June 30, 2000

Mr. Roy J. Schepens
Assistant Manager for High-Level Waste
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

SUBJECT: SAVANNAH RIVER SITE HIGH LEVEL WASTE TANK CLOSURE: CLASSIFICATION OF RESIDUAL WASTE AS INCIDENTAL

Dear Mr. Schepens :

The U.S. Nuclear Regulatory Commission (NRC) has completed the review of the tank closure methodology for the high-level waste (HLW) tanks at the Savannah River Site (SRS). Under the terms and conditions of the Department of Energy (DOE)/NRC Memorandum of Understanding and the DOE/NRC Interagency Agreement, both dated July 9, 1997, the NRC is acting in an advisory capacity and is not providing regulatory approval. The focus of the review was whether or not the residual waste left in the HLW tanks, after cleaning, could be labeled as incidental waste. The criteria for incidental waste were approved by the Commission in the Staff Requirements Memorandum (SRM) dated February 16, 1993, in response to SECY-92-391, "Denial of PRM 60-4 - Petition for Rulemaking from the States of Washington and Oregon Regarding Classification of Radioactive Waste at Hanford," and described in the March 2, 1993, letter from R. Bernero, NRC, to J. Lytle, DOE. The review focused on DOE's "Regulatory Basis for Incidental Waste Classification at the Savannah River Site High-Level Waste Tank Farms," "High-Level Waste Tank Closure Program Plan," "Environmental Radiological Analysis, Fate and Transport Modeling of Residual Contaminants and Human Health Impacts from the F-Area High-Level Waste Tank Farm," "Industrial Wastewater Closure Module for the High-Level Waste Tank 17 System," and "Industrial Wastewater Closure Module for the High-Level Waste Tank 20 System." It also included the responses (letter from R. Schepens, DOE, to K. Stablein, NRC, September 30, 1998) to the request for additional information, as well as information resulting from the April 1, 1999, public meeting between NRC and DOE staff. The results of the NRC staff review are enclosed to provide input to your decision. DOE is responsible for determining whether the residual tank waste can be classified as incidental.

Your tank closure methodology proposes using the incidental waste criteria approved by the Commission in the February 16, 1993 SRM and stated in the March 2, 1993, letter from R. Bernero, NRC, to J. Lytle, DOE, that were established for the treatment and disposal of removed HLW. In reviewing your methodology, staff took a generic performance-based approach rather than strictly applying the criteria developed in 1993. Criterion One from the March 1993, letter specifies that "...wastes have been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical." DOE identified only water washing and oxalic acid washing as technically feasible

with regards to removal of key radionuclides following bulk waste removal. Water washing and bulk waste removal have been shown to be capable of removing 98 percent of the initial tank activity. Depending on the initial sludge inventories, oxalic acid washing, or comparable cleaning, will be required on selected tanks, although it is not considered to be economically practical for all 51 tanks.

The sampling methods used to characterize the HLW tanks at SRS have been evaluated. Several different sampling techniques were used. In general, the sampling process for Tanks 17 and 20 was adequate. NRC staff has concluded that available removal technologies have been extensively examined to determine those that are both technically and economically practical, and that the residual waste left in the tanks is limited to waste that cannot be removed by application of those technologies currently considered technically and economically practical for HLW tank cleaning. As the HLW tank closure process evolves over the next several decades the technical and economic feasibility of other waste removal options should continue to be evaluated.

The staff recommends that a set waste sampling protocol should be developed and followed. The number of samples obtained will be a function of the tank contents, as well as the homogeneity of the sludge. All sample results should be compared to process estimates to ensure consistency and accuracy. Any significant inconsistencies resulting from tank sampling and process history should result in further sampling.

The staff review generally found that DOE's methodology for removal of key radionuclides to the maximum extent economically and technically practical achieves the objectives of Criterion One.

The staff review of Criterion Two, "...wastes will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for class C low-level waste as set out in 10 CFR Part 61," made use of information you provided on initial tank inventories and expected removal efficiencies. Fourteen of the 51 HLW tanks are anticipated to meet Class C limits by utilizing concentration averaging with only bulk waste removal and water washing. The other 37 tanks would require chemical cleaning via oxalic acid washing to meet Class C limits, even with the application of concentration averaging. DOE, therefore, plans to rely on alternative considerations for the classification of waste, rather than planning to use oxalic acid cleaning to meet Class C concentration limits. In particular, DOE relies on its plans to solidify the waste in layers of grout, some 30 feet below the surface of the ground, and relies on the disposal site, which it considers to be stable. In addition, it appears that there is reasonable assurance that the performance objectives of 10 CFR Part 61, Subpart C can be met without meeting the Class C concentration limits for all tanks. These considerations are similar to those in 10 CFR 61.58 of the Commission's regulations, and are viewed by DOE as providing comparable protection to an inadvertent intruder. Staff believes that concentration averaging in accordance with the Branch Technical Position on Concentration Averaging, is generally acceptable in this context to meet Class C concentration limits, and recognizes that the alternative provisions for waste classification proposed by DOE are generally similar to those in 10 CFR 61.58. Staff recommends that DOE develop site-specific concentration limits for residual waste in the SRS HLW tanks in order to bound the associated analyses and to provide a specific benchmark for satisfactory cleaning of the tanks.

As for the portion of Criterion Two that addresses the solid physical form, the staff believes that the waste has been sufficiently immobilized to help prevent inadvertent intrusion. By utilizing three different types of grout, the waste is further protected. The initial reducing grout pour helps to reduce the mobility of the radionuclides. The middle layer of grout provides a solid foundation to guard against subsidence, and, finally, the top layer of strong grout provides protection against physical penetration of the waste. Therefore, the physical form aspect of Criterion Two appears to be achieved by your methodology.

Assessing Criterion Three, "...wastes are to be managed, pursuant to the Atomic Energy Act, so that safety requirements comparable to the performance objectives set out in 10 CFR Part 61 are satisfied," involves the evaluation of the tank farm performance assessment (PA).

DOE has indicated that it intends to meet a 4 mrem/yr drinking water dose limit. From standard dose modeling methodology, the drinking water dose is expected to be the largest dose contributor pathway. It appears from the performance assessment that the drinking water dose will be less than the 4 mrem/yr drinking water dose limit, and by extrapolation, that the individual dose will be less than the 25 mrem/yr total effective dose equivalent (TEDE) requirement of 10 CFR 61.41. In meeting the performance objective of §61.41, reliance on institutional controls beyond 100 years will not be needed, although DOE has proposed institutional controls in perpetuity. Future PAs should focus on meeting the performance objectives of 10 CFR Part 61 Subpart C and should not rely on any active institutional controls beyond 100 years. The NRC staff has concluded that the DOE methodology will achieve safety objectives comparable to §61.41.

To show protection of an inadvertent intruder, the standard agriculture scenario consists of a farmer who lives at the tank farm, and drills a well near the tank farm and then uses the well water to irrigate his crops and feed his livestock as well as himself. DOE-SR has provided only calculated drinking water doses for this intruder scenario. DOE's intruder PA showed that the maximum drinking water dose the farmer would receive via the ground-water pathway was 130 mrem/year at a well distance of 1 meter from the tank farm, at approximately 700 years. According to DOE-SR, the drinking water dose pathway is expected to be the highest dose contributor and, therefore, provides reasonable assurance of protection of individuals from inadvertent intrusion using a 500 mrem/year limit. The DOE-SR analysis assumes all activity is contained within the reducing grout layer located at the bottom of each tank, and that this contaminant zone is not disturbed. This then implies that there is no activity in any vertical component of the tank structure and, therefore, a typical construction scenario (with a 10 foot deep basement) would not disturb any contaminated portion of the tank structure.

The staff recommends that future performance assessments for SR tank closures, including individual tank closure modules, and the H-Tank Farm Fate and Transport Modeling, include the full agriculture scenario (all pathways) as well as the discovery scenario, as described in the Draft Environmental Impact Statement for 10 CFR Part 61. Staff also notes that closure of ancillary piping and equipment must consider an inadvertent intruder. That is, performance assessment must consider disturbed surface piping and equipment, which, in addition to tank sources, must not exceed a TEDE of 500 mrem per year (all pathways) for the discovery and agricultural scenarios. Furthermore, all external components (e.g., piping) have not been demonstrated to provide the same protection to an inadvertent intruder as the residual waste in

the HLW tank bottoms. Without the proper intruder scenarios (e.g., intruder-agriculture) the NRC does not recognize in-situ disposal of external components as achieving the objectives of Criterion Three.

The worker is protected by DOE regulations which are analogous to 10 CFR Part 20. The worker protection performance objective of §61.43 is, therefore, considered to be adequately addressed. By filling the tanks with three layers of grout, the site stability performance objectives of §61.44 can also be satisfied.

The staff recommends that future tank closure modeling should include a more thorough PA for all predicted or known source terms (i.e., all HLW tanks) in the F-Area Tank Farm and including the following: early degradation of grout, degradation of ancillary equipment and piping, combined aquifer scenarios, conservative distribution coefficient analysis, conservative radionuclide dispersion analysis, submerged tanks, conservative analysis for the horizontal versus vertical flux radionuclide transport processes for the saturated zone, and a complete all-pathways dose assessment. See the enclosed Technical Evaluation Report for further details and additional recommendations. In addition, future tank closure modeling (including individual tank closure modules, as well as fate and transport modeling for H-Tank Farm) should not refer to, or be reliant on in any way, previous modules. This will avoid confusion and errors associated with outdated data and assumptions.

By generally achieving each of the performance objectives stated in 10 CFR Part 61, Subpart C, the staff has concluded that the tank closure methodology is consistent with the objectives of Criterion Three.

Based on the information provided the staff has concluded that the methodology for tank closure at SRS appears to reasonably analyze the relevant considerations for Criterion One and Criterion Three of the three incidental waste criteria. DOE would undertake cleanup to the maximum extent that is technically and economically practical, and would demonstrate it can meet performance objectives consistent with those required for disposal of low-level waste. These commitments, if satisfied, should serve to provide adequate protection of public health and safety. Further, DOE's methodology relies on alternative classification considerations similar to those contained in the Commission's regulations at 10 CFR 61.58. The NRC staff, from a safety perspective, therefore does not disagree with DOE-SR’s proposed methodology, contingent upon DOE reaching current goals for bulk waste removal, as well as water and chemical washing, such that the performance objectives comparable to those stated in Subpart C 10 CFR 61 are met. In addition, NRC judgment as to the adequacy of the methodology is dependent on verification that the assumptions underlying the analysis are correct.

The analysis performed regarding the proposed tank closure methodology for the HLW tanks located at the DOE Savannah River Site was performed by NRC according to the terms and conditions of the established Memorandum of Understanding and the Interagency Agreement. The analysis and resulting NRC conclusions are specific only to the 51 tanks located at the DOE Savannah River F and H Area tank farms, and related piping and equipment. The NRC assessment is a site-specific evaluation, and is not a precedent for any future decisions on waste classification scenarios at other sites, particularly sites under NRC jurisdiction.

If you have any questions about the details of this letter, please contact Jennifer Davis of my staff at (301) 415-5874.

Sincerely,

/RA/

William F. Kane, Director
Office of Nuclear Material Safety
and Safeguards

Enclosure: Results of NRC Staff Review of DOE
Savannah River HLW Tank Closure Methodology

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