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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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November 22, 1994

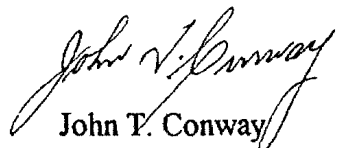
The Honorable Victor H. Reis
Assistant Secretary for Defense Programs
Department of Energy
Washington, D.C. 20585

Dear Dr. Reis:

A Defense Nuclear Facilities Safety Board staff review team visited the Savannah River Site on September 19-21, 1994, and focused on the FB-Line safety envelope. The staff noted that there is high risk associated with a propagated fire because the release path from a potential fire involving the third and fourth levels would not be filtered.

The enclosed report is a synopsis of the observations made during the review and is forwarded for your information.

Sincerely,


John T. Conway
Chairman

c: The Honorable Tara O'Toole, EH-1
Mr. Mark Whitaker, EH-6
Dr. Mario Fiori, Manager, SR Operations Office

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

September 30, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director**COPIES:** Board Members**FROM:** David C. Lowe**SUBJECT:** Savannah River Site (SRS) - FB-Line Safety Envelope Review Trip Report (September 19-21, 1994)

1. **Purpose:** This trip report documents the Defense Nuclear Facilities Safety Board (DNFSB) technical staff (D. Lowe, J. Roarty, A. De La Paz, and D. Moyle) September 19-21, 1994, review of the FB-Line safety envelope.
2. **Summary:** The FB-Line Basis for Interim Operation (BIO) identified a propagated fire as the highest risk accident. In the discussions with Westinghouse Savannah River Company (WSRC), it was concluded that a reasonable uncertainty band attached to the results of the accident analysis (but no uncertainty analysis was conducted) would include a region extending above the WSRC risk acceptance curve. The major contributor to the consequences is that the 3rd and 4th level room exhaust does not go to the sand filter so an unmitigated release can result. The DNFSB staff believes that the high risk associated with this accident suggests that additional preventive and mitigative actions might be considered.
3. **Background:** The FB-Line receives plutonium nitrate solutions from F-Canyon for processing into plutonium metal buttons. FB-Line also recovers plutonium residues and transfers them to F-Canyon for further processing. FB-Line is scheduled to restart in March 1995. This review was based on discussions with Department of Energy - Savannah River Operations Office (DOE-SR) and WSRC personnel.
4. **Discussion:**
 - a. **Authorization Basis:** The BIO has been submitted to DOE-SR for approval. The BIO includes additional accident analyses and updates the authorization basis documents. WSRC is developing a FB-Line safety envelope management database that will link the authorization basis to operating procedures, surveillances, and calibrations. This database is based on the F-Canyon database and will incorporate similar verification and validation procedures. This is a very important tool for managing the safety envelope for a facility, and the DNFSB staff suggests that it would be advisable for WSRC to develop a site-wide safety envelope management procedure that incorporates the lessons-learned from F-Canyon and other appropriate facilities.

- b. Propagated Fire: The FB-Line BIO identified a propagated fire as the highest risk accident. A reasonable estimate of the uncertainty inherent in the accident analysis (but no uncertainty analysis was conducted) would lead to error bands whose upper bounds would lie above the WSRC risk acceptance curve. The major contributor to the consequences is the possibility of fire, inasmuch as the atmospheric exhaust from the 3rd and 4th level rooms does not go to the sand filter, and so an unmitigated release could result. The 3rd and 4th level room exhaust normally goes through two high efficiency particulate airborne (HEPA) filter banks prior to release, but the HEPA filters are assumed to be consumed in a propagated fire. A major assumption in the accident analysis is that the fire will not propagate to the storage vaults.

The high risk associated with this accident suggests that additional preventive and mitigative actions may be appropriate. WSRC stated that there is a planned modification to redirect the 3rd and 4th level room exhaust to the sand filter with a planned completion date of December 1995. The DNFSB staff believes that acceleration of this project should be seriously considered if such is possible without severely delaying the intended use of FB-Line. Additionally, a reduction in the amount of material allowed in the 3rd and 4th levels would reduce the accident consequences. WSRC stated that there is a storage location (i.e., outside and above the vault) that was included in the source term calculations, but there is no need to use this storage location. WSRC indicated that it would be a minor administrative change to the Technical Standards to eliminate this potential source term. The DNFSB staff believes that these and/or other appropriate actions should be considered in order to reduce the risk from a propagated fire.

- c. Ion Exchange Column Uncontrolled Reactions: The BIO identifies the potential for ion exchange highly energetic uncontrolled reactions and identifies measures to prevent these accidents. One preventive measure identified in the BIO, but not identified as a safety-related component, is the column vent. Additionally, WSRC stated that they were not aware of the technical basis for the vent size, but they would follow up on this issue.
- d. Hydrogen Deflagration: The potential for hydrogen production by radiolysis and buildup in process vessels has been identified, but it was not considered in the Safety Analysis Report. Thus, an unreviewed safety question evaluation (USQE) is underway for this event. The potential exists for buildup to flammable concentrations within a few days since these vessels are not continuously ventilated. WSRC is proposing the manual purging of 21 process vessels by opening a fill line which will purge any flammable gases via the vessel vent system. This will require manually purging each of the 21 process vessels approximately every 8 hours for several minutes. The operating procedures are being developed, and the vessel vent purge system has been designated a safety-related system. A functional test of the purging procedure and a determination of adequacy will be conducted prior to startup. The major hazard from a hydrogen deflagration is the potential

for changing the geometry of a geometrically-favorable process vessel and the resultant risk of a criticality. WSRC stated that about 75% of the criticality risk is associated with hydrogen deflagration.

- e. Criticality Safety: WSRC has implemented a program to reduce the risk of an inadvertent criticality by assigning a Criticality Safety Specialist to each shift. The Criticality Safety Specialist is a senior operator with additional training on criticality safety. The Criticality Safety Specialist conducts a facility walkdown each shift looking for criticality safety infractions, such as incorrectly sized containers in a glovebox, and documents these walkdowns by completing a procedure checklist. WSRC management stated that they normally observe significant operations, but that depends on the individuals initiative and knowledge of ongoing operations.

This situation is comparable to the standard nuclear industry practice of incorporating quality assurance and radiological protection hold points in procedures which require these oversight functions to observe critical procedural steps to ensure compliance. Considering the consequences of a criticality accident and that credit is taken in the accident analysis for the Criticality Safety Specialist as a preventive measure, the DNFSB staff suggests that additional procedural implementation of this program be considered to ensure that the safety envelope is maintained. For example, inserting hold points at critical steps (e.g., line breaks, material transfers) in an operational or maintenance procedure would ensure that the Criticality Safety Specialist observes the activity.

- f. Dissolving Operations: The current startup plan does not include dissolving operations, but they are included in the BIO. The Technical Standards that are applicable to dissolving operations do not comply with ANSI/NFPA 69 (American National Standard Institute/National Fire Protection Association), *Explosion Prevention Systems*. The DNFSB staff believes that the Technical Standards should be revised prior to startup of dissolving operations.
5. **Future Actions**: The staff will perform follow-up reviews when DOE/WSRC actions are complete which is expected in early 1995.