December 15, 1999

FOR: The Commissioners

FROM: William D. Travers /s/
Executive Director for Operations

SUBJECT: CLASSIFICATION OF SAVANNAH RIVER RESIDUAL TANK WASTE AS INCIDENTAL

PURPOSE:

To request Commission approval to transmit the attached draft letter (Attachment 1) from W.F. Kane, U.S. Nuclear Regulatory Commission (NRC), to R.J. Schepens, U.S. Department of Energy (DOE EXIT), at Savannah River (SR). The draft letter provides the results of the NRC staff review of the DOE-SR proposed methodology for classification of residual high-level tank waste at SR as incidental.

SUMMARY:

DOE-SR requested that NRC staff review the DOE-SR methodology for classification of residual tank waste at SR as incidental [letter request dated December 20, 1996 (Attachment 2), from A.L. Watkins/DOE-SR, to C.J. Paperiello/NRC]. The DOE-SR methodology relates to DOE-SR's plan to retrieve and process defense high-level waste (HLW) stored in 51 tanks at SR, and close the tanks once they are emptied of their contents. Specifically, using the methodology as a basis, DOE-SR intends to determine whether essentially all the HLW has effectively been removed from the tanks such that DOE-SR can classify the residual wastes as incidental. Staff previously advised the Commission of DOE's request (see J. Taylor, to the Commissioners, dated September 13, 1996; and H. Thompson, to the Commissioners, dated February 18, 1997). Staff indicated it would seek Commission approval of its response to the DOE-SR request (SECY-97-096, L. Callan, to the Commissioners, dated May 2, 1997).

DOE-SR based its methodology on three criteria for incidental waste classification previously developed as a guide for DOE to classify, as incidental, certain wastes removed from HLW tanks at DOE's Hanford site. These criteria were approved by the Commission in a 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 a letter from R. Bernero/NRC, to J. Lytle/DOE, dated March 2, 1993 (Attachment 3).

DOE-SR has the responsibility for classifying its waste, including the responsibility of determining whether residual waste in the DOE-SR HLW tanks should be classified as incidental waste. Further, DOE-SR has the responsibility for identifying the criteria it will use for its incidental waste classification decisions, as well as the methodology it will implement.

Therefore, viewing its role as providing technical assistance to DOE-SR, the NRC staff reviewed the DOE-SR methodology and supporting documents and concluded that the DOE-SR methodology appears to reasonably analyze the relevant considerations for Criterion One and Criterion Three of the three incidental waste criteria that DOE-SR proposes to use. The DOE-SR methodology would not meet Criterion Two, which provides that waste "...not exceed the applicable concentration limits for Class C low-level waste." However, DOE-SR's methodology relies on alternative classification considerations similar to those contained in the Commission's regulations (10 CFR 61.58).

The staff has prepared a draft response letter. The staff also notes that, while this draft response relates only to DOE-SR, DOE will also likely need to make future classification decisions about residual tank waste for tank closures at other sites including West Valley, Idaho National Engineering and Environmental Laboratory, and Hanford.

BACKGROUND:

The SR Site, a 310-square-mile area adjacent to the Savannah River, is owned by DOE and operated by the Westinghouse Savannah River Company. DOE-SR's mission includes production of nuclear materials for national defense, environmental restoration, and the receipt and disposition of research reactor fuels. While separating fissionable material from irradiated fuel, DOE-SR generated large volumes of defense-related liquid HLW. DOE-SR stored the HLW, which amounts to approximately 34 million gallons, in 51 underground tanks located in F-Area and H-Area tank farms. DOE-SR is currently retrieving and processing the waste into low-level waste forms through the saltstone process, and into HLW glass through vitrification, for eventual disposal at a geologic repository. After bulk removal, DOE-SR will close the HLW tanks and ancillary equipment in accordance with South Carolina Department of Health and Environmental Control (SCDHEC) regulations.(1) DOE-SR has already closed two tanks, numbers 17 and 20, and has cleaned but not closed a third tank, Tank 16.

DOE-SR plans to remove as much waste as is technically and economically practical from each tank, and then fill the tank with layers of grout. A key part of its disposal plans will be classification of the residual tank waste as "incidental." If DOE-SR classifies the residual waste as incidental, then DOE-SR believes it would be appropriate for DOE-SR to conclude that neither the tank itself nor the residual waste it contains is HLW. By letter dated December 20, 1996, from A.L. Watkins/DOE-SR, to C.J. Paperiello/NRC, DOE-SR submitted a request for NRC review of DOE's incidental waste classification methodology. Subsequent to that request, NRC and DOE-SR established a Memorandum of Understanding and an Interagency Agreement to provide funding for the staff review (SECY-97-096, L. Callan, to the Commissioners, dated May 2, 1997).

DISCUSSION:

As requested, the NRC staff evaluated the DOE-SR waste classification methodology. DOE-SR used, as the basis for the DOE-SR methodology, the three criteria for incidental waste classification that were previously developed as a guide for DOE to classify, as incidental, certain wastes removed from HLW tanks at DOE's Hanford site. The criteria were approved by the Commission in an 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 a letter from R. Bernero/NRC, to J. Lytle/DOE, dated March 2, 1993 (Attachment 3). As reflected in the staff's draft letter response, the NRC staff, from a safety perspective, does not disagree with DOE-SR's proposed methodology for meeting the three criteria. However, the draft staff letter response also notes that application of Criterion Two, which specifies Class C concentration limits, may be problematic in that options for addressing radionuclide concentrations in the tanks are limited. Residual tank waste typically is inaccessible to standard separation technologies (i.e., ion exchange, liquid-liquid separation). Mechanical removal technologies can remove bulk quantities of waste, but cannot preferentially remove key radionuclides. Reduction of volume by waste removal does not change concentration. Some chemical treatments, such as oxalic washing, which can remove key radionuclides, appear to be technically practical, but DOE-SR could find them not to be economically practical for every HLW tank (see the discussion for Criterion One below).

After evaluating a range of options, DOE-SR has selected bulk waste removal followed by water washing as its base case removal strategy. From Tank 16 clean-up data, DOE-SR predicts that bulk waste removal and water washing will remove approximately 98 percent of initial tank activity. Oxalic acid washing, another option evaluated by DOE-SR, could remove an additional 2 percent. Total removal efficiency with oxalic acid washing is 99.99 percent of the total tank activity. The DOE-SR estimate for oxalic acid washing is $1,050,000 per tank, including disposal costs. If DOE-SR selected oxalic acid washing as a base case removal strategy for all tanks, it would reduce the dose (from F-Tank Farm) to a member of the public from 1.9 mrem per year to 1.7 mrem/year (10 percent), and would reduce drinking water dose (from F-Tank Farm) to an inadvertent intruder from 130 mrem per year to 110 mrem per year (15 percent). Note that the current base case for the F-tank farm does include oxalic acid washing for 10 of the 22 tanks to the extent necessary to meet the performance objectives of 10 CFR Part 61. The listed dose reduction factors apply to oxalic acid washing the remaining 10 tanks in F-Tank Farm. (Two tanks have already been closed.) DOE-SR has concluded that, for the F-Tank Farm, oxalic acid washing the 10 remaining tanks would add approximately $10,500,000 for a limited dose reduction benefit. DOE-SR expects results for individual tanks in the H-Tank Farm to be similar in terms of additional costs.

For the discussion of the staff review of the DOE-SR methodology, the staff comments follow the three incidental waste criteria that DOE-SR proposes to use.

CRITERION ONE:
Criterion One specifies that "...wastes have been processed (or will be processed) to remove key radionuclides to the maximum extent that is technically and economically practical." The first step in evaluating removal of radionuclides is establishing initial waste volumes and radionuclide concentrations. The NRC staff has evaluated the DOE-SR tank sampling methodology for the characterization of the waste content. Although the DOE-SR sampling procedures and methods are reasonable, the staff recommends that DOE-SR establish a set protocol for tank sampling (i.e., sampling locations and number of samples taken).

Based on information provided by DOE-SR, it appears that few technologies have been demonstrated for the removal or separation of key radionuclides from residual tank waste. After evaluating a range of options, DOE-SR selected bulk waste removal followed by water washing as its base case removal strategy. (See discussion above.) With respect to Criterion One, DOE-SR considers oxalic acid washing to be technically, but not economically, practical. Accordingly, removal of key radionuclides by bulk waste removal followed by water washing is considered by DOE-SR to be the most technically and economically practical removal strategy. However, DOE-SR does intend to perform oxalic acid cleaning on approximately 37 tanks to the extent necessary to meet performance objectives.

The staff concludes that DOE-SR has reasonably analyzed the relevant considerations for Criterion One. Its methodology should result in removal of key radionuclides to the maximum extent economically and technically practical. DOE-SR will have to determine if it is cost-beneficial to expend more than $15 million[(2)] (for F- and H- Tank Farms) to achieve limited dose savings. It is up to DOE-SR to make the determination; and additional cleaning can be performed if they choose. It should be noted also, that the projected doses for F-Tank Farm (without additional cleaning) appear to meet the performance objectives of 10 CFR Part 61 (see discussion for Criterion Three, below) and appear to meet the radiological criteria for license termination (10 CFR 20.1402). Finally, neither ALARA (as low as reasonably achievable) nor safety considerations require the expenditure of the additional funds.

CRITERION TWO:
Criterion Two states that "...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." Based on information provided by DOE-SR, it appears that the waste will be in a solid physical form. DOE-SR will fill each tank with over 30 feet of grout after bulk waste removal. DOE-SR further specifies that the bottom layer will be a

reducing grout that is used to limit the release of radionuclides into the ground water. The second layer is a low-strength grout used to fill most of the tank to prevent any subsidence, and fill void space. The top layer of grout will be a high-strength grout that will protect the waste from physical penetration.

DOE-SR expects that, with the application of concentration averaging in accordance with the NRC "Branch Technical Position [BTP] on Concentration Averaging and Encapsulation," dated January 17, 1995, and 10 CFR 61.55(a)(8), 14 of the 51 HLW tanks at SR will meet Class C concentration limits after bulk waste removal and water washing.(3) According to DOE-SR, the remaining 37 tanks would require chemical cleaning via oxalic acid washing to meet Class C concentration limits, even if concentration averaging were used.

DOE-SR therefore relies on alternative considerations for the classification of the waste, rather than planning to use oxalic acid cleaning to meet Class C concentration limits. In particular, DOE-SR relies on its plans, described above, to solidify the waste in layers of grout, some 30 feet below the surface of the ground; further, DOE-SR relies on the disposal site which it considers to be stable. Finally, DOE-SR relies on its plans to clean the remaining 37 tanks, using oxalic acid, to the extent necessary to meet the performance objectives of Part 61 (see discussion below under Criterion Three).(4) These alternative considerations - waste form, method of disposal and stability of the site - are viewed by DOE-SR as providing comparable protection for an inadvertent intruder to that which would be provided if the waste met Class C limits.

The draft staff letter response notes that the DOE-SR methodology does not assure waste is Class C in accordance with Criterion Two. However, the draft response also notes that the DOE-SR methodology relies on an approach that is similar to that in section 61.58 of the Commission's regulations which provides for alternative considerations for classification "if after evaluation, of the specific characteristics of the waste, disposal site, and method of disposal, [the Commission] finds reasonable assurance of compliance with the performance objectives of [10 CFR Part 61] Subpart C." As discussed below, DOE-SR has provided information showing the DOE-SR methodology will meet the performance objectives of Part 61. Further, DOE-SR's methodology relies on the presence and stability of the waste form and the depth of the waste to protect the inadvertent intruder.(5)

The staff recommends that an alternative waste classification be administered at SR for HLW tank residuals similar to that provided for in 10 CFR 61.58. Staff considers that residual tank waste concentrations should be limited to avoid unreasonably high concentrations, and to further protect the public health and safety. The following limits are related to the development of the Class C concentration limits, which is discussed in the Draft Environmental Impact Statement (DEIS) for the 10 CFR 61 rulemaking. Staff recommends the following alternative waste classification be administered at SR for HLW tank residuals similar to that provided for in 10 CFR 61.58. The reclassification shall redefine the maximum allowable radionuclide concentrations as follows: no radionuclide concentration shall exceed ten times the value specified in Table 1 of 10 CFR 61.55, at 500 years following the proposed Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) closure for each tank grouping, and no radionuclide concentration shall exceed the value specified in Table 2 Column 3 in 10 CFR 61.55. The procedure established in 10 CFR 61.55(a)(7) shall be followed such that the sum of the fractions for all Table 1 radionuclides shall not exceed ten, and the sum of the fractions for all Table 2 radionuclides shall not exceed one. The administration of an alternative waste classification does not supercede the need to meet all aspects of Criterion One and Criterion Three.

CRITERION THREE:
Criterion Three states that "...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, Subpart C are satisfied." Each performance objective is discussed below, along with staff's evaluation of the DOE-SR tank farm performance assessment (PA) for the entire F-Area tank farm, which addresses each of the different dose receptors.

10 CFR 61.41, PROTECTION OF THE GENERAL POPULATION
With respect to 10 CFR 61.41, "Protection of the general population from releases of radioactivity," DOE provided information showing a site limit equivalent to a 4 mrem/year drinking water dose to the public. (The DOE-SR information indicates the drinking water dose pathway is expected to be the highest dose pathway to the public.) According to DOE-SR, because the PA results indicate that the 4 mrem/year drinking water limit can be met, the 25 mrem/year whole body dose equivalent in 10 CFR 61.41 should be met.

As indicated by the PA, DOE-SR projects the combined doses to the public from all pathways to be below the 25 mrem/year limit; therefore, DOE-SR considers that safety requirements comparable to 10 CFR 61.41 can be satisfied, provided that it meets its goal of tank cleaning efficiency. Staff agrees.

10 CFR 61.42, PROTECTION OF AN INADVERTENT INTRUDER
The 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 that the 500 mrem/year limit, used as a basis for waste classification, to show protection of individuals from inadvertent intrusion, can be met. 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.

In order for the DOE methodology to be consistent with the DEIS for 10 CFR Part 61, 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 DEIS. 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 the 500 mrem per year (all pathways, total effective dose equivalent) for the discovery and agricultural scenarios. Furthermore, the staff recommends that all external components of the HLW tanks (e.g., piping) meet Class C concentration limits without the application of concentration

averaging, unless DOE-SR can demonstrate that closed external components provide protection to an inadvertent intruder (similar to that provided for the HLW residual contained in the closed tanks). This is important because the current PA shows that the external components contribute the most significant dose prior to 1000 years.

10 CFR 61.43, PROTECTION OF WORKERS
DOE-SR will meet the worker protection standard in 10 CFR 61.43 through the use of DOE regulations, 10 CFR Part 835, which are comparable to those administered by NRC through 10 CFR Part 20.

10 CFR 61.44, STABILITY OF THE DISPOSAL SITE
For the fourth performance objective, 10 CFR 61.44, "Stability of the disposal site after closure," the DOE-SR information indicates the site stability of the tank farm and HLW tanks themselves will be provided from the grout used to immobilize the residual waste. Over 30 feet of grout will be added to each tank, and DOE-SR states that no active maintenance for the tanks will be needed once the grouting process has been completed.

Based on its review of DOE PA results and supplementary information provided during the course of this review, the draft staff response concludes that DOE-SR has reasonably analyzed the considerations under Criterion Three in concluding that its tank closure methodology is consistent with Criterion Three.

INSTITUTIONAL CONTROL:
DOE has proposed institutional control of the site in perpetuity. The DOE approach includes the following: (1) SR boundaries shall remain unchanged, and the land shall remain under the ownership of the Federal government, consistent with the site's designation as a National Environmental Research Park; (2) residential uses of all SR land shall be prohibited; and (3) an Integral Site Model that incorporates three planning zones (industrial, industrial support, and restricted public uses) will be used. The land around the F and H Areas (i.e., between Upper Three Runs Creek and Four Mile Branch) will be considered in the industrial use category.

NRC, as provided in 10 CFR 61.59, does not allow reliance on active institutional controls for more than 100 years. It appears, from the PAs performed by DOE, that DOE-SR's closing of tanks in accordance with the stated tank closure methodology could meet the performance objectives of Part 61, without dependence on institutional controls.

NATURAL RESOURCES DEFENSE COUNCIL PETITION:
On July 28, 1998, the Natural Resources Defense Council (NRDC) submitted a petition requesting that NRC exercise immediate licensing authority over all HLW in the 51 tanks at DOE-SR. The NRDC petition argues that "DOE has invented... the term 'incidental waste' as a means of circumventing NRC licensing authority and safety oversight," and also states that "...[e]ven if NRDC were to accept NRC's informal working definition of the term 'incidental waste,' the waste remaining in the SRS Tanks under the Program could not be construed as 'incidental' as the term is currently interpreted by DOE." NRC has acknowledged receipt of the petition (letter from C.J. Paperiello/NRC, to T.B. Cochran/NRDC, dated August 27, 1998). Note that DOE has provided comments on the NRDC petition, which argue that "NRC has no licensing authority over the SRS tanks." This paragraph is intended only to provide information to the Commission, and does not request a Commission decision regarding the petition. Unless the Commission directs otherwise, the Nuclear Material Safety and Safeguards Office Director will issue a decision on the petition, consistent with this Commission paper and the associated Office of General Counsel memorandum, and the Commission will have the opportunity to review that Director's Decision after it is issued. A separate Commission paper regarding the NRDC petition response will not be provided unless requested by the Commission after issuance of the Director's Decision.

CONCLUSIONS AND RECOMMENDATIONS:

Based on staff's review of the information provided by DOE-SR, the draft staff response indicates that DOE-SR appears to have reasonably analyzed the relevant considerations in concluding that its tank closure methodology for F-Area and H-Area HLW Tank Farms at SR can meet Criteria One and Three. The DOE-SR information does not show that all tank waste will be Class C or less in accordance with Criterion Two. In lieu of achieving Class C concentrations, DOE-SR's methodology relies on alternate waste classification considerations similar to those provided for in 10 CFR 61.58 of the Commission's regulations. DOE-SR recognizes that the classification of the residual waste as incidental is contingent on DOE-SR's reaching current goals for bulk waste removal, as well as water and chemical washing, such that the performance objectives stated in Part 61, Subpart C, can be met.

The staff recommends that the Commission approve the attached draft staff response to DOE-SR. This response indicates that the NRC staff, viewing its role as providing technical assistance to DOE-SR, reviewed the DOE-SR methodology and supporting documents and concluded the DOE-SR methodology reasonably analyzes the relevant considerations in concluding that Criterion One and Criterion Three of the incidental waste criteria are met, and that although not all of the residual tank waste can meet Class C concentration limits in accordance with Criterion Two, DOE-SR has provided alternate waste classifications considerations similar to those provided for in 10 CFR 61.58. As reflected in the staff's draft letter response, the NRC staff, from a safety perspective, does not disagree with DOE-SR's proposed methodology for meeting the three criteria. This finding is contingent on DOE-SR satisfactorily addressing the staff recommendations presented in the draft letter.

The staff notes that, while this draft response relates only to DOE-SR, DOE will also likely need to make future classification decisions about residual waste at Savannah River and other sites including West Valley, Idaho National Engineering and Environmental Laboratory, and Hanford.

COORDINATION:

The Office of the General Counsel has reviewed this Commission Paper for legal implications and is providing its views to the Commission via a separate memorandum.

William D. Travers

CONTACT: B. Jennifer Davis, NMSS/DWM
301-415-5874

Attachments:

1. Draft letter response from C.J. Paperiello/NRC, to R.J. Schepens/DOE, "Savannah River Site High-Level Tank Closure:Classification of Residual Waste as Incidental."
2. Letter request from A.L. Watkins/DOE-SR, to C.J. Paperiello/NRC, dated December 20, 1996.
3. Letter from R. /NRC, to J. Lytle/DOE, dated March 2, 1993.

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1. DOE-SR informed the staff that SCDHEC concurrence on DOE's tank closure methodology is contingent on NRC agreement that the residual tank waste is incidental. The staff believes its response will provide a basis for DOE to go forward with SCDHEC.

2. It would cost approximately $15 million to clean the additional 14 tanks which are projected to meet the Class C concentration limits, and that are not projected to need any oxalic acid cleaning to meet performance objectives.

3. The staff believes that concentration averaging in accordance with the BTP is generally acceptable in this context to meet Class C concentration limits.

4. DOE-SR provided cost information for bulk waste removal plus water washing, and for oxalic acid cleaning to meet Class C concentration limits. However, cost information is not available for bulk waste removal plus water washing plus oxalic acid cleaning only to the extent necessary to meet performance objectives. Note that tanks cleaned with oxalic acid to meet performance objectives may not necessarily meet Class C concentration limits.

5. Assuming the contaminant zone of the waste form is not disturbed, the radionuclide of greatest impact on drinking water dose to the intruder is Tc-99 which is well below the limits of Table 1 of 10 CFR Part 61 (i.e., the greatest dose contributor is not above the Class C concentration limits).