DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700 Washington, D.C. 20004-2901
(202) 694-7000

January 24, 2007

The Honorable James A. Rispoli
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Mr. Rispoli:

The Defense Nuclear Facilities Safety Board (Board) and its staff have closely followed conceptual and preliminary design activities, pilot plant testing, and safety basis development for the Integrated Waste Treatment Unit (IWTU) at the Idaho National Laboratory. The Board acknowledges approval of the Critical Decision 2/3B milestone, formally establishing the project's performance baseline and authorizing long-lead procurement of major process equipment and early site work. The overall safety strategy as discussed in the enclosed project summary appears sound, and the preliminary design of important process systems that confine and control hazardous materials is conservative. The Board has no significant safety issues with the project at this time (Critical Decision 2/3B). The final design, however, is progressing and there remain a number of items the Board believes must be addressed before the approval of final design and construction of the project. These items are listed below for your information:

- Distributed control system design, including 1) fail-safe logic that places the steam reforming process in a safe configuration following control system failure, and 2) rapid shutdown system sensitivity to safety-related operating parameters.

- Completion of the pilot plant mercury adsorber bed over-temperature event investigation, and development of an adequate control set to prevent recurrence in the full scale IWTU.

- Completion of the analysis of pilot plant testing results for the mineralized waste form and assessment of the ability of the existing facility design to accommodate any needed process design changes to allow utilizing this waste form if needed in the future.

- Validation that the radionuclide assumptions in the safety basis are accurate, either through completion of sampling or through batch feed sampling requirements.

- Routine configuration management of important safety documents, e.g., the Preliminary Documented Safety Analysis report, to ensure safety requirements are properly incorporated during final design.

In addition to these items, the Board encourages the IWTU project to consider incorporating limited, post-seismic monitoring capability into the IWTU control system as defense-in-depth assurance of safe shutdown. Currently, no seismically qualified system exists to verify safe shutdown following an earthquake.

The Board commends DOE for considering a potential future mission in this facility. Further, DOE convened an expert panel early in preliminary design to confirm that the design of the facility could accommodate this mission. The Board is encouraged by the project's commitment to address this panel's recommendations.

Interaction between our staff and IWTU project personnel has been productive thus far, and we look forward to continuing this dialogue in the future.

Sincerely,

A. J. Eggenberger
Chairman

c: The Honorable David K. Garman
Mr. Mark B. Whitaker, Jr.

Enclosure

Enclosure
Integrated Waste Treatment Unit Project Summary

The Integrated Waste Treatment Unit (IWTU) will convert approximately 900,000 gallons of acidic, liquid sodium bearing waste to a solid carbonate or mineralized product for permanent disposal at the Waste Isolation Pilot Plant or an off-site geologic repository. The sodium bearing waste is currently stored in three tanks at the Idaho Nuclear Technology and Engineering Center (INTEC) and will be treated using steam reforming technology. The IWTU will also stabilize liquid wastes generated from continued cleanup of the INTEC area. Portions of the facility's structure may have a future mission to support the recovery of High-Level-Waste Calcine for off-site disposal, and are thus being designed to more rigorous structural requirements.

The safety strategy relies on confinement of hazardous materials, radiation shielding, and accident prevention during steam reforming and waste product handling operations. Significant hazards include mercury release from a charcoal adsorber bed fire, hydrogen deflagration in process equipment, and confinement boundary failure resulting in release during a seismic event. Engineered and administrative controls will prevent and mitigate worker consequences from these and other events identified in safety basis documents. Controls credited as safety-significant for the IWTU include the following:

- rapid shutdown system (including its uninterruptible power supply);
- off-gas cooling system;
- radiation shielding (process cell, carbon reduction reformer cell, packaging station cell, storage vaults, vault loading area, 72B transport cask and adapter, and remote-handled transuranic (RH-TRU) waste canister transfer bell); and
- confinement (storage vaults, process cell, carbon reduction reformer cell, packaging station cell, RH-TRU canister, and denitration and mineralization reformer and carbon reduction reformer in-cell carbon addition lines).

To provide additional worker protection, all components providing primary confinement of the waste during operations with the exception of the RH-TRU canister are credited as defense-in-depth. The building ventilation system is also credited as defense-in-depth, and a Technical Safety Requirement level control will require cessation of steam reforming operations if the system becomes inoperable.

A one-tenth scale pilot plant was constructed at Hazen Research, Inc. to demonstrate integrated operation of the IWTU process, confirm process chemistry and mass and energy balance calculations, and demonstrate acceptability of the waste product and off-gas emissions. The first stage of testing produced a carbonate waste form. Valuable lessons learned were derived from this effort including, among others, the acceptability of sintered metal in the high temperature process gas filter and the control set to prevent and mitigate a charcoal adsorber bed fire. Testing for the mineralized waste form was completed at the end of 2006.

The project is now moving forward into final design and is preparing for long-lead procurement of major process equipment.