DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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February 10, 2009

Dr. Inés R. Triay
Acting Assistant Secretary for Environmental Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Dr. Triay:

The Defense Nuclear Facilities Safety Board (Board) has closely followed final design activities and safety basis development for the Salt Waste Processing Facility (SWPF) at the Savannah River Site. The Board notes the Department of Energy's (DOE) approval of the Critical Decision 3 (Approve Start of Construction) milestone for the project. As discussed in the enclosed project summary, the overall safety strategy for SWPF appears sound and the Board has identified no significant safety issues that would preclude construction. There remain a number of outstanding actions dealing with safety-related systems that the Board believes must be addressed before completion of construction and operation of the facility:

- In a letter dated January 10, 2007, the Board noted technical weaknesses in the geotechnical design requirements and structural engineering for the Central Process Area building. Subsequent actions by DOE and its contractor resolved the technical issues. The Board has reviewed the structural design for the Central Process Area building below the 116-foot level and determined the design to be satisfactory. The Board received the design for the remainder of the building recently and has commenced its review. DOE's contractor has not yet completed a Summary Structural Report.

- The design of safety-related systems used to limit and remove flammable gas may need to be modified based on the outcome of (1) experiments to quantify the thermolytic component of hydrogen generation, and (2) evaluation of the effect of heat input provided by air pulse agitators on the generation of flammable gas in the process vessels. These considerations may require the implementation of safety-significant interlocks for operation of the air pulse agitators and adjustment of air flow rates and sizing for both the air dilution system and process vessel ventilation system.

- The design of the confinement ventilation systems does not implement all features specified in DOE Standard 1066-99, *Fire Protection Design Criteria*, for protection

of final high-efficiency particulate air filters. Either the design needs to incorporate these features, or equivalency of the design to the standard's requirements needs to be demonstrated.

- The analysis of piping structural capacity following potential explosions (deflagrations or detonations) due to hydrogen accumulation does not include several key considerations, including deflagration-to-detonation transitions and reflections due to piping configuration or obstructions. Additionally, the analysis does not provide sufficient technical basis for allowing plastic deformation of the piping in the event of an explosion. Considering the lack of experimental data regarding the behavior of piping when subjected to stresses above its yield stress due to an explosion, the analysis should ensure that pipe stresses resulting from an explosion are limited to the elastic regime to ensure that the integrity of the confinement barrier provided by the piping is maintained.

- The design needs to ensure that all operator actions necessary following a seismic event can be readily accomplished. Such actions include turning off equipment that provides substantial heat input to process vessels, ventilating and sparging process vessels, and monitoring the performance of the air dilution system. Additionally, the need for operator action to cool process vessels following a seismic event must be evaluated.

- The safety-significant control of ignition sources in the process cells needs to be specified in greater detail in safety basis and design documents.

- The potential for equipment interactions as a result of a seismic event that could affect safety-related structures, systems, and components requires evaluation.

The Board will continue to follow these issues until they are satisfactorily closed. The interaction between the Board's staff and SWPF project personnel has been productive, and we look forward to continuing this dialogue as the project moves forward.

Sincerely,

A. J. Eggenberger
Chairman

Enclosure

c: Mr. Jeffrey M. Allison
Mr. Mark B. Whitaker, Jr.

Enclosure
Salt Waste Processing Facility: Summary of Safety Strategy

The Salt Waste Processing Facility (SWPF) will separate actinides, strontium, and cesium from salt waste that is currently stored in high-level waste tanks at the Savannah River Site. Actinides and strontium will be removed through a sorption process using monosodium titanate; cesium will be removed using caustic-side solvent extraction, which employs an organic extraction solvent. The Central Process Area building and the adjoining Alpha Finishing Facility contain waste storage and process equipment associated with SWPF. The Central Process Area building houses cells containing process vessels used to (1) accomplish the sorption process; and (2) contain the actinides, strontium, and cesium removed by the sorption and caustic-side solvent extraction processes. The Central Process Area building also houses the caustic-side solvent extraction and analytical laboratory equipment. The Alpha Finishing Facility houses equipment that provides the capability for additional sorption if necessary and stores the clarified salt solution prior to transfer to the Saltstone Production Facility.

Significant hazards include deflagrations in process equipment, release of radioactive liquid as an aerosol, and release of radioactive material caused by a seismic event and ensuing fire. Engineered and administrative controls will prevent and mitigate worker consequences from these and other events identified in safety basis documents, relying on a safety strategy that confines highly radioactive materials within the Central Process Area process cells, prevents combustion of flammable gas in the process vessels, and precludes release of radioactive liquid as an aerosol. Structures, systems, and components credited as safety-significant controls for SWPF include the following:

- Vessels, cells, filters, sumps, piping, and gloveboxes to confine radioactive material.
- Ventilation systems and associated interlocks to confine airborne radioactivity, mitigate the consequences of leaks and spills, and limit the amount of flammable gas in process vessels during operation.
- A high-turbidity interlock to prevent transfer of actinides and strontium from the process cell vessels to the caustic-side solvent extraction equipment.
- A high-gamma radiation interlock to prevent transfer of cesium from the caustic-side solvent extraction equipment to the Alpha Finishing Facility.
- A high-gamma radiation alarm to alert operators so they can prevent exceedance of the limit for concentration of radioactive material in the Strip Effluent Hold Tank.
- A system to provide air flow through process vessels to remove flammable gas during normal operations and following accidents.
- Interlocks that turn off recirculation pumps in the event of a high temperature in process vessels.

- Controls to prevent ignition of flammable gas.

- Design features of the air pulse agitation system, including orifices that limit the flow rate of air through the air pulse agitators.

- Leak detection systems that alert operators to spills.

- The Central Process Area building structure to provide structural support for safety-related systems during natural phenomena events, and to limit the spread of fires.

- System design features that allow operator action to remove flammable gas from process vessels following a seismic event.

Defense-in-depth features include safety management programs and noncredited process system instrumentation and interlocks.

Construction of the Central Process Area building has been initiated. Equipment procurement is ongoing.