Follow-up Notes from 11 February 2008 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), the South Carolina Department of Health and Environmental Control (SCDHEC), the U.S. Environmental Protection Agency, Region IV (EPA-IV), and the U.S. Nuclear Regulatory Commission (NRC), participated by conference call on 11 February 2008.

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 eighth 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 approaches and identifying other specific questions. This call is a follow-up to the meeting held in Columbia, South Carolina on 31 January 2008.

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

1. Waste Release Technical Reference Paper
2. Tank Liner Failure Technical Reference Paper

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

Waste Release Technical Reference Paper

- NRC staff asked for clarification on the solubility limits for technetium under oxidizing conditions. NRC staff commented that given that there were two different discussions in the technical reference paper, it was unclear what the PA was assuming. DOE stated that it is their belief that the best estimate for technetium solubility is 10^{-11} M, as used in the base case for the oxidizing condition.

- NRC staff also questioned whether iron co-precipitation with technetium is addressed in the technical reference paper. DOE stated that it addressed the iron co-precipitation with technetium by using 10^{-11} M for base case in the oxidizing conditions. NRC staff requested information on the waste release calculations for technetium. DOE indicated that the calculations for technetium are located on the bottom of page 15 and the calculations for technetium are found in table 10. NRC staff indicated that page eight mentions Tank 18 dip samples. DOE noted that Tank 18 dip sample was used to develop some of the probabilities and was used as one of the controlling phases in the oxidized case. NRC stated that it should be clear in the PA why DOE believes that the Tank 18 dip sample condition bounds the condition expected to be present in the contamination zone of grouted SRS tanks.

- NRC staff commented on the reference to the use of the Hanford sludges in developing the values used in the technical reference. NRC staff questioned whether the Hanford chemical conditions are representative of what would be found in the SRS tank sludges. DOE reiterated that the numbers in the waste release paper are the based on SRS iron co-precipitation to technetium ratios and only compared to Hanford Tank numbers for comparison. NRC staff asked about some of the calculations being based on a ratio of plutonium to iron in the liquid phase. DOE indicated that the partition coefficient is assumed to be equal to one (=1) and that the distribution coefficient is believed to be greater than one (>1) therefore the partition coefficient (lower solubility) would be less, so the value being one (1) is believed to be conservative. DOE stated that it used rare earth elements as an analog for actinides in this case and there are no other bases. DOE believes it is a reasonable and conservative case. NRC staff suggested that DOE document this explanation in the PA and technical report. NRC staff asked whether DOE expected the behavior of rare earth elements would be a good analogy for technetium co-precipitation. DOE indicated they did not expect rare earth elements would provide a good analogy for the co-precipitation of technetium. NRC staff asked that DOE provide a basis for assuming a distribution coefficient of 1 for technetium co-precipitation.

- NRC staff questioned the probabilistic weighting of different solubility controlling cases and was interested in any supporting discussion for the assumed probabilities. NRC staff inquired about uncertainty in solubility calculations on pages 12 through 14 and on uncertainty in chemical conditions that would be present. For example, figure four (4) shows uncertainty in parameters and resulting variability in solubility. NRC staff were also concerned that there appears to be a leap in logic from uranium to all other elements. DOE agreed that there is a leap of about plus or minus two orders of magnitude, but feels that plus or minus two orders of magnitude is reasonable. NRC staff inquired whether DOE can better support this approach, such as doing a similar analysis with plutonium. NRC staff noted that they would expect the uncertainties to be radionuclide-specific and recommends doing similar analysis for the most risk significant radionuclides.

- NRC staff commented that Appendix B on the derivation of numbers of pore volumes until solubility occurs (reaching oxidizing conditions) implies that the liner does not fail until the grout fails. NRC staff would like to see the model results for an alternate case in which the liner fails before the grout has completely failed hydraulically (i.e., a case in which fast pathways through mostly intact grout are possible). DOE indicated that the assumption is that the grout is available to support reducing conditions but that this assumption may not be evident in Appendix B. DOE agrees that there is a need for further explanation of the future considerations, so future users of the waste release technical reference paper consider these runs in their PAs.

Tank Liner Technical Reference Paper

- NRC staff asked for clarification on which scenario evaluated in the reference document would be considered for the base case or compliance case for steel liner degradation (e.g., steel liner in contact with soil or concrete). NRC staff noted that commensurate with the risk significance of the time to failure of the steel liner to modeling results, sufficient model support would be necessary to justify the selection of the most likely scenario to be used in the compliance demonstration.
- NRC staff noted that the distributions used in the probabilistic analysis did not specifically account for the various failure scenarios evaluated or considered in the reference document (e.g., steel liner in contact with soil and humid air; consideration of non-diffusion-limited transport of deleterious species through degraded concrete). DOE indicated that although the probability distributions

only considered the scenario where the steel liner was in contact with cement with various assumptions regarding diffusion coefficients, that the range of failure times would encompass other failure mechanisms not specifically considered.

- DOE indicated that liner failure does not always affect the peak dose but affects the timing of release.
- NRC staff encouraged DOE to further develop support for the tank liner failure model. NRC staff encouraged DOE to consider the potential for risk dilution due to uncertain assumptions regarding steel liner failure (as well as assumptions regarding waste release) that would tend to spread tank releases out in space and time, thereby lowering the potential peak dose. NRC staff suggested that DOE consider and explain how the cumulative effect of releases from multiple tanks could affect the results. NRC staff believes that DOE could then determine the likelihood of these potentially high-risk scenarios to more efficiently address uncertainty in the timing of waste release due to assumptions in the waste release and steel liner failure references.
- NRC staff asked about support for (i) the time invariant assumptions regarding transport parameters of deleterious species through the cementitious materials, (ii) the appropriateness of a single degradation model for the entire period evaluated in the steel liner failure calculations, as well as (iii) potential issues associated with the decoupling of steel liner failure from cementitious material failure. NRC staff stated the example, which DOE mentioned in the January 31 F Area Tank Farm scoping meeting, that cementitious material failure would occur by the time of mean steel liner failure for Type I and III tanks (around 12,000 years). Using this example, NRC staff explained that the assumption for the base case or compliance case that the steel liner is in contact with cementitious materials for the entire 12,000 year time period may be inconsistent with the conceptual model for steel liner failure. NRC staff stated that if the cementitious materials had degraded prior to the predicted failure time of the steel liner, the degradation model for the steel liner in contact with cement may not be appropriate at the time the cementitious materials are assumed to degrade. NRC staff believes that the less likely scenario of the steel liner in contact with soil, which represents the case when the cementitious material has degraded, would seem to be more appropriate at the time the cementitious materials are assumed to degrade, which would hasten the degradation of the steel liner.