

Mr. Joel T. Case, Director
INTEC Waste Programs
U.S. Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, ID 83401-1563

SUBJECT: NRC REVIEW OF IDAHO NUCLEAR TECHNOLOGY AND ENGINEERING
CENTER DRAFT WASTE-INCIDENTAL-TO-REPROCESSING DETERMINATION
FOR TANK FARM FACILITY RESIDUALS - CONCLUSIONS AND
RECOMMENDATIONS

Dear Mr. Case:

The U.S. Nuclear Regulatory Commission (NRC) has completed its review of the waste-incident-to-reprocessing (WIR) determination for tank farm facility (TFF) residuals at the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Engineering and Environmental Laboratory (INEEL). As established in the Memorandum of Understanding (MOU) between the U.S. Department of Energy (DOE) and NRC, dated September 7, 2001, NRC's activities related to the review are being carried out in an advisory capacity. Any advice given to DOE's Idaho Operations Office (ID) does not constitute a regulatory approval, authorization, or license for DOE activities.

Your letter, dated February 7, 2001, requested NRC review of two WIR determinations, the first addressing management of sodium-bearing waste as transuranic waste. The results of NRC's review of that WIR determination were transmitted to you on August 2, 2002. The second WIR determination addresses residual waste in the TFF. DOE-ID requested that NRC review the TFF determination to the criteria set forth in DOE Order 435.1, "Radioactive Waste Management."

This letter transmits the NRC conclusions and recommendations regarding the TFF WIR determination. As described in our letter to you dated July 17, 2001, NRC's review focused on whether the waste has been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical (Criterion One), and whether the waste will be managed so that safety requirements comparable to the performance objectives in 10 CFR Part 61, Subpart C, are satisfied (Criterion Three). In accordance with NRC's most recent incidental waste guidance for tank closure (contained in the "Final Policy Statement for the Decommissioning Criteria for the West Valley Demonstration Project at the West Valley Site," dated February 1, 2002), the incorporation of waste into a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste (LLW) (Criterion Two) was not analyzed. Together, Criteria One and Three are risk-informed and performance-based, and allow flexibility to develop innovative approaches to meeting the performance objectives in Part 61. When demonstrating that performance objectives have been met, NRC believes that focus should be placed on the potential health

consequences of leaving waste on-site (i.e., doses that might occur) instead of focus being placed on more indirect measures of health risk (i.e., meeting specific radionuclide concentration limits).

On February 13, 2002, DOE-ID submitted the "Idaho Nuclear Technology and Engineering Center Tank Farm Facility Residuals – Waste-Incidental-to-Reprocessing Determination Report, Draft A" for NRC review. After initial review of the WIR determination and the associated performance assessment (PA), NRC staff provided DOE-ID with a list of questions and comments in a request for additional information (RAI), dated June 5, 2002, to obtain the information needed to complete its review. In addition, NRC staff members met with DOE-ID on October 2, 2002, to discuss DOE-ID's preliminary responses to the RAI. On December 6, 2002, DOE-ID submitted a revised determination for NRC review consisting of: 1) "Final Responses to the Request for Additional Information on the Idaho National Engineering and Environmental Laboratory Draft Waste Incidental to Reprocessing Determination for Tank Farm Facility Residuals"; 2) "Performance Assessment for the Tank Farm Facility at the Idaho National Engineering and Environmental Laboratory," Volumes 1, 2, and 3, Revision 1; and 3) "Idaho Nuclear Technology and Engineering Center Tank Farm Facility Residuals – Waste-Incidental-to-Reprocessing Determination Report, Draft B."

NRC reviewed the determination to assess whether it had sound technical assumptions, analysis, and conclusions with regard to meeting the incidental waste criteria, and thus, that DOE-ID's proposed management of residual tank farm waste as LLW is protective of public health and safety and the environment. NRC conclusions and recommendations regarding DOE-ID's WIR determination, as provided in DOE-ID's revised draft, are presented in the attached technical evaluation report and summarized below.

Criterion One:

DOE-ID has recently sampled three tanks and used those data, along with process history and analytical modeling, as a basis for estimating the composition of tanks that have not been recently sampled. Of the approximately 3.2 million terabecquerels (TBq) [87 million curies (Ci)] of waste generated by spent fuel reprocessing, approximately 3400 TBq (92,600 Ci) are estimated to remain in the tanks after closure, representing about 0.1 percent of the initial inventory. Preliminary results from cleaning performed on tank WM-182 indicate that the residual inventory may be substantially less than 0.1 percent of the initial inventory. NRC staff believes that the sampling approach for determining the inventory remaining in the tanks is reasonable. DOE-ID has analyzed various chemical and mechanical options for removal of residual waste from the tanks, and has performed economic analysis for three options. DOE-ID's preferred option is the use of a washball and directional spray nozzles, combined with a modified steam-jet pumping system.

Based on staff's review of the information provided by DOE-ID, NRC staff concludes that DOE-ID's methodology for removal of key radionuclides to the maximum extent technically and economically practical is acceptable with respect to meeting Criterion One. We recommend that DOE-ID remain cognizant of developing tank cleaning technologies at other sites and, if necessary, re-evaluate its preferred technology for future tank closure.

Criterion Three:

Criterion Three requires evaluation of the protection of the general population from releases of radioactivity, the protection of individuals from inadvertent intrusion into the waste, the protection of individuals during operations, and the stability of the disposal site after closure. DOE-ID developed a PA to demonstrate protection of the general population from releases of radioactivity, as well as protection of individuals from inadvertent intrusion. In response to NRC's RAI, DOE-ID performed uncertainty and sensitivity analyses and expanded the PA to include additional data for the inventory, infiltration, release, and transport parameters; technical basis for selection criteria; and additional simulations for vertical hydraulic conductivity and flooding. Staff believes that DOE-ID has developed a reasonable source term and has adequately modeled system degradation, release, hydrology, and transport. NRC agrees that the source term used in the PA is conservative, because it is based on the following: 1) radionuclide concentrations in tank WM-188 are used as the basis for estimating the concentrations in the other tanks; 2) 3.2 centimeters (1.3 inches) of material will remain in the bottom of the tank; and 3) radionuclide concentrations in the solid materials will be unaffected by tank cleaning. NRC believes that the PA results could be further improved by exploring methods for measuring the inventory present in the sand pads and by confirming that the sorption coefficients assumed for concrete, basalt, and interbedded sediments are conservative. Both the sand pad inventories and the sorption coefficients appear to be important parameters in the TFF PA.

For DOE-ID's modeling, the public is represented by an adult member of a farming community who lives in a residence downstream of the TFF. As indicated by the PA, DOE-ID estimates that the all-pathways total effective dose equivalent to the public would be 0.014 millisievert/year (mSv/yr) [1.4 millirem/yr (mrem/yr)], which is well below the performance objective of 0.25 mSv/yr (25 mrem/yr) in 10 CFR 61.41. Staff has concluded that there is reasonable assurance that safety requirements comparable to the performance objectives of 10 CFR 61.41 can be met, including the provision that reasonable effort should be made to maintain releases of radioactivity to the general environment as low as is reasonably achievable (ALARA). The ALARA provision is not part of the PA calculation, as the PA is the means to generate results to compare to performance objectives. Through demonstration of Criterion One (the waste has been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical), DOE-ID can satisfy the intent of the ALARA provision to maintain releases of radioactivity to the environment ALARA.

DOE-ID evaluated acute and chronic radiological impacts for an intruder-drilling scenario and an intruder-construction scenario, after failure of institutional controls at 100 years. The maximum dose for the intruder-drilling scenario occurs in the first year after the institutional control period ends, and is 2.32 mSv (232 mrem) for acute exposure and 0.911 mSv/yr (91.1 mrem/yr) for chronic exposure. The maximum dose for the intruder-construction scenario occurs in the first year after the institutional control period ends, and is 0.0093 mSv (0.93 mrem) for acute exposure and 0.261 mSv/yr (26.1 mrem/yr) for chronic exposure. The intruder doses are calculated to be less than 5-mSv/yr (500-mrem/yr). Staff agrees that DOE-ID has developed reasonable intruder scenarios to satisfy the requirements in 10 CFR 61.42.

DOE-ID will assure worker protection through the use of DOE regulations (10 CFR Part 835), which are analogous to the requirements in 10 CFR Part 20. NRC staff agrees that this will satisfy the requirements in 10 CFR 61.43.

Site stability of the high-level waste tanks will be provided by grouting the tanks, the tank vaults, and the process piping. NRC staff concludes that DOE-ID's plans for grouting appear sufficient to indicate that safety requirements comparable to 10 CFR 61.44 can be met.

Based on its review of DOE-ID PA results and supplementary information provided during the course of this review, NRC concludes that DOE-ID has reasonably analyzed the applicable considerations for Criterion Three, as described above.

Overall Conclusions:

Based on the staff's review of the information provided by DOE-ID, NRC staff has determined that DOE-ID appears to have reasonably analyzed the relevant considerations in concluding that the residual waste in the TFF can meet Criteria One and Three for incidental waste determinations. DOE-ID's determination that the residual waste from tank closure activities is incidental waste (to be managed as LLW), has sound technical assumptions, analysis, and conclusions with regard to protecting public health and safety and the environment. NRC staff judgment as to the adequacy of DOE-ID's tank closure methodology is dependent on verification that the assumptions underlying the analysis are correct.

DOE-ID's analysis and results could be further improved by following the staff recommendations provided in the technical evaluation report. This NRC assessment is a site-specific evaluation and is not a precedent for any future decisions regarding WIR activities at other sites.

If you have any questions regarding this letter or the attached technical evaluation report, please contact Anna Bradford of my staff at (301) 415-5228.

Sincerely,

/RA/

Lawrence Kokajko
Environmental Performance and
Assessment Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Attachment:

"U.S. Nuclear Regulatory Commission Review of Idaho Nuclear Technology and Engineering Center Draft Waste-Incidental-to-Reprocessing Determination for Tank Farm Facility Residuals"

cc: K. Lockie/DOE-ID
K. Picha/DOE-HQ