DEFENSE NUCLEAR FACILITIES SAFETY BOARD

December 15, 1993

MEMORANDUM FOR: G.W. Cunningham, Technical Director

COPIES: Board Members

FROM: David C. Lowe

SUBJECT: Savannah River Site (SRS) - Separations Chemical Processing Review Trip Report (December 8-9, 1993)

1. Purpose: This trip report documents the Defense Nuclear Facilities Safety Board (DNFSB) technical staff (D. Lowe) December 8-9, 1993 follow-up review of SRS Separations chemical processing activities and plans.

2. Summary: In general, the issues raised in a previous DNFSB trip report are being addressed, but are still in progress, by Department of Energy Savannah River Operations Office (DOE-SR) and Westinghouse Savannah River Company (WSRC). The notable exception is the DNFSB staff position that a comprehensive review of all thirteen DOE Tomsk-7 lessons-learned review team criteria be addressed by either existing upgrade efforts (e.g., conduct of operations and training programs), other engineering programs (e.g., process hazard review effort), or supplemental reviews. Several criteria are being addressed, but an evaluation to ensure that all criteria have been reviewed has not been conducted.

3. Background: F-Canyon and FB-Line are currently scheduled to resume operations in February 1994 and March 1994, respectively. This trip report documents the status of issues raised in DNFSB trip report dated October 1, 1993 which was forwarded to DOE on October 27, 1993.

4. Discussion:

   a. Tomsk-7 Lessons-Learned: The following is an update of actions resulting from the Tomsk-7 lessons-learned review.

      (1) The draft process hazard review (PHR) using a hazard and operability (HAZOP) technique was reviewed. This effort should address many of the concerns and vulnerabilities of a Tomsk-7 organic-nitrate event. Several action items and recommendations have been identified. The action items are supposed to be implemented, where appropriate, prior to restart.

      (2) A consequence analysis of a Tomsk-7 organic-nitrate event is being conducted.

(3) An unreviewed safety question determination (USQD) will be conducted after the PHR and consequence analysis are complete.

(4) The DNFSB staff consider revisions planned to the Technical Standards to prevent a Tomsk-7 organic-nitrate reaction to be appropriate. This is similar to the approach used to protect from the classical red-oil organic-nitrate reaction. WSRC stated that the need for any Technical Standard changes will be addressed through the USQD process.

A comprehensive review of the DOE Tomsk-7 lessons-learned review team criteria (see Attachment 1) has not been demonstrated. The PHR, accident analysis, and USQD will address several of the criteria. Other criteria can be addressed by programs that are already being implemented, e.g., conduct of operations, training, and procedure upgrades. As noted in the DNFSB staff trip report dated October 1, 1993, forwarded by a Board letter on October 27, 1993, the DNFSB staff considered that DOE and WSRC reviews would consider all the criteria and that they would be comprehensively evaluated and documented prior to start-up. The DNFSB staff considers this a prerequisite to facility re-start.

WSRC stated that their response to the DOE lessons-learned review team final report will include a comprehensive review of areas of concern, not a punchlist approach to the DOE concerns. DOE-SR is conducting an oversight assessment of WSRC activities in response to the Tomsk-7 accident. Additionally, the DNFSB staff expects the DOE and WSRC operational readiness reviews (ORRS) will use the DOE criteria as a basis for their independent assessments.

b. Flammable Gas Control: WSRC Separations Engineering is reviewing the technical basis for flammable gas control in all Separations process vessels and unit operations. This is a direct result of lessons-learned from the HB-Line restart effort. The current status is:

(1) WSRC has completed calculations for FB-Line to determine the minimum purge gas flow, time to purge, and emergency purge time requirements. The operational parameters will be based on these calculations and included as part of Procedure 2.01, FB Line Configuration Control and Safety-Related Systems, and referenced in a revised Technical Standard and Basis for Interim Operation (BIO) document.

(2) WSRC is conducting a similar program for F-Canyon and H-Canyon. Instead of calculating the hydrogen generation rate for all tanks, the worst case generator, Tank 17.1 (F-Canyon tank containing americium and curium), will be used as the basis for determining purge gas and time to purge requirements. The operational parameters will documented in a manner similar to FB-Line.

(3) The operational limits established as a result of this program will be reviewed and revised as necessary to ensure that sufficient margins are in place to compensate for the uncertainties in the calculations. WSRC stated that they would include adequate margins to compensate for uncertainties.

A concern for some FB-Line geometrically safe tanks is that a deflagration resulting from the buildup of hydrogen may change the tank geometry and result in the potential for a criticality. A safety analysis and USQD are being conducted to review this concern. WSRC stated that additional safety systems may be designated as a result of these efforts.

c. Tank 17.1 Corrosion Issue: DNFSB staff concerns about the lack of a tank sampling program and in-service inspection program were discussed with DOE/WSRC. They stated that they have the same concerns and plan to address these concerns in future action plans. Other actions include:

(1) A revised corrosion study is being prepared by Savannah River Technology Center (SRTC) to include the expected corrosion in Tank 17.1 based on:
- American Society of Mechanical Engineers (ASME) Boiler Construction Code, Section VIII (1949) design tolerances.
- Minimum wall thickness determined in 1971 of 0.45 inches.
- Assumed uniform corrosion since 1980 determined from change in iron inventory.

(2) WSRC stated that the solids formed in the sample after the sample was taken from the tank, but they are not sure if the solids formed in the sample before or after the analyses were done. This indicates that there is no sludge in the tank.

(3) A possible action was presented to determine the general corrosion of tanks in a strong acid environment by conducting ultrasonic testing (UT) of cold chemical tanks containing concentrated nitric acid.

(4) Preparing plans to UT two vertical sections of tank 17. 1. These two sections can be tested without removal of jumpers or other equipment.

d. H-Canyon Evaporator 16.1 Coil Leak: Separations Engineering stated that they are addressing the cooling coil leak in tank 16. 1. They plan on using tank 13.3 as the evaporator and will hydrostatically test the cooling coils prior to putting into service.Tank 16.1 will be used as a storage vessel and the cooling coils will be blanked off.These process vessels are of similar design and construction, only their function is different. An action plan has been developed and has been requested. DNFSB staff follow-up is required to ensure that the tank is qualified using the appropriate standards.

5. Future Actions: The staff will perform follow-up reviews until DOE/WSRC actions are complete.

DOE Lessons-Learned Review Team
Generic Questions/Criteria

1. Has a safety envelope been established for "red oil" incidents and is it reflected in the Safety Analysis Report (SAR) and controlling Operational Safety Requirements (OSRs)?

2. Is the presence of organics and their accumulation adequately accounted for?

3. Is the potential for degradation of these organics characterized and accounted for in operations?

4. Are acid concentration, nitrate concentration, temperature, and pressure controls used to prevent "red oil" type accidents?

5. Is the adequacy of instrumentation to monitor and anticipate the initiation of a "red oil" excursion assured?

6. What vessel venting/purging of vessel freeboard is performed? Basis for adequacy?

7. How is mixing assured? What is the basis for assuring mixing adequacy and for verifying that it is appropriately implemented?

8. Are representative and timely samples taken for organic content?

9. Do special procedures exist for the processing of nitrate solution containing small amounts of organics?

10. Are critical process steps related to "red oil" concerns independently verified and/or are electro/mechanical interlocks activated? Have these precautionary measures proved adequate?

11. Are off-normal procedures (alarm response) in existence relating to a "red oil" driven process excursion? Are the operators appropriately trained?

12. Do appropriate emergency response procedures exist for a "red oil" type of event?

13. Is there a vulnerability to inadvertent transfers of concentrated nitric acid and, if so, what precautions are taken to avoid them?

Attachment 1