

## DEFENSE NUCLEAR FACILITIES SAFETY BOARD

December 7, 1994

**MEMORANDUM FOR:** G. W. Cunningham, Technical Director

**COPIES:** Board Members

**FROM:** A. De La Paz

**SUBJECT:** Report on Review of F-Canyon and FB-Line Safety Envelopes and Planning for Disposition of Americium/Curium Solution in F-Canyon - Savannah River Site

- 1. Purpose:** This report documents a follow-up review of the safety envelope at the F-Canyon and FB-Line facilities at the Savannah River Site (SRS) by Defense Nuclear Facilities Safety Board (DNFSB) technical staff (D. Lowe and A. De La Paz). The review also included discussion of the preparations for disposition of the americium/curium (Am/Cm) solution that is currently stored in F-Canyon. This review was conducted on December 1-2, 1994.
- 2. Summary:** Westinghouse Savannah River Company (WSRC) personnel have addressed most of the concerns expressed by the DNFSB staff regarding the safety envelopes of the F-Canyon and FB-Line facilities. The DNFSB staff will continue to follow the remaining concerns until they are addressed.

WSRC is proposing that the Am/Cm solution in Tank 17.1 be stabilized by vitrification. WSRC personnel have performed a scoping analysis of several other options, including converting the solution to oxide. The final disposition option will be chosen by the Interim Management of Nuclear Materials Environmental Impact Statement Record of Decision. Current WSRC planning shows Am/Cm vitrification finishing in 1999, about two years later than recommended by the DNFSB in Recommendation 94-1. The DNFSB staff will continue to review the approaches being developed by Department of Energy (DOE) and WSRC for the disposition of the Am/Cm solution.

- 3. Background:** The review documented in this report is a follow-up to a F-Canyon review conducted on July 26-27, 1994 and a FB-Line review conducted on September 19-21, 1994. The issues from the July review were forwarded to DOE in a Board letter dated September 21, 1994. The issues from the September review were forwarded to DOE in a Board letter dated November 22, 1994.

#### 4. Discussion/Observations:

- a. F-Canyon: The following issues were raised in the July review and the current status is as follows:

1. Potential Hydrogen Deflagration: The DNFSB staff was informed by WSRC personnel that differential pressure instruments have been installed to verify that adequate air flow is present to prevent the accumulation of flammable concentrations of hydrogen in process vessels. The F-Canyon safety-related systems procedure requires a 0.01-inch (water gauge) pressure differential between the canyon and each process vessel.

In the event that the process vessel vent system is lost in Tank 17.1 (tank with the shortest time to the lower flammability limit), WSRC has written a procedure to blow process air into Tank 17.1. For the other process vessels, WSRC has modified the loss of process vessel vent fan procedure to ensure that vessel bubbler air flow is sufficient to dilute hydrogen generated by radiolysis. The DNFSB staff will review these procedures.

2. Cooling Water Monitor System: WSRC personnel stated that the current date for installation of an automatic diversion system for the Cooling Water System is April 1995. This modification includes the installation of a control system to automatically operate the cooling water diversion valves if a timer is not reset within a specified time. WSRC personnel also discussed plans to upgrade detector electronics equipment in March 1995. As planned, both of these actions are prior to the restart of F-Canyon.
3. Uncontrolled Organic-Nitric Acid Reactions: In order to prevent process vessel overpressurization as a result of organic-nitrate uncontrolled reactions, WSRC defined the required vent areas for the various process vessels and modified operating procedures to ensure that specific process vessel nozzles be designated to remain open.

WSRC personnel stated that they plan to submit changes to the F-Canyon Basis for Interim Operation (BIO) document later this month to add safety-related systems for operation of the continuous evaporator in an acidic mode. The changes include the deletion of the Operational Safety Requirement to maintain the organic concentration below 0.5 v/o in the evaporator feed, and the addition of several interlocks to monitor evaporator temperature, the evaporator aqueous layer level, and a liquid level

interlock on the Solvent Hold Tank. In addition, Evaporator Feed Tank agitator indication will be monitored to detect large amounts of organic from solvent extraction. The DNFSB staff will review these changes when the BIO is submitted for DOE approval.

- b. FB-Line: The following issues were raised in the September review and the current status is as follows:
1. Propagated Fire: WSRC has accelerated efforts to tie in the third and fourth level ventilation exhaust systems to the sand filter. This effort is currently planned to be completed in May 1995, prior to facility restart. Once complete, this tie in will significantly reduce the potential consequences from a propagated fire that consumes the third and fourth level HEPA filters.
  2. Ion Exchange Column Uncontrolled Reactions: WSRC personnel and the DNFSB staff have not yet agreed upon the technical basis for the anion and cation exchange column vent sizes. The DNFSB staff will continue to monitor WSRC's resolution of this issue.
  3. Hydrogen Deflagration: WSRC personnel have determined that 30 FB-Line process vessels will require head space purging due to the production of hydrogen from radiolysis. Twenty-one of these vessels will be purged with the vessel vent system and the remaining nine will be purged with the liquid level bubblers. WSRC is still planning on performing a functional test of the purging procedure using the vessel vent system, as well as developing an operating procedure. WSRC personnel stated that the functional test and procedure development are FB-Line restart activities. The DNFSB staff will continue to follow the development of these actions.
- c. Stabilization of Americium/Curium Solution: DOE and WSRC personnel described the actions to date to stabilize the Am/Cm solution currently stored in Tank 17.1 of F-Canyon. WSRC discussed several options that were considered. These include: (1) vitrifying the solutions into a borosilicate glass by installing a small melter in the F-Canyon Multi-Purpose Processing Facility (MPPF); (2) discarding the material to the waste tanks; (3) transferring the solution to a precipitator-settler, collecting the precipitate in filters, and then calcining the precipitate; and (4) in-situ solidification by adding concrete to Tank 17.1. A fifth option is a modification to option (3) in which the precipitation-settling step is accomplished in Tank 17.1.

Options (2) and (4) were not pursued since DOE has determined that there is a programmatic need for this material, primarily for future production of californium-252. WSRC has reviewed option (3) in more detail since this is similar to the process utilized

to separate and package americium-241 oxide in the MPPF. However, WSRC states that the existing equipment in the MPPF has not been maintained, such that estimates of the cost to ready the facility are comparable to process development and procurement for vitrification. WSRC personnel also stated that glass is the preferred form over oxide for several reasons: (1) Oak Ridge National Laboratory prefers glass since they only plan to use small amounts of the Am/Cm at a time; (2) glass is more stable, less dispersible, and non-hygroscopic when compared to oxide; (3) glass may be more easily certified for transportation; (4) if the need for the material ends, the glass is suitable for long-term storage; and (5) the Am/Cm can be readily recovered from the glass product. Current WSRC planning shows that vitrification of the solution can be finished by 1999, but DOE has not made a final decision on the specific disposition option for the Am/Cm solution. This target date is approximately two years later than recommended by the DNFSB in Recommendation 94-1.

The DNFSB staff will continue to follow DOE and WSRC preparations for stabilizing the Am/Cm solutions, especially process development activities for vitrification and the technical basis for the long-term stability of borosilicate glass from alpha radiolysis and helium generation.

5. **Future Staff Actions:** The DNFSB staff will continue to follow the issues as noted above.