Summary Notes from 18 September 2007 Savannah River Site F-Area Tank Farm Performance Assessment Input Meeting

Attendees: Representatives from Department of Energy-Savannah River (DOE-SR), DOE-Headquarters (DOE-HQ), and the U.S. Nuclear Regulatory Commission (NRC), met at the DOE offices in Germantown, Maryland on 18 September 2007. The South Carolina Department of Health and Environmental Control (SCDHEC) and the U.S. Environmental Protection Agency, Region IV (EPA-IV) participated by phone, in addition to other SRS and WSRC personnel.

Discussion: DOE is pursuing final closure on the F-Area Tank Farm (FTF) located at Savannah River Site (SRS). At some point in the future, DOE and NRC will consult on waste determinations for these tank closures; additionally these tanks will be closed in coordination with EPA and SCDHEC in accordance with the Federal Facility Agreement for the Savannah River Site and the State-approved closure plans pursuant to the State Industrial Wastewater permit. The DOE, NRC, EPA, and SCDHEC met for the seventh in a series of technical exchanges on the proposed inputs for a revision to the FTF Performance Assessment (PA). The technical exchanges are intended to capitalize on early interactions between the agencies with a goal of improving DOE's FTF PA. Technical discussion during the meeting allowed for the clarification of general modeling parameter values and identifying other specific questions.

Topics: The following nine specific topical areas were discussed during the meeting:

1. Closure Cap Conceptual Model Status
2. Bioaccumulation and Consumption Rates Status
3. Hydrogeology Conceptual Model Status
4. Residual Inventory Status
5. Grout/Concrete Properties Testing Status
6. Waste Release Conceptual Model Status
7. Tank Liner Life Estimates & Conceptual Model Status
8. PORFLOW Model Development Status
9. Goldsim Model Development Status

Summary: The following summarizes the discussion during the meeting, by topical area.

Closure Cap Conceptual Model Status

- DOE is preparing Revision 2 of the SRNL report on the closure cap input assumptions for the FTF PA and is incorporating suggestions and recommendations from previous scoping meetings. DOE anticipates distributing the document in late September or October.
- DOE confirmed that the closure cap modeling for the FTF PA will assume conservatively that each modeled hole in HDPE liner will correspond with vegetative intrusion (i.e., a root in every hole), even though statistical modeling showed only approximately 20% coincidence of such.
- DOE plans to use the HELP model to provide boundary conditions for PORFLOW modeling for the FTF PA.
- DOE stated that preliminary results from the closure cap modeling for the FTF PA were expected to show degradation/infiltration impacts reach their maximum effect at approximately 2,000 years.
- NRC staff stated that the sensitivity of the results to the failure time of the cap should be explored (e.g., how much credit for the cap is actually needed to meet performance objectives in the presence of other engineered barriers with longer lifetimes) to determine how much model support is needed for the assumed performance of the cap.

Bioaccumulation and Consumption Rates Status

- DOE is preparing Revision 2 of the SRNL report on the bioaccumulation and consumption rates for the FTF PA and is incorporating the suggestions and recommendations from previous scoping meetings. DOE anticipates distributing the document in late September or October.
- DOE plans to evaluate the impact of the IAEA dry transfer factors versus wet upon the rates presented in the SRNL report for the FTF PA.
- DOE and NRC staff agreed that the dominant food type assumption for the FTF PA should be a regional specific assumption and that the appropriate type would be non-leafy vegetables.

- DOE confirmed that the modeling of the bioaccumulation and consumption rates for the FTF PA is being incorporated into the Goldsim model.

Hydrogeology Conceptual Model Status

- DOE is preparing Revision 2 of the SRNL report on the hydrogeology conceptual model for the FTF PA and is incorporating the suggestions and recommendations from previous scoping meetings. DOE anticipates distributing the document in late September or October.
- DOE plans to provide information concerning the transport of radionuclides from previous release data at the site and to discuss this information in the context of calibrating the groundwater flow and transport model for the FTF PA.
- DOE indicated that it still needs to quantify spatial correlations in the thickness of the Tan clay underlying the F Area Tank Farm and the flow paths between the F Area Tank Farm and its assessment points for the FTF PA.

Residual Inventory Status

- DOE noted that the Inventory input parameter assumptions for the FTF PA have been modified to remove "zero" default values and to reflect the assumption of an additional 75% removal from Tanks 19 & 18 based on deployment of the new heel removal technology.
- DOE plans to update the residual inventory data chart for the FTF PA with color-coding to indicate where non-detect values used. DOE will also add a note explaining why some radionuclides (e.g., iodine, neptunium) are not reflected.
- DOE and NRC Staff agreed that DOE should explain values in the residual inventory inputs for the FTF PA that are under-predicted by the waste characterization system.
- DOE and NRC Staff agreed that DOE should re-evaluate the estimate of potential corrosion products in the residual inventory input assumptions for the FTF PA.

Grout/Concrete Properties Testing Status

- DOE agreed that while the conceptual model for the FTF PA assumes reducing

grout characteristics, other alternative formulations will also be evaluated.

- DOE and NRC Staff agreed that for the FTF PA DOE should address scale effects using larger scale samples and ensure that its justification is supported. NRC staff recommended that DOE consider uncertainty in material properties due to biases in testing methods including laboratory versus field experiments, as well as techniques used to measure properties (e.g., centrifuge versus flexible wall permeameter).
- NRC staff noted that the grout permeability values seemed low compared to information obtained from literature.
- NRC Staff recommended that DOE consider both maximum internal temperatures and temperature gradients in the grout monolith during curing that could cause internal cracks in grout matrix. DOE agreed to address this issue in the FTF PA.
- DOE stated that it currently does not have plans to model hysteresis in adsorption and desorption rates identified in batch experiments for the FTF PA. However, as a longer term project, column experiments may provide additional future model support and would be considered. NRC staff inquired whether non-equilibrium and non-linear models were available in PORFLOW and noted that kinetically-limited desorption could be a result of mass transfer limitations (e.g., diffusion-limited transport) from internal pore space which is conceptually different than kinetically-limited desorption.

Waste Release Conceptual Model Status

- DOE stated that the waste release conceptual model for the FTF PA assumes that release is solubility controlled.
- DOE and NRC Staff agreed that DOE should place less reliance on the tank 18 & 19 dip samples in its support for the waste release conceptual model assumptions for the FTF PA.
- DOE stated that the waste release conceptual model for the FTF PA assumes that reducing capability is linear with grout slag content. NRC staff noted that DOE should consider providing information supporting the minimum amount of sulfide sulfur in slag that would be necessary to maintain reducing conditions over the compliance period.

- DOE stated that the waste release conceptual model for the FTF PA assumes that the cement fraction of the waste matrix controls pH evolution.
- DOE stated that the waste release conceptual model for the FTF PA assumes that the co-precipitation of iron for Pu-239 appears to be important to waste release rate. NRC staff noted that DOE should consider providing sufficient support for Pu-239 co-precipitation commensurate with the risk-significance of the credit.

Tank Liner Life Estimates & Conceptual Model Status

- DOE is preparing Revision 2 of the SRNL report on the tank liner life estimates and conceptual model for the FTF PA, and is incorporating the suggestions and recommendations from previous scoping meetings. DOE anticipates distributing the document in late September or October.
- DOE and NRC Staff agreed that DOE should address the justification for its assumption that general corrosion is the dominant mechanism controlling tank liner life for the scenarios where the steel liner is in contact with grout for the FTF PA. DOE indicated that pitting corrosion is evaluated for scenarios where the steel liner is in contact with surrounding soils.
- NRC Staff noted that performance of the whole system is important, not just one barrier, e.g., tank liner. DOE and NRC Staff agreed that DOE should understand and present the relationship between parts and whole system in the FTF PA (e.g., coupling of grout degradation modeling and steel liner failure).
- NRC staff asked how DOE planned to incorporate steel liner life distributions in its Goldsim model. DOE has not decided which distributions it would use or how the information would be abstracted into the Goldsim model.

PORFLOW Model Development Status

- DOE stated that PORFLOW will be used to develop general flow models that will be abstracted for insertion into the Goldsim modeling platform for the FTF PA.
- DOE and NRC Staff agreed that DOE should ensure it has appropriately bounded corrosion product release from the tank walls (e.g., DOE plans to consider tank wall inventory with tank floor waste which is modeled as a solubility versus a sorption-controlled release) for the FTF PA.

- NRC Staff noted that currently, water flow over floor is assumed the worst-case scenario for release for the FTF PA, but water flow on wall may be more realistic case. DOE agreed to evaluate.
- DOE plans to evaluate the spatial and time discretization in the PORFLOW model to ensure the accuracy of model predictions and to prevent excessive numerical dispersion in the FTF PA. DOE agreed to evaluate automated transport time-stepping capabilities in PORFLOW. NRC staff inquired about the available solvers in PORFLOW and the basis for DOE's selection.
- NRC staff inquired about DOE's parameterization of grid cells to represent preferential flow pathways through the system in PORFLOW versus modeling flow and transport through discrete fractures and requested that DOE document its preferred approach.
- DOE and NRC Staff agreed that DOE should develop an approach for addressing cracks in base mats underneath the tanks and how they affect release in the FTF PA.
- DOE and NRC Staff agreed that DOE should examine whether the average moisture retention curves in the FTF PA are sufficiently representative given variability.
- DOE and NRC Staff agreed that DOE should add additional pictorial representations of flow fields in both the horizontal and vertical planes at different time steps in the FTF PA.
- DOE noted that the materials properties assumptions being used for input into the models in the FTF PA are being updated to reflect recent experiments.
- NRC recommended that DOE verify the point of maximum exposure given the complex geometry of the tanks in relation to groundwater flow directions and the cumulative effect of releases from multiple tanks at various time periods following closure (i.e., DOE should not automatically assume that the point of maximum exposure beyond the buffer zone would occur at 100 meters.)

Goldsim Model Development Status

- DOE stated that Goldsim is being used for various uses including uncertainty/sensitivity analyses and understanding some system behavior in the

FTF PA. DOE does not expect at this time, however, to use Goldsim for the compliance analyses in the FTF PA.

- DOE stated that its development of the conceptual abstractions and incorporation into the Goldsim Model platform for the FTF PA is a work in progress.
- DOE noted that it is willing, when completed, to submit the Goldsim dashboard to NRC to facilitate review of the FTF PA. NRC Staff agreed to consider DOE's offer.
- DOE is preparing Revision 2 of the SRNL report on the Kd values for the FTF PA, and is incorporating the suggestions and recommendations from previous scoping meetings. DOE anticipates distributing the document in late September or October.
- DOE noted that the Goldsim model will include a mechanism for a certain fraction of the flow to bypass the basemat in the FTF PA. DOE and NRC Staff agreed that this appears to be an important parameter and therefore will require appropriate justification in the FTF PA.
- DOE and NRC Staff agreed that DOE should document the dispersion associated with fast flow paths through the basemat versus the conceptual model in the FTF PA.
- DOE and NRC Staff agreed that DOE should document the quality assurance for the Goldsim model application for the FTF PA and be prepared to discuss with NRC Staff at a future meeting.
- DOE noted that the Goldsim model application is currently being designed to calculate peak doses for the FTF PA.
- NRC and DOE discussed the sensitivity of the Goldsim model results to the amount of dilution in the saturated zone (e.g., importance of Goldsim parameters such as saturated zone thickness). NRC noted that the abstraction of the three-dimensional PORFLOW model into the Goldsim model is important to the compliance demonstration and that while NRC agrees that it may be appropriate to dilute aquifer concentrations to determine exposure point concentrations at a well, that the approach DOE is considering will be carefully evaluated given its risk significance.