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# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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August 18, 2000

The Honorable Carolyn L. Huntoon  
Assistant Secretary for  
Environmental Management  
Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-0113

Dear Dr. Huntoon:

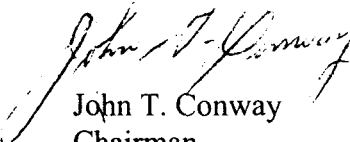
The staff of the Defense Nuclear Facilities Safety Board (Board) recently reviewed the americium/curium (Am/Cm) solution stabilization project at the Savannah River Site. The Board initially identified the need for expeditious stabilization of the Am/Cm solution in Recommendation 94-1, *Improved Schedule for Remediation*, and reiterated the urgency of the task in Recommendation 2001, *Prioritization for Stabilizing Nuclear Materials*. The Board is pleased that many of the technical challenges responsible for slowing this project have been resolved and that steady progress now is being made. However, several safety-related issues identified during the staff's review merit attention.

The Board calls to your attention, especially, the contractor's practice relative to the selection and classification of systems relied upon to perform safety-related functions for the Am/Cm project. The Board's staff observed that the reliability and performance of some of these systems is not commensurate with the consequences of failing to perform their safety functions. This is particularly the case for existing F-Canyon systems and systems that protect assumptions made in the safety analysis. Additionally, it does not appear that the Am/Cm project is applying applicable industry standards in the design of safety-related instrumentation and control systems.

The Board's reviews of the authorization bases for the H-Canyon, the Replacement High-Level Waste Evaporator, and the mobilization of waste from Tank 8 at the F-Area Tank Farms—documented in letters to the Department of Energy (DOE) dated March 11, 1998, November 22, 1999, and June 29, 2000, respectively—revealed similar issues associated with the identification and implementation of safety controls. The Board encourages DOE to apply the lessons learned from these prior reviews to the Am/Cm project.

The enclosed report summarizes the observations of the Board's staff on these issues. The Board requests to be briefed and informed by DOE regarding how these issues will be resolved for the Am/Cm project, and how lessons learned regarding the identification and implementation of safety-related systems and controls will be institutionalized.

Sincerely,



John T. Conway  
Chairman

c: Mr. Mark B. Whitaker, Jr.  
Mr. Greg Rudy

Enclosure

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Issue Report

July 25, 2000

**MEMORANDUM FOR:** J. K. Fortenberry, Technical Director

**COPIES:** Board Members

**FROM:** D. Ralston

**SUBJECT:** Americium/Curium Solution Stabilization at the Savannah River Site

This report documents issues reviewed by the staff of the Defense Nuclear Facilities Safety Board (Board) regarding the stabilization of americium/curium (Am/Cm) solution at the Savannah River Site (SRS). Members of the Board's staff R. T. Davis, D. Ogg, D. Ralston, and R. Robinson performed this review during a visit to SRS on June 27-29, 2000.

**Background.** Tank 17.1 in the north end of F-Canyon contains approximately 14,000 liters of solution bearing several isotopes of americium and curium. In Recommendation 94-1, *Improved Schedule for Remediation*, the Board expressed concern about the continued storage of this material as a solution and requested the Department of Energy (DOE) to expedite its stabilization. The Board reaffirmed the importance of quickly stabilizing this material in Recommendation 2000-1, *Prioritization for Stabilizing Nuclear Materials*. Am/Cm solution stabilization has been delayed significantly beyond original expectations primarily because of unexpected research and development issues identified for this first-of-its-kind project. The SRS contractor, Westinghouse Savannah River Company (WSRC), has now completed conceptual design of a vitrification system, and detailed design and technology implementation are proceeding.

**Project Status.** The WSRC plan for stabilization of this material includes pretreatment in the F-Canyon and vitrification in the Multi-Purpose Processing Facility (MPPF), an F-Canyon hot cell area. WSRC has completed the detailed design for pretreatment, and DOE recently approved a critical decision to begin construction activities. Preparation of the MPPF to receive the vitrification system (e.g., rack removal and service connections) is nearing completion. WSRC recently awarded a contract to Teledyne-Brown Engineering (TBE) for detailed design, fabrication, and pre-installation testing of the in-cell vitrification system. The current schedule shows pretreatment operations beginning in 2004 and vitrification being completed in summer 2005. Delivery of the vitrification system by TBE is currently on the project critical path.

**Hazard Analyses and Development of Controls.** WSRC has completed preliminary hazard analysis and interim functional classification documents for both pretreatment and vitrification. WSRC is using functional classification as a design input for the development of new safety systems, as well as for verification of the adequacy of existing systems identified in the analyses. Controls will be incorporated into the existing F-Canyon Basis for Interim

Operation and Technical Safety Requirements. The staff identified the following issues associated with this process and its implementation for the Am/Cm project:

- *Safety System Implementation*—Some safety functions rely on existing F-Canyon systems (e.g., sump alarms and level instruments) that are not currently credited to perform a safety function in the existing canyon authorization basis. Although the Process Vessel Vent (PVV) system is currently credited as a safety-significant system for F-Canyon, it will be required to perform a safety-class function during pretreatment. In addition, failure of certain canyon support systems (e.g., instrument and process air) could prevent a safety system from performing its safety function. As stated in Recommendation 2000-2, *Configuration Management, Vital Safety Systems*, the Board believes DOE should take appropriate measures to ensure reliable performance of safety systems. WSRC has identified limited tests that will help verify the adequacy of existing systems, including differential pressure tests to verify ventilation flow in the PVV system. However, given the significant hazard posed by the Am/Cm material, the staff believes it would be prudent for WSRC to formally review the adequacy of these systems to perform the proposed safety functions. Compensatory measures may be appropriate where failure of a noncredited system could impact a safety system.
- *Initial Conditions*—WSRC does not intend to designate as safety-related the systems that verify or protect the initial conditions assumed in the safety basis. A similar issue was identified in a letter from the Board dated November 22, 1999, regarding the Replacement High-Level Waste Evaporator at SRS. Failure of these systems to adequately monitor the associated parameters could preclude safety-class systems from providing the necessary mitigation in accident scenarios. The staff believes the functional classification, surveillance, and maintenance of systems that protect safety basis assumptions should be based on the safety impact of failure to maintain these initial conditions.
- *Safety System Instrumentation*—For this project, safety-significant alarms and interlocks will confirm that important process control parameters are maintained within identified safe operating ranges. Design and implementation of these systems requires engineering judgment and appropriate application of commercial nuclear and industrial design standards. WSRC recently issued an implementation guide for Instrument Society of America (ISA) standard S84.01, *Application of Safety Instrumented Systems for the Process Industries*, and established a site-wide implementation team. However, this standard has not been identified as a design requirement for the Am/Cm project. For the vitrification system, WSRC currently plans to use an off-the-shelf programmable logic controller for both safety system interlocks and basic process control; doing so would be contrary to the ISA standard. The staff believes it would be prudent to make appropriate use of the ISA standard in the design and implementation of safety-significant alarms and interlocks.

- *Independent Design Review*—WSRC performed an independent design review to verify the adequacy of the pretreatment design. Following this review, a WSRC management review of design drawings identified several deficiencies in the design of safety systems, indicating that the independent review may not have been appropriately focused. WSRC is developing lessons learned to ensure that subsequent independent reviews are more effective. The staff urged WSRC to consider whether additional review of the pretreatment design is appropriate, and to apply these lessons learned to the vitrification design review as well as other site projects.
- *DOE Review*—As part of the Project Management Improvement initiative at SRS, WSRC identified the early development and approval of the safety basis approach as a key to success for new projects. This is typically accomplished in the Preliminary Safety Analysis Report (PSAR), which must be approved by DOE. A PSAR is not being developed for the Am/Cm project, and DOE approval of safety documents will not occur until relatively late in the project (i.e., 2003). To date, there appears to have been little DOE review of the safety basis approach for this project. The staff believes it would be appropriate for DOE to review and comment on these safety documents sooner, to limit the potential for last-minute design changes and ensure that adequate time is available to develop engineered solutions for issues identified during the review process.