1 approval is granted by DOE.	• Path forward is in alignment with Appendix B of the HTF 3116 Basis Document and the recommendation.	• Appendix B of the HTF 3116 Basis Document remains as provided in the Draft HTF 3116 Basis Document. • As part of the Liquid Waste PA Maintenance Program, any new information relative to assumed inventories utilized in the HTF PA will be evaluated.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
TER page 3-56 *6. If oxalic acid is not available to be used for cleaning future tanks and a technology with similar proven effectiveness is not used as an alternative, the NRC staff recommends that DOE reconsider the validity of assuming that the cooling coil and tank wall surface inventory is negligible.*									
3	3-24	3.2.2	3116(a)(2) [HRR Removal to MEP]	*If plans change and DOE decides not to perform additional cleaning of these annuli, the NRC staff recommends that DOE revise the annulus inventory assumption in the HTF PA.* Note: This recommendation is referring to Tanks 9, 10 and 14.	N/A	N/A	• For all future waste tank closure activities in HTF, the process outlined in Appendix B of the HTF 3116 Basis Document will be followed to support DOE Tier 2 Closure Authorization prior to grouting. • The final residual radionuclide inventory for each waste tank, including the final annulus inventory, will be developed and documented based on final tank characterization as described in Appendix B of the HTF 3116 Basis Document. • Utilizing the final residual characterization, a Special Analysis will be prepared to evaluate the impacts of the final inventory. If new information impacting assumed inventories for any of the waste tanks is discovered, that new information will be evaluated as part of the Special Analysis. • Appendix B of the HTF 3116 Basis Document outlines the process used. The process outlined in Appendix B is controlled by two site procedures, Manual S4, ADM.53 (Maximum Extent Practical (MEP) Documentation Process) and Manual S4, ENG.50 (LW Project & Closure Operating Plans) which will be revised and subsequently implemented for HTF once Tier 1 approval is granted by DOE.	• Path forward is in alignment with Appendix B of the HTF 3116 Basis Document and the recommendation.	• Appendix B of the HTF 3116 Basis Document remains as provided in the Draft HTF 3116 Basis Document. • As part of the Liquid Waste PA Maintenance Program, any new information relative to assumed inventories utilized in the HTF PA will be evaluated.

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4	4-7	4.1	3116(a)(3)(A) & 3116(a)(3)(B) [10 CFR Part 61, Subpart C]	*…DOE should develop separate site specific factors for risk-significant annular waste versus tank waste sources in the future. Annular and tank sources would then be separately compared to adjusted waste classification concentration limits to determine the classification of HTF components.*	N/A	N/A	• The methodology for waste classification is provided in the HTF 3116 Basis Document. The residual waste within the primary tank and annulus are combined and a single site factor is utilized. The site factor was developed based off of HTF PA results which do not independently evaluate the annulus versus the primary tank. DOE considers the site factors to be conservative whether they would be applied to just the primary tank, the annulus or the combined tank.	• The site specific factors were calculated to provide a general representation of the relationship between the concentration of the residuals in an HTF waste tank and the resulting dose impact to an inadvertent intruder. To determine the site factors, the intruder was assumed to be exposed via various pathways from water used at the one-meter well and from drill cuttings resulting from installing a well. When determining the site factors for waste tanks the dose contribution from the one-meter well conservatively used the HTF PA one-meter results which included the contribution from all HTF sources not just a single tank. Therefore, the resulting dose attributed to a specific tank (Tank 13 used to calculate site factors) was conservatively high. The dose contribution from drill cuttings is linear to the amount of material contained in the drill cuttings and therefore the ratio of the concentration to the resulting dose would essentially remain unchanged. The impact on the site factor relative to the drill cutting contribution is not dependent on the source. Therefore, DOE considers the site factors to be conservative whether they would be applied to just the primary tank, the annulus or the combined tank.	• A footnote has been added to the HTF 3116 Basis Document (Section 7) noting the NRC TER conclusion regarding the waste classification methodology. (Footnote #95 of the HTF 3116 Basis Document.)

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5	4-24	4.2.3.1, 4.2.3.3	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*1. DOE should improve its documentation of the screening and disposition of FEPs in the HTF PA to enhance transparency and traceability including the use of expert judgment during the screening and implementation of included FEPs in the HTF PA (Low-to-Medium Risk Significance, Intermediate Term).*	Low-to-Medium	Intermediate	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1.	•DOE has a robust program for maintenance of the HTF PA, including documentation concerning FEPs, pursuant to DOE's policies, DOE Manual 435.1-1 and DOE's authority under the Atomic Energy Act of 1954, as amended.	• A footnote has been added to the HTF 3116 Basis Document (Section 7) noting that DOE will evaluate this recommendation under DOE Manual 435.1-1 pursuant to DOE's responsibility under the Atomic Energy Act of 1954, as amended. (Footnote #109 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative to applicable FEPs and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.

TER page 4-18

The NRC staff recommends that DOE clarify for FEPs with the aforementioned justification whether the FEP is perceived to be unlikely during the assessment period or the impact is perceived to be insignificant according to DOE's decision criteria.

TER page 4-18

The NRC staff recommends that DOE include subject matter experts on the screening team in the specific engineering and scientific disciplines that are pertinent to the expert judgments being made. In some cases, subject matter experts may not be available due to the nature of the FEP or resource limitations. In these cases, DOE should document more clearly the specific expertise of the chosen experts and how their experience relates to the expert judgment being made. Regardless of whether appropriate subject matter experts are utilized, DOE should clearly document a transparent technical basis for each screening decision that also provides a traceable link to the information considered and relied upon to arrive at the screening decision.

TER page 4-19

The NRC staff recommends that DOE enhance the transparency and traceability of its expert judgment process to be consistent with the guidance provided in NUREG-1563 for informal expert judgment. Specifically, subject matter experts should provide reasoning for their opinions and the data, if any, from which those opinions are formed. Further, sufficient documentation should exist to allow external examination of what the judgments are, how the judgments are arrived at (their basis), and how the judgments are used.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
				TER page 4-19 *Finally, the NRC staff has questions regarding the screening decisions for the following FEPs. The outstanding questions are identified for each FEP below:* *• 2.7.04, Acid Rain—(Excluded) It is not clear to the NRC staff why this FEP was determined to be outside the scope of the HTF PA. The NRC staff believes that information on acid rain and its effects on the performance of the closed tanks could be considered in the PA should the anticipated impact be expected to be sufficiently significant.* *• 2.2.07, Pollution—(Excluded) It is not clear to the NRC staff why this FEP was determined to be outside the scope of the HTF PA. The NRC staff believes that information on existing pollution and its effects on the performance of the closed tanks could be considered in the PA should the anticipated impact be expected to be sufficiently significant.* *• 3.5.12, Chelating Agents Effects—(Excluded) It is not clear to the NRC staff how DOE considered the effects of chelating agents on contaminant mobility, such as oxalates that result from the use of oxalic acid during tank cleaning. Other examples of chelating agents may include humic or fulvic acids in SRS soils or agents used in the solvent extraction processes from H-canyon that remain in the waste received at HTF.* *• 3.6.01, Thermal Processes and Conditions the Engineered System—(Excluded) It is not clear to the NRC staff how DOE considered the effects of heat of hydration and how changes in stresses resulting from the heat of hydration could change both hydrologic and mechanical properties of the engineered components.* *• 3.6.04, Thermo-Mechanical Stresses Alter Characteristics of Engineered Barrier System Components—(Excluded) See discussion for FEP 3.6.01 above.* *• 6.2.04, Seismicity Associated with Igneous Activity—(Excluded) It is not clear to the NRC staff whether the rationale for screening this FEP out is related to the subject of this particular FEP. The justification provided in Table 4.3-1 of SRR-CWDA-2012-00011, Rev. 0 for screening out this FEP indicates that the closure system does not have enough heat to significantly impact the results. This rationale appears unrelated to the subject of this particular FEP.* TER page 4-21 *The NRC staff recommends that DOE improve the transparency and traceability of its implementation of FEPs as described in SRRCWDA-2012-00044, Rev. 1 to ensure comprehensive, accurate, and traceable links to clear descriptions of how included FEPs are actually implemented in the HTF PA.*				

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6	4-24	4.2.3.3	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*2. DOE should 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 HTF PA as discussed in more detail in the Sections that follow (See individual recommendations for risk-significance and timing information).*	See individual recommendations	See individual recommendations	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1.	Note: This recommendation did not specify any particular items. Specific recommendations are captured within other entries contained in the matrix. The wording of the recommendation states that this would be expected to occur during the monitoring period.	• A footnote has been added to the HTF 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. (Footnote #116 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative key modeling assumptions and the potential impacts on the conclusions of the HTF PA will be evaluated.
7	4-33	4.2.5.3	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*1. DOE should provide additional model support for (1) the long-term hydraulic conductivity of the upper foundation layer and lateral drainage layer, and (2) the long-term erosion of the topsoil layer (see FTF Monitoring Factors 5.1 and 5.2; Camper, 2013a [ML12345A322]) (Low Risk Significance, Intermediate Term [Prior to Final Closure]).*	Low	Intermediate [Prior To Final Closure]	• 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.	• As noted in the HTF 3116 Basis Document, "The closure cap design described in the HTF PA is based on the best information available at the time the HTF PA was developed. [SRS-CWDA-2010-00128] 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 HTF PA. Any actual closure cap design will be finalized closer to the time of HTF 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 the design. . . ."	• A footnote has been added to the HTF 3116 Basis Document (Section 7) noting that the NRC TER included several recommendations regarding closure cap settlement and stability. 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. (Footnote #133 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative to closure cap settlement and stability and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.

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8	4-33	4.2.5.3	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*2. DOE should provide additional model support to understand the effects of perimeter infiltration and focused infiltration in the drainage valley between the East and West Caps on near-field and far-field groundwater flow patterns and radionuclide transport (Low Risk Significance, Intermediate Term [Prior to Final Closure]).*	Low	Intermediate [Prior To Final Closure]	• DOE will evaluate this recommendation 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.	• As noted in the HTF 3116 Basis Document, "The closure cap design described in the HTF PA is based on the best information available at the time the HTF PA was developed. [SRS-CWDA-2010-00128] 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 HTF PA. Any actual closure cap design will be finalized closer to the time of HTF 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 the design. . . ." • This recommendation is specific to HTF due to the design of the HTF closure cap.	• A footnote has been added to the HTF 3116 Basis Document (Section 7) noting that the NRC TER included several recommendations regarding closure cap settlement and stability. 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. (Footnote #133 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative to closure cap settlement and stability and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity relative to HTF will be captured in the Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.

TER page 4-31

DOE should evaluate the potential effects of focused perimeter recharge, including that in the drainage valley. The analysis should include appropriate refinement of the grid cells receiving recharge and a well-supported value for the diversion of flow.

#	TER Page #	TER Section	NDAA Criterion	NRC Recommendation/Observation (TER Wording in Italics)	NRC Risk Significance	NRC Timing	Path Forward	Technical Justification for Path Forward	Impact to HTF 3116 Basis Document
9	4-34	4.2.5.3	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*3. Prior to completing the final closure cap design, DOE should conduct 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; see FTF Monitoring Factor 5.2; Camper, 2013a [ML12345A322]) (Low Risk Significance, Intermediate Term [Prior to Final Closure]).*	Low	Intermediate [Prior To Final Closure]	• 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.	• As noted in the HTF 3116 Basis Document, "The closure cap design described in the HTF PA is based on the best information available at the time the HTF PA was developed. [SRS-CWDA-2010-00128] 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 HTF PA. Any actual closure cap design will be finalized closer to the time of HTF 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 the design. . . ."	• A footnote has been added to the HTF 3116 Basis Document (Section 7) noting that the NRC TER included several recommendations regarding closure cap settlement and stability. 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. (Footnote #133 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative to closure cap settlement and stability and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.
10	4-113	4.2.11.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*As indicated in the FTF TER (Camper, 2011 [ML112371751]), Gordon Aquifer concentrations should not be used to demonstrate compliance with the performance objectives if higher concentrations are observed in another aquifer that can support groundwater dependent pathways.*	N/A	N/A	• In the HTF PA deterministic modelling DOE utilized the highest radionuclide concentration from any of the aquifers to determine peak groundwater dose results. For probabilistic modeling DOE considers the well depth (i.e., aquifer source) to be a valid and appropriate variable of the HTF system and does not plan any changes as a result of the NRC recommendation.	• The deterministic peak groundwater pathway dose results used for compliance demonstration are calculated using the radionuclide concentrations in the UTRA-UZ which are the highest concentrations from any of the three distinct aquifers modeled (UTRA-UZ, UTRA-LZ, and Gordon Aquifer). To simulate the probability that the well source might be drilled into a lower aquifer (UTRA-LZ or the Gordon Aquifer), well depth probabilities were used as a stochastic in the HTF probabilistic model. DOE considers the well depth utilized in the HTF PA (i.e., aquifer source) to be a valid and appropriate variable for the probabilistic modeling of the HTF system.	• This recommendation does not impact the HTF 3116 Basis Document.

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11	4-115	4.2.11.6	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*The NRC staff concludes that in future PA updates, DOE could improve the current far-field model to reduce uncertainty in dose modeling predictions. For example:* *…* *2. Selection of the compliance boundary and loading of the contaminant source cells (i.e., tank cells in the far-field model) could be evaluated to ensure that the dose estimates are not significantly underestimated (Medium-to-Low Risk Significance, Long Term).* *…* *As a result of the uncertainty in the far-field model, the NRC staff will monitor these items when the HTF PA is revised as part of DOE's PA maintenance program. DOE can address this monitoring area by making appropriate revisions during future HTF PA updates.*	Medium-to-Low	Long Term	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. • DOE will share information in this area with the NRC as available.	• This recommendation is specific to HTF due to the shape of the selected compliance boundary utilized in the HTF PA. Note: The wording of the recommendation states that this would be expected to occur while developing future PA updates during the monitoring period.	• A footnote has been added to the HTF 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. (Footnote #116 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative to the far-field model and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity relative to HTF will be captured in the Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan and will be evaluated as part of PA maintenance under DOE Manual 435.1-1.

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12	4-115	4.2.11.6	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*The NRC staff concludes that in future PA updates, DOE could improve the current far-field model to reduce uncertainty in dose modeling predictions. For example:* *…* *3. Additional information could be collected during the monitoring period to support DOE's modeling treatment of the calcareous zones in the UTRA-LZ. DOE could 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 UTRA-LZ. Site-specific Kds may also need to be developed for the UTRA-LZ (Medium Risk Significance, Long Term).* *…* *As a result of the uncertainty in the far-field model, the NRC staff will monitor these items when the HTF PA is revised as part of DOE's PA maintenance program. DOE can address this monitoring area by making appropriate revisions during future HTF PA updates.*	Medium	Long Term	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. • DOE will share information in this area with the NRC as available.	• DOE has a robust program for maintenance of the HTF PA to incorporate new or updated information, including information concerning calcareous zones and site-specific K_ds for the UTRA-LZ, as appropriate. Note: The wording of the recommendation states that this would be expected to occur while developing future PA updates.	• A footnote has been added to the HTF 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. (Footnote #116 of the HTF 3116 Basis Document) • As part of the PA Maintenance Program, any new information relative to calcareous zones and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.

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13	4-117	4.2.13	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*In Section 4.2.17 of the FTF TER (Camper, 2011 [ML112371751]), the NRC staff identifies several concerns related to DOE's FTF biosphere parameters, specifically: (1) the appropriateness of the use of root vegetable transfer factors for plant transfer factors in the SRS regions, (2) the treatment of uncertainty in plant transfer factors, and (3) the use of a drinking water consumption rate less than 2 L/day. In the HTF PA, DOE addresses the use of root vegetable transfer factors by weighting transfer factors that are available in IAEA-472 (IAEA, 2010) by the estimated percentages of the major plant groups commercially produced in the SRS Area (Section 3.1.2; SRNL-STI-2010-00447, Rev. 0). For the remainder of the NRC staff's previous concerns, the NRC staff continues to recommend, as it did in the FTF TER, that future updates to PAs provide a more technically defensible rationale for these issues.*	N/A	N/A	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1. • DOE will share information in this area with the NRC as available.	• DOE has a robust program for maintenance of the HTF PA to incorporate new or updated information, including information concerning biosphere parameters, as appropriate. Note: The wording of the recommendation states that this would be expected to occur while developing future PA updates.	• A footnote has been added to the HTF 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. (Footnote #116 of the HTF 3116 Basis Document) • As part of the Liquid Waste PA Maintenance Program, any new information relative to biosphere parameters and the potential impacts on the conclusions of the HTF PA will be evaluated. • This activity will be evaluated as part of PA maintenance under DOE Manual 435.1-1. The Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program — FY2015 Implementation Plan will capture this item as it relates to HTF.
14	4-157	4.2.19.2	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*With regard to the hybrid modeling approach, the NRC staff thinks that the information provided in the sensitivity and uncertainty analysis greatly improves understanding of overall system performance and is helpful with respect to informing the compliance decision. However, the uncertainty analysis should not be used to demonstrate compliance with the performance objectives because (1) there is limited support for the base case, and (2) there is limited support for the assignment of the likelihood of alternative cases and consequently, the averaging of alternative cases in the "All Cases" model. Therefore, the NRC staff recommends that DOE continue to present the results of alternative cases individually and provide qualitative information regarding the likelihood of alternative cases. With regard to the deterministic analysis, the NRC staff thinks that additional information is needed to support the compliance case, Case A. Ideally, supporting information would be in the form of additional experimental or field data, natural analogs, peer review, expert elicitation, and other forms of model support. Without this additional model support, it is difficult to argue the relative likelihood of the base case compared to alternative cases.*	N/A	N/A	• DOE considers the base case (Case A) utilized in the HTF PA to be valid and appropriate for use as the HTF compliance case and does not plan any immediate changes as a result of the NRC recommendation. DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1	• This recommendation did not specify any particular model areas requiring additional support. Specific recommendations are captured within other entries contained in the matrix. Development of additional information supporting the compliance case is expected to occur during development of future PA updates.	• This recommendation does not impact the HTF 3116 Basis Document. • As part of the Liquid Waste PA Maintenance Program, any new information relative to base case model support and the potential impacts on the conclusions of the HTF PA will be evaluated.

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15	4-161	4.2.19.4	3116(a)(3)(A)(i) & 3116(a)(3)(B)(i) [10 CFR Part 61, Subpart C]	*Because the uncertainty and sensitivity analysis is not used to demonstrate compliance, recommendations and conclusions specific to DOE's uncertainty and sensitivity analyses can be considered in future HTF PA updates (i.e., intermediate to long-term recommendations).* *However, because the probabilistic analysis informs the compliance demonstration and may provide more realistic assumptions in some important areas, DOE should use the results to inform areas where additional model support is needed.*	N/A	Intermediate-to-Long Term	• DOE will evaluate this recommendation as part of PA maintenance under DOE Manual 435.1-1.	Note: This recommendation did not specify any particular items. Specific recommendations are captured within other entries contained in the matrix. The wording of the recommendation states that this would be expected to occur while developing future PA updates during the monitoring period.	• This recommendation does not impact the HTF 3116 Basis Document. • As part of the HTF PA maintenance program, any new information relative to uncertainty and sensitivity analyses and the potential impacts on the conclusions of the HTF PA will be evaluated.