95-0003441

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004
(202) 208-6400

July 11, 1995

The Honorable Thomas P. Grumbly
Assistant Secretary for Environmental Management
Department of Energy
Washington, D. C. 20585

Dear Mr. Grumbly:

A Defense Nuclear Facilities Safety Board staff review team visited the Savannah River Site on March 20, 1995, through March 24, 1995. This review addressed the conduct of operations and engineering at the Defense Waste Processing Facility and the In-Tank Precipitation Facility. This review was prompted by recent occurrences at both facilities which were caused by inadequate technical review by engineers. It appears that the engineering review of design changes is superficial and does not reveal fundamental design deficiencies. The enclosed report provides a summary of observations made during the review and is forwarded for your consideration.

Sincerely,

John T. Conway
Chairman

c: The Honorable Tara O'Toole, EH-1
Mr. Mark Whitaker, EH-9
Dr. Mario Fiori, Manager, SR Operations Office

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

May 1, 1995

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: J. T. Arcano, Jr.

SUBJECT: Savannah River Site (SRS) - Review of Conduct of Operations and Engineering at the Defense Waste Processing Facility (DWPF) and the In-Tank Precipitation (ITP) Facility

1. **Purpose:** This report documents a review of conduct of operations and engineering at the DWPF and the ITP Facility by a team consisting of technical staff personnel of the Defense Nuclear Facilities Safety Board (Board), (T. Arcano, D. Wille, and T. Davis) and an Outside Expert (R. West) on March 20-24, 1995. Both facilities are operated by the Westinghouse Savannah River Company (WSRC) High Level Waste (HLW) Management Division.

2. **Summary:** Recent occurrences at DWPF and ITP were caused in part by inadequate technical review by engineers and, at DWPF, by improper performance of conduct of operations by supervisors and operators. The engineering review of design changes appears superficial and does not reveal fundamental design deficiencies. WSRC does not appear to be taking action to correct this problem.

   Conduct of operations, by operators and supervisors at DWPF was deficient in the areas of system control, lockout/tagout, procedural compliance and test control. The team also noted problems with procedural compliance and communications during the visit. Actions of facility management to remedy this condition will be reviewed in future staff visits. The Board's staff could not observe glass production because it was suspended due to glass quality problems. Also, the staff could not observe operations at the control room simulator due to problems with the training simulator's computer.

3. **Background:** The ITP facility is used to separate high-level waste supernate into a high-level waste and a low-level waste fraction. The ITP high-level waste fraction and sludge from the Extended Sludge Processing facility are fed to the Defense Waste Processing Facility, where these waste streams join and are processed into glass. The ITP facility is scheduled for a Department of Energy (DOE) Operational Readiness Review (ORR) in mid-May 1995. The DWPF is scheduled for a DOE ORR in mid-November 1995.

4. Discussion:

a. Engineering Technical Review: Recent occurrences revealed problems with the process for engineering and design review of operating procedures, test procedures and facility modifications. Discussions with management personnel revealed a lack of corrective action to minimize the recurrence of similar problems.

1. In-Tank Precipitation Facility: WSRC designed a new downcomer assembly for the process tank that allows chemical additions to be made near the bottom of the tank. This eliminates foaming that occurs when additions are made at the waste surface. To prevent waste from siphoning back to the lower chemical additions area, the downcomer required an anti-siphon device. While attempting to install the downcomer assembly, it was found that the assembly was 16 inches too long for the tank and that the siphon break was located below the maximum height allowed by Operational Safety Requirements. In fact, the incorrectly designed anti-siphon safety feature could have allowed the release of more than 25,000 gallons of high-level waste in the event of a tank siphon.

   The incorrect sizing of the downcomer was caused by one incorrect dimension on a drawing signed by the designer and verified and checked by another designer (both engineers are no longer employed by the design agent and were not available to explain the source of the error). Three subsequent levels of review (design authority approval, Unreviewed Safety Question review, and Facility Operating Safety Committee approval) failed to detect the error or the incorrectly located siphon break feature.

   An Unreviewed Safety Question (USQ) screening determined that a safety evaluation was necessary because the siphon break differed from the safety analysis description. The safety evaluation, approved by the Facility Operations Safety Committee chairman, justified the siphon break design by stating that the Technical Programs Manager agreed that the design would adequately guard against siphoning. Had the safety evaluation included a technical discussion regarding tank levels, this design error might have been discovered.

   The design requirement for the location of the siphon break (i.e., the elevation above waste level) was not defined in the functional requirements document, the design output drawings, or the safety evaluation. Additionally, the documented list of design changes does not reference any calculations for the downcomer design. For example, the adequacy of the siphon break welds to support the lower portion of the downcomer was neither discussed nor demonstrated by calculation. As a result, the

design output information submitted by the design agent was not sufficiently documented to allow adequate technical review and approval of the modification nor was the design basis for the siphon break preserved for future reference.

A modification to shorten the contaminated downcomer and properly locate the siphon break was eventually accomplished with an accumulated worker radiation dose of 60-70 man-millirem. WSRC corrective action consisted of efforts to improve the performance of the subcontracted design agent but did not address improving the WSRC design and engineering review process.

2. Defense Waste Processing Facility:

   (a) Melter Feed Tank Inadvertent Addition: In January 1995, poor control of a startup test resulted in the inadvertent addition of approximately 650 gallons of scrubber solution to the Melter Feed Tank (Occurrence Report SR-WSRC-WVIT-1995-0004). The staff reviewed problems with the sequencing of the test procedure, the extent and locations of cautions pointed out in the test procedure, and the engineering review process. A significant contributor to this occurrence was an improperly sized orifice that resulted in excessive flow to the scrubber. Engineers were aware of the problem but did not inform operators. No one at the briefing of the team could discuss whether actions had been taken to improve the test procedure, to ensure proper engineering review, or to ensure adequate communication between the engineers and operators.

   (b) Precipitant Tank Overflow of Sodium Tetraphenylborate: The precipitant tank, which is currently used to provide radioactive waste simulant to the Salt Process Cell, has design problems. To meet net positive suction head requirements for the discharge pump and to ensure that a sufficient quantity of simulant is available, the level in the tank must be raised above that of the tank's high level alarm. On two recent occasions, HLW engineering issued instructions allowing the tank level to be increased above settings of the high-level alarm, which resulted in a significant overflow of tetraphenylborate (800 gallons and 60 gallons). These overflow events were attributed to an inadequate technical review of the tank caused by a lack of understanding of the tank design. Had this event occurred after radioactive operations had begun, the liquid that overflowed would have been highly radioactive. The DWPF Engineering Manager emphasized to his staff the need to better understand details of the systems, as well as the need to remain skeptical in their review of engineering work.

b. DWPF Conduct of Operations:

1. Recent Occurrences: Recent occurrences (Melter Feed Tank inadvertent addition, activation of the safety circuit during sampling, overflow of the sanitary waste treatment basin) indicate that operational problems exist at DWPF. These occurrences were caused by deficiencies in operator and supervisor attention to duties, procedure compliance, testing control, and preparation and verification of lockout/tagout .

   DWPF management ascribed the major cause of the melter feed tank occurrence to complacency of operators and test personnel after a recent extended outage, as well as management's failure to perceive this degradation. Management has taken the following actions:

   (a) The Facility Manager and Startup Manager reviewed senior operators' and startup supervisors' responsibilities for testing and plant operations.

   (b) Senior test and management personnel are now directly involved in pre-test briefings.

   (c) Senior management night shift coverage is again in place during plant testing.

   (d) The startup manual was revised to clarify responsibilities for ensuring readiness for testing and to strengthen pretest briefing (including a briefing checklist).

   (e) Lockout/tagout writers have been placed under the Operations Manager, who has provided additional written guidance on the proper method of writing lockout/tagouts.

2. Job Performance Evaluations: The staff observed several job performance evaluations. Problems were seen with entry and content of procedure changes, communications, procedural compliance and system lineup. The evaluation technique used did not correct all operator deficiencies and in most cases reenforced incorrect operational performance.

3. Drill Performance: DWPF recently began a program of one or two casualty drills each week. The staff observed one drill that was terminated soon after starting due to degraded equipment that the drill team was unaware of. Staff interviews found that operators were uncertain of actions to take for the problem and that the Alarm Response Procedure provided insufficient guidance.

Based on this limited sampling, it appears that the DWPF drill program is still in its infancy and has significant work remaining to ensure that procedures and operators are ready for radioactive operations.

4. Alarms: Over the past two years, DWPF personnel have reduced the number of alarms by about 60% and simplified the steps in the response to alarms. However, a significant number of alarms remain (over 1000). To further simplify the system, DWPF is reviewing a software package that determines the root cause of multiple alarms based on facility status. Full installation of this package will require a significant amount of additional testing and qualification.

   The facility developed an integrated control room simulator to train operators. Operators will be challenged by a cascade of alarms which will allow the facility to determine if additional changes to the alarm system are necessary.

5. Qualified Watchstanders Notebook: This notebook is an important tool for management to ensure and to demonstrate that operations personnel are appropriately qualified. Apparently, the notebook has not been used correctly. A check of the watchstanders notebook revealed that the list of qualified operators had not been updated since April 14, 1994. Five personnel assigned shift responsibilities were not listed in the notebook as qualified; the requalification dates of three persons were overdue with no evidence they had been requalified. There was no record of proficiency status in the notebook.

c. ITP Conduct of Operations: As a follow-up to issues raised during previous staff reviews, the status of procedures was reviewed. Procedures are scheduled to be completed and reviewed by mid-April 1995. However, no formal process exists for the first-use review of new procedures; the extent of this review is left to the judgement of the Shift Manager. A major factor in determining the need for a review was the competence of the operator performing the first-use. It appears that complexity of procedures and the potential hazard of improper performance would be more valid criteria for determining the extent of review needed.

d. ITP DOE Facility Representative Program: To date, the DOE ITP Facility Representatives have shown themselves to be viable assets in the identification and resolution of operational issues. Of the three facility representatives, one is fully qualified, one only lacks an interview with the field office manager, and the other is in the early stages of qualification. The records of examinations and qualifications of the DOE HLW Facility Representative were reviewed. The written examinations were found to be thorough in coverage and of sufficient difficulty to determine the level of knowledge of candidates. The grading was found to be accurate.

The records of oral examinations were complete and showed that these boards were conducted at the expected breadth and depth. The records were easily auditable and showed the level of knowledge demonstrated. The qualification records also were complete and easily auditable and demonstrated that the Facility Representatives had completed the stated qualification requirements.

e. Savannah River Site Partial Loss of Power: On March 10, 1995, the SRS main electrical distribution system experienced a ground fault for approximately 1.6 seconds before breakers isolated the fault. Site facilities experienced severe voltage dips which caused ventilation and diesel generator systems to switch to backup configurations. The fault occurred when a static line, which is over 40 years old, failed and grounded one of the phase conductors. Failure appears to have been caused by lightning-induced pitting of the copper-clad steel line.

   Power companies contacted by WSRC do not use this copper-clad steel as a conductor because of problems with lightning induced pitting. The site is systematically inspecting the lines to determine the extent of the problem and the appropriate corrective action.

5. **Future Actions:** The Board's staff will continue to perform follow-up reviews as required to pursue the issues raised in this trip report.