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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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August 9, 2007

The Honorable Thomas P. D'Agostino
Administrator
National Nuclear Security Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0701

Dear Mr. D'Agostino:

The Defense Nuclear Facilities Safety Board (Board) has closely followed the conceptual design activities and associated safety basis development for the Uranium Processing Facility (UPF) at the Y-12 National Security Complex (Y-12). The UPF project is awaiting formal approval of the Critical Decision-1 (CD-1) milestone, which establishes the preliminary project baseline range. The overall safety strategy for the facility, which is discussed in the enclosed project summary, appears to be reasonably conservative at CD-1. As the project progresses, the Board is tracking a number of open items that must be addressed early in the preliminary design stage to minimize project risk. The UPF project personnel provided a status of the open items to the Board during a briefing held on July 31, 2007. The UPF project personnel have developed a path forward for the resolution of these items and expect them to be resolved in the next six to nine months. These items are listed below for your information:

- In developing off-site dose consequences, the Preliminary Hazards Analysis is using an airborne release fraction and respirable fraction for bulk uranium metal that are not the conservative bounding values provided in Department of Energy (DOE) Handbook 3010, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*. This deviation from Handbook values should be technically justified. The project has provided the Board with a technical justification which is currently under review.
- The plume dispersion analysis is based on a methodology that uses a building wake model and a computer program that is not a toolbox code in the DOE Software Assurance Center Registry. The analytical results may not have sufficient conservatism in estimating the dose consequences.
- The chemical hazards for the project have not been adequately analyzed in the hazards analysis to identify whether additional safety controls are needed for UPF or its associated bulk storage facility.
- American Nuclear Society 2.26, *Categorization of Nuclear Facility Structures, Systems and Components for Seismic Design*, and American Society of Civil Engineers 43-05, *Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities*,

are used in the facility design basis even though they are not yet approved for use by DOE. This use requires the development of supplementary guidance to be compatible with existing DOE orders and standards. The implementation of limit state performance criteria for nonstructural systems is an area of particular concern.

- The foundation design has not been formally documented. Presuming the foundation approach will be similar to that used for the Highly Enriched Uranium Materials Facility, the geotechnical design has not identified the dynamic properties of the backfill needed to complete the seismic structural analysis.
- The federal staffing for this project may not be sufficient to provide appropriate technical oversight of a project of this size. DOE is developing an oversight plan to detail the functional area oversight needs for the project.

The Board recognizes that DOE has captured some of these issues as conditions of approval in its conditional acceptance of the Preliminary Hazard Analysis and safety design strategy. The remainder have been discussed with project personnel.

The Board commends the safety basis reviewers from the Y-12 Site Office for conducting a systematic analysis of safety functions and controls developed from the contractor hazard analysis. This effort was fundamental in providing the needed level of confidence that the identified safety controls were sufficiently conservative for CD-1. This systematic analysis should have been conducted by the contractor and documented in the Preliminary Hazard Analysis.

The Board also commends DOE for its efforts to retroactively implement the revised requirements of DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and the expectations of draft DOE Standard 1189, *Integration of Safety into the Design Process*, into the conceptual design and safety basis development for UPF.

Interaction between the Board's staff and UPF project personnel has been productive thus far, and the Board looks forward to continuing this dialogue in the future.

Sincerely,



A. J. Eggenberger
Chairman

c: The Honorable William C. Ostendorff
Mr. Mark B. Whitaker, Jr.
Mr. Theodore D. Sherry

Enclosure

ENCLOSURE

URANIUM PROCESSING FACILITY PROJECT SUMMARY

The Uranium Processing Facility (UPF) is planned to modernize enriched uranium processing capability at the Y-12 National Security Complex (Y-12). This new facility will replace several deteriorating facilities, including the 9212 Complex, and will provide a significant enhancement in the safety of Y-12 operations.

The safety design strategy for UPF during normal operations and in accident conditions begins with the minimization or, where possible, elimination of nuclear and hazardous materials. This is followed by the use of passive controls to segregate nuclear materials to reduce accident consequences and preclude a nuclear criticality. Next, active systems are used to provide fire suppression, process safety controls, and primary and secondary confinement of materials. The incorporation of new technologies and lessons learned from current processing operations are expected to minimize the use of personal protective equipment and administrative controls required for many operations in the existing facilities.

To minimize hazardous materials, the UPF project plans to incorporate several new technologies, some of which will also improve the inherent safety of operations compared with the current processes in existing Y-12 facilities. UPF will utilize a new metal production process that eliminates the need to use and store large quantities of hydrogen fluoride. The pulsed columns currently used for primary extraction will be replaced with centrifugal contactors, which will reduce the inventory of combustible solvents. Microwave casting technology will replace the current casting process, which will reduce oxide generation and improve criticality safety by not using water for cooling.

UPF was determined to be a Hazard Category 2 facility based on the quantity of nuclear material. The project conducted a hazard analysis that was used to develop the safety functions that the safety controls needed to provide. Safety controls were then initially identified based on historical knowledge of existing safety controls at current Y-12 facilities. DOE later performed a systematic analysis of safety functions and controls, which identified additional safety controls. The control set includes a safety-class fire barrier to segment the source term in the facility. The controls credited as safety-significant include the following:

- Facility structure
- Primary and secondary active confinement systems
- Fire suppression system, including alarms, sprinkler system, plenum deluge system, fire barriers, and the fire water supply
- Glovebox inerting system, including oxygen monitoring and the ability to respond remotely to a loss of inert atmosphere
- Criticality accident alarm system
- Backup power for active safety systems
- Material containers for in-process storage
- Pressure relief for process equipment where needed
- High-temperature interlocks on process equipment where needed
- Flame management systems for process equipment where needed

- Phase separators for process equipment with the potential for organic–nitric acid reactions
- Vents for process equipment with the potential for organic–nitric acid reactions
- Seismic isolation of flammable gas lines into the facility
- Shielding for radiography equipment

All credited safety-class and safety-significant controls have been preliminarily identified as being Performance Category 3 for natural phenomena hazards. The project has identified appropriate design criteria for the safety systems, structures, and components, including consensus standards to be used for their design.

The project risk management plan encompasses standard risks expected on major design and construction projects. As the project incorporated the expectations of the draft DOE standard on integrating safety into design, the assumptions made in developing the safety basis have been captured as specific risks. The risks associated with issues identified by the Board are also captured. In its safety evaluation report, DOE questioned the adequacy of project contingency funds assigned to the risks associated with the confinement ventilation approach and bulk chemical storage.

The project acquisition strategy calls for issuing three architect-engineer design contracts—for mechanical process systems, chemical process systems, and the facility. The current site contractor, BWXT, will handle project integration, requirements management, design configuration management, and safety basis development. To provide real-time integration of the design efforts, BWXT plans to collocate design personnel in one facility in the Oak Ridge area. Subsequent independent contracts for construction will be issued following the completion of the final design stage.

DOE currently has a Federal Project Director, who is assisted by a team of part-time personnel. This level of staffing may not be sufficient to provide appropriate technical oversight of a project of this size. Of particular concern is the ability to adequately oversee and review the process design and safety basis development, which has been covered by two part-time individuals. DOE has developed plans to add three dedicated personnel to the project team by the start of fiscal year 2008 to increase the oversight of the project. The project is in the process of developing a detailed staffing plan.

The Project Execution Plan comprehensively identifies the types of reviews that are expected to be conducted during the life of the project. However, little detail is given for the design reviews that evaluate whether safety is being integrated as early as possible throughout each phase of the project life. The development of additional detail on the number, scope, and scheduling of these reviews is expected in the first year of preliminary design.

The project has developed planning for the startup, transition to operations, and commissioning of UPF. It should be noted that DOE's Technical Independent Project Review Team identified that the cost and schedule for these activities appear to be low based on recent experience with other DOE projects and commercial experience.