POLICY ISSUE
NEGATIVE CONSENT

May 15, 2003 SECY-03-0079

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: NRC REVIEW OF IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY DRAFT INCIDENTAL WASTE (WASTE-INCIDENTAL-TO-REPROCESSING) DETERMINATION FOR TANK FARM FACILITY CLOSURE

PURPOSE:

To inform the Commission that the staff plans to transmit the attached letter unless instructed otherwise by the Commission, from the Director of the Division of Waste Management, U.S. Nuclear Regulatory Commission (NRC), to the Director of Idaho Nuclear Technology and Engineering Center (INTEC) Waste Programs, U.S. Department of Energy (DOE), at the Idaho Operations Office (ID). The proposed letter provides the results of the NRC staff's review of the Idaho National Engineering and Environmental Laboratory (INEEL) draft incidental waste [or waste-incidental-to-reprocessing (WIR)] determination regarding the closure of the Tank Farm Facility (TFF).

SUMMARY:

This paper summarizes the results of the staff's review of DOE-ID's WIR determination regarding closure of the TFF. Staff reviewed the determination to assess whether it had sound technical assumptions, analysis, and conclusions with regard to meeting the incidental waste

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criteria. NRC staff is providing technical assistance and advice to DOE-ID regarding its determination that management of residual tank farm waste as low-level radioactive waste (LLW) is protective of public health and safety and the environment. NRC is not providing regulatory approval in this action. The details of the staff's review, including conclusions and recommendations, are located in the technical evaluation report, attached to the proposed response to DOE-ID (see Attachment).

BACKGROUND:

In 1969, NRC recognized the concept of incidental waste or WIR in a draft policy statement that addressed the definition of high-level radioactive waste (HLW). Certain material that otherwise would be classified as HLW need not be disposed of as HLW and sent to a geologic repository because the residual radioactive contamination after decommissioning is sufficiently low to not represent a hazard to the public health and safety if disposed of in a near-surface LLW disposal facility. Consequently, incidental waste is not considered to be HLW. The original incidental waste criteria 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." The criteria are described in the March 2, 1993, letter from R. Bernero, NRC, to J. Lytle, DOE: (1) the waste has been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical; (2) the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C LLW as set out in 10 CFR Part 61; and (3) the waste is 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.

In the May 30, 2000, SRM on SECY-99-0284, "Classification of Savannah River Residual Tank Waste as Incidental," the Commission stated that a more generic, performance-based approach should be taken. In effect, cleanup to the maximum extent that is technically and economically practical, and demonstration that performance objectives could be met (consistent with those that the Commission demands for the disposal of LLW) should serve to provide adequate protection of the public health and safety and the environment. 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 Commission adopted this performance-based approach and noted the criteria that should be applied to the incidental waste determinations at West Valley:

(1) The waste should be processed (or should be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical; and

(2) The waste should be managed so that safety requirements comparable to the performance objectives in 10 CFR Part 61, Subpart C, are satisfied.

On July 9, 1999, DOE issued DOE Order 435.1, "Radioactive Waste Management." DOE Order 435.1 discusses the WIR evaluation process and the criteria for a WIR determination. The DOE Order 435.1 and its associated manual and guidance require that all DOE radioactive

waste be managed as HLW, transuranic (TRU) waste, or LLW. The Order states that waste, determined to be incidental to reprocessing, is not HLW and shall be managed in accordance with the requirements for TRU waste or LLW, if it meets appropriate criteria. DOE criteria continue to include Class C concentration limits, unless alternate criteria is applicable.

DISCUSSION:

On February 7, 2001, DOE-ID requested NRC consultation on, and review of, two draft incidental waste determinations for INEEL. In the Memorandum from William D. Travers, Executive Director for Operations, to the Commissioners, dated June 18, 2001, the staff notified the Commission of its plans to review the determinations and provide its recommendations to the Commission. After receiving no objection from the Commission, NRC and DOE-ID developed a Memorandum of Understanding (MOU) that established the framework for NRC to provide technical assistance to DOE-ID in regard to the incidental waste determinations (see SECY-01-0150, "Memorandum of Understanding and Interagency Agreement between the U.S. Department of Energy and the U.S. Nuclear Regulatory Commission on the Review of Incidental Waste Determinations for the Idaho National Engineering and Environmental Laboratory," dated August 6, 2001, and related SRM, dated August 29, 2001). An Interagency Agreement (IA) implements the MOU and establishes that all costs incurred by NRC, including contractor support, will be reimbursed by DOE-ID. In addition, the MOU establishes that NRC's activities under the MOU are carried out in an advisory capacity, and that any advice given to DOE-ID under the MOU does not constitute regulatory approval, authorization, or license for DOE activities. The MOU and IA became effective on September 7, 2001.

The first WIR determination involved waste currently stored in the TFF, located within the INTEC at INEEL, and addressed whether this waste may be managed as TRU waste. DOE-ID is planning to remove, treat, and dispose of the waste, which consists mostly of decontamination solutions from spent fuel reprocessing maintenance and closure activities. The results of the NRC review of this WIR determination were provided to the Commission on June 21, 2002 [see SECY-02-0112, "NRC Review of Idaho National Engineering and Environmental Laboratory Draft Incidental Waste (Waste Incidental to Reprocessing) Determination for Sodium-Bearing Waste"]. In the associated SRM, dated July 26, 2002, the Commission advised the staff that it had no objections to the proposed letter, subject to incorporation of comments and changes, and the letter was transmitted to DOE-ID on August 2, 2002.

The second WIR determination addresses the decontamination and closure of tanks used to store liquid HLW and sodium-bearing waste, and evaluates whether the tanks and tank residuals can be managed as LLW. There are 11 large underground storage tanks contained in octagonal or square concrete vaults. The 11-1,000 cubic meter (m^3) (300,000-gallon) tanks are stainless steel vessels with an inside diameter of 15 meters (m) [49 feet (ft)] and a wall height of 6.4 m (21 ft) or 7.0 m (23 ft). The tanks rest on sand pads distributed over the bottom of the concrete vaults. In 1962, two of the sand pads were contaminated with first-cycle extraction wastes as a result of back-siphoning events. Eight of the 11 tanks contain stainless steel cooling coils on the floors and walls of the tanks. The tops of the concrete vaults are covered with approximately 3 m (10 ft) of soil to provide radiation shielding. There is residual waste in approximately 3,200 m (10,600 ft) of process piping associated with the TFF. In addition, there are four 100-m^3 (30,000-gallon) underground storage tanks at the TFF.

However, DOE-ID determined that the inventory in these four smaller tanks and in one of the 11 large tanks is insignificant compared to the other 10 large tanks. Therefore, only 10 of the 15 tanks located at the TFF were included in the evaluation.

DOE-ID plans to clean the tanks with high-pressure water, followed by pumping of slurried solids and dilute liquid from the tank. After removing residual waste to the extent technically and economically practical, DOE-ID will perform sampling of the residuals, add adsorbent materials to eliminate any free liquids, and fill the tanks and tank vaults with grout. DOE-ID has developed a WIR determination and performance assessment (PA) to evaluate whether the tanks and tank residuals can be managed as LLW and closed in place. This paper addresses the staff review of the tank closure WIR determination and PA.

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. As noted in the June 18, 2001, Memorandum, NRC's review focused on Criterion One (whether the waste has been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical) and Criterion Three (whether the waste will be managed so that safety requirements comparable to the performance objectives in Part 61, Subpart C, are satisfied). Since NRC's most recent incidental waste guidance for tank closure, as presented in the "Final Policy Statement for the Decommissioning Criteria for the West Valley Demonstration Project at the West Valley Site," does not include a criterion to assess whether the waste meets Class C concentration limits, NRC staff did not evaluate whether the INTEC waste would meet this criterion. Therefore, even though DOE's WIR determination addresses all three criteria presented in DOE Order 435.1, NRC staff will not provide conclusions or recommendations for the Class C concentration limits (Criterion Two).

After initial review of the WIR determination and the 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 the staff's 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 conclusions regarding DOE-ID's WIR determination are presented in the attached technical evaluation report and are summarized in this paper.

Criterion One:

Criterion One specifies that "...wastes should be processed, or should be further processed, to remove key radionuclides to the maximum extent that is technically and economically practical." The first step in evaluating this criterion is to establish the tank inventory. DOE-ID has recently sampled three of the tanks and used the resulting data, as well as process history and analytical modeling, as a basis for estimating the composition of tanks that have not been

recently sampled. The concentrations for radionuclides lacking current analytical data were estimated using the ORIGEN2 model and analytical data for cesium-137 concentrations. Of the approximately 3.2 million terabecquerels (TBq) [87 million curies (Ci)] of waste generated by spent fuel reprocessing at INTEC, approximately 3400 TBq (92,600 Ci) are estimated to remain in the tanks following closure, representing about 0.1 percent of the initial inventory.

DOE-ID evaluated numerous chemical and mechanical waste removal technologies for cleaning of the tanks. Because of the acidic nature and low amount of solids in the waste at INTEC, none of the chemical processes was determined to be technically practical for the tanks. Several mechanical cleaning options were considered, such as mixer pumps, sluicing systems, and disposable crawlers. Sluicing systems and mechanical arms were technically practical and were retained for economic evaluation. A washball and directional spray nozzles, combined with a modified steam-jet pumping system, were determined to be the preferred technology for the INTEC tanks.

Because only limited technologies were applicable to the INTEC tanks, only three options were considered in DOE-ID's economic evaluation: the preferred system, a hypothetical new system that would provide 50 percent more waste removal, and complete tank removal. The cost estimate to develop and deploy the preferred system is $27 million. The hypothetical new system is estimated to cost an additional $14 million. DOE-ID does not believe that developing a new system is economically practical, because the preferred system can achieve high waste removal efficiencies and can meet the performance objectives. Complete tank removal is estimated to cost an additional $5.3 billion, and would result in a relatively large radiological impact to workers.

The staff concludes that DOE-ID has reasonably analyzed the relevant considerations for Criterion One. Because of the nature of the waste at the TFF, DOE-ID's analysis of the technical practicality of additional waste removal options is reasonable. As discussed in the attached technical evaluation report, the development of four source term estimates by the DOE-ID is conservative with respect to the information that is known, and the conservative source term used in the PA is likely to bound the quantity of and radionuclide concentrations in the materials remaining in the tanks. Cleaning performed for tank WM-182, using the preferred system, has shown that less waste may remain in the tanks (less than 0.1 percent of the initial inventory) than the amount assumed by DOE-ID in its WIR determination. DOE-ID's methodology for removing key radionuclides to the maximum extent technically and economically practical is reasonable.

Criterion Three:

Criterion Three specifies that "...the waste should be managed so that safety requirements comparable to the performance objectives in 10 CFR Part 61, Subpart C, are satisfied." DOE-ID's PA and each performance objective in Part 61 are discussed below.

Performance assessment

DOE-ID has prepared 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 staff'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. DOE performed modeling of four different scenarios: best-, realistic-, conservative-, and worst-case. The conservative case was used by DOE-ID to compare to the performance objectives and to provide a demonstration of compliance. The uncertainty and sensitivity analyses using the best-, realistic-, and worst-case scenarios were intended to serve as an evaluation of whether the conservative case is indeed conservative. DOE-ID provided a sampling and analysis plan that it will use after tank cleaning, to characterize the residual materials remaining in the tanks. Tank closure (grouting) will only proceed if closure performance objectives can be met, in accordance with the sampling plan.

The staff believes that DOE-ID has developed a reasonable source term estimate and has adequately modeled engineered system degradation, release, hydrology, and transport. The staff has several recommendations to increase confidence in the modeling predictions, such as confirming sand pad contaminant levels and verifying that reducing conditions are likely to be present in the grout. The staff recommendations are detailed in the attached technical evaluation report.

10 CFR 61.41, Protection of the general population

In DOE-ID's model, the public is represented by an adult member of a farming community, who lives in a residence and uses a drinking-water well located where the maximum concentration of radionuclides in the ground water is predicted to occur. DOE-ID provided a series of analyses to evaluate the impact of key uncertainties including: residual inventory, infiltration rate, transport parameters, and grout distribution coefficients. DOE-ID applied a compliance period of 1,000 years, and also analyzed out to 1 million years to assess longer-term impacts. As indicated by the PA, DOE-ID estimates that the all-pathway 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 developed a performance assessment model to evaluate sensitivity of the PA results and to roughly corroborate DOE-ID's calculations. Staff has concluded that there is reasonable assurance that safety requirements comparable to 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.

10 CFR 61.42, Protection of an inadvertent intruder

Many standard intruder scenarios were not considered to be applicable for the TFF because depth to the waste in the tanks is 10 m (30 ft) or more. DOE-ID evaluated acute (short-term exposure) and chronic (long-term exposure) radiological impacts for an intruder-drilling scenario and an intruder-construction scenario, after failure of institutional controls at 100 years.

The intruder-drilling scenario assumes a well is drilled directly through the waste in the tank. The acute intruder is exposed to drill cuttings from an irrigation or domestic drinking water well. The chronic intruder is exposed by drilling the well, inhaling re-suspended drill cuttings, and engaging in agricultural activities. The maximum dose occurs in the first year after the

institutional control period ends, and is 2.32 mSv (232 mrem) for the acute scenario and 0.911 mSv/yr (91.1 mrem/yr) for the chronic scenario.

The intruder-construction scenario assumes excavation and construction occurs on the site and disturbs the process piping. The acute intruder exposure is a result of inhalation, ingestion, and direct radiation from contaminated soil. The chronic intruder is assumed to live in the constructed building and receive additional doses as a result of engaging in agricultural activities. The maximum dose occurs in the first year after the institutional control period ends, and is 0.0093 mSv (0.93 mrem) for the acute scenario and 0.261 mSv/yr (26.1 mrem/yr) for the chronic scenario.

Staff agrees that DOE-ID has developed reasonable intruder scenarios and has performed technically sound analyses to assess intruder doses. The intruder doses are calculated to be less than 5-mSv/yr (500-mrem/yr). Staff has concluded that there is reasonable assurance that safety requirements comparable to 10 CFR 61.42 can be met.

10 CFR 61.43, Protection of workers

DOE-ID will meet the worker protection standard in 10 CFR 61.43 through the use of DOE regulations, 10 CFR Part 835, which are analogous to the requirements in 10 CFR Part 20.

10 CFR 61.44, Stability of the disposal site

DOE-ID information indicates that site stability of the HLW tanks will be provided by grouting the tanks, the tank vaults, and the process piping. In addition, the depth to the residual waste in the tanks is greater than 10 m (30 ft) and the depth to residual waste in the piping is greater than 3 m (10 ft) for 70 percent of the piping. Staff concludes that DOE-ID's plans for grouting appear sufficient to meet safety requirements comparable to those in 10 CFR 61.44.

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

FUTURE ACTIONS:

DOE Headquarters expects that a minimum of five, and possibly up to 11, WIR determinations will be submitted for NRC review before the end of fiscal year 2004. The current process for NRC review of DOE's WIR determinations is based on the establishment of individual MOUs and IAs with each DOE site. Each site-specific MOU and IA is provided to the Commission for review, and the results of the staff's technical reviews are also provided to the Commission before transmittal to DOE. DOE Headquarters is developing a complex-wide MOU and IA that will address all of the upcoming WIR reviews for all DOE sites. Consolidating all WIR reviews under one MOU would be more efficient and would conserve staff resources by removing the need to develop a new MOU and Commission Paper for each site's review request. Since WIR reviews are expected to become more common and routine, the staff plans to propose that it no longer provide its review results for each WIR evaluation to the Commission for review. This topic will be addressed in more detail in a separate Commission Paper after DOE has provided its proposed complex-wide MOU.

CONCLUSIONS:

Based on the staff's review of the information provided by DOE-ID, NRC staff has concluded that the DOE-ID's WIR determination for residual tank farm waste demonstrates that the residual waste can meet the incidental waste criteria. 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. The staff believes that DOE-ID's analysis and results could be further improved by following the staff recommendations provided in the technical evaluation report.

RECOMMENDATION:

Unless otherwise directed by the Commission within 10 days, the staff plans to send the attached proposed letter response and technical evaluation report to DOE-ID. Action will not be taken until the SRM is received. We consider this action to be within the delegated authority of the Director of the Office of Nuclear Material Safety and Safeguards.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objections.

/RA/

William D. Travers
Executive Director
for Operations

Attachment:
Proposed ltr response from L. Kokajko/NRC, to J.T. Case/DOE-ID, "NRC Review of Idaho Nuclear Technology and Engineering Center Draft Waste-Incidental-to-Reprocessing Determination for Tank Farm Facility Residuals - Conclusions and Recommendations"

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WITS200100058/NMSS200100314 **ML012250219** *See Previous Concurrence Log: 03-035

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