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# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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October 9, 1997

The Honorable Alvin L. Alm  
Assistant Secretary for Environmental Management  
Department of Energy  
Washington, D.C. 20585

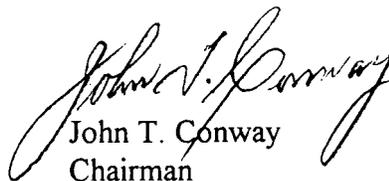
Dear Mr. Alm:

Defense Nuclear Facilities Safety Board (Board) staff review teams have visited the Savannah River Site several times this year to review implementation of Recommendation 96-1 at the In-Tank Precipitation (ITP) Facility, and to assess the authorization basis and safety programs for the high-level waste tank farms. The Board requested Mr. R. Tontodonato of the Board's staff to review the reports of these visits and to summarize these findings for us. The enclosed report is his **summary** of the issues identified during each site visit and the progress made in resolving each open item.

There are several key issues the Board would like to draw to your attention. The numerous observations made by our staff regarding the ITP nitrogen inerting systems make it clear that great care must be taken to ensure these systems are rigorously effective and reliable. Furthermore, the staff's observations regarding controls on ITP pump operations highlight the fact that ITP appears to be developing an undue reliance on administrative controls. Engineered controls would be preferable, to the extent that they are practical, for a facility facing such a long and technically demanding mission. Finally, the prolonged discussions that have taken place regarding the accident analyses and controls for hydrogen deflagrations in waste tanks and waste tank overheating indicate that closure of these issues is proving difficult and may warrant increased scrutiny from the Department of Energy. The Board is closely following the progress of the research on the chemistry of the ITP process, and the results that continue to come in with bearing on the safety of the process.

The enclosed reports provide a synopsis of the observations made during the reviews conducted by the Board's staff and are forwarded for your consideration. If you have any questions, please feel free to call me.

Sincerely,

  
John T. Conway  
Chairman

c: Mr. Mark Whitaker

Enclosures

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

September 5, 1997

**MEMORANDUM FOR:** G. W. Cunningham, Technical Director  
S. Krahn, Deputy Technical Director

**COPIES:** Board Members

**FROM:** R. Tontodonato

**SUBJECT:** Status of Open Issues Identified in Recent Trip Reports for Savannah River Site Waste Management Facilities

This memorandum documents the current status of the issues related to Savannah River Site (SRS) waste management facilities that were identified in recent trip reports by the staff of the Defense Nuclear Facilities Safety Board (Board) and for which Board action is pending. The following reports are addressed:

- *Review of Adequacy and Reliability of In-Tank Precipitation Facility Safety Systems, Savannah River Site, January 23–24, 1997, D. Napolitano, February 5, 1997*
- *Review of Technical Safety Requirements for High-Level Waste Tank Farms, Savannah River Site, March 31–April 1, 1997, D. Napolitano, April 15, 1997*
- *Review of Savannah River Site In-Tank Precipitation Facility, April 2–3, 1997, D. Drop and R. Tontodonato, April 15, 1997*
- *In-Tank Precipitation Facility and Tank Farm Instrumentation and Control Systems, T. Davis, May 7, 1997*
- *Review of Savannah River Site Waste Management Facilities, June 9–11, 1997, R. Tontodonato, June 16, 1997*

**Recommendation 96-1 and the In-Tank Precipitation Facility.** The staff reports discussed the following issues.

*Reliability of Nitrogen Inerting System*—The February 5, 1997, report identified that numerous problems were causing the primary inerting system for Tanks 48 and 49 to trip off line far too frequently, and that a comprehensive evaluation of the system's failure modes could help identify ways to improve reliability. Westinghouse Savannah River Company (WSRC) has subsequently worked to identify and eliminate vulnerabilities in the nitrogen system, and has made further upgrades, as documented by the April 15, 1997, staff report on the In-Tank Precipitation (ITP) Facility. The staff will continue to monitor the system's reliability to ensure that unplanned outages are reduced to a minimum.

*Vapor Space Mixing*—The February 5, 1997, and April 15, 1997, staff reports identified that test results used by WSRC to show that mixing in the Tank 48 vapor space was sufficient to eliminate pockets of air and benzene were not conclusive. The February 5, 1997, report stated that modeling of fluid flows and worst-case pockets would help resolve this issue. WSRC is currently performing this work and plans to prepare a white paper summarizing these calculations in September 1997.

*Oxygen In-Leakage Calculations*—The February 5, 1997, report identified weaknesses in WSRC's calculation of how long the Tank 48 ventilation system could be inoperable before the oxygen concentration would exceed operating limits. WSRC is now preparing an improved calculation. The staff will review the calculation as soon as it becomes available.

*Positive-Pressure Inerting*—The February 5, 1997, report stated that it seemed prudent to continue evaluating a positive-pressure inerting system, based on the issues associated with the reliability and adequacy of the existing negative-pressure system. Also, the May 7, 1997, report identified that lack of fuel control during operation of the planned low-flow positive-pressure backup nitrogen system was a potential concern, particularly if oxygen monitoring was not required in that mode of operation. This issue will be reviewed further once the draft Safety Analysis Report (SAR) and Technical Safety Requirements (TSRs) are available (November 1997).

*Controls on Pump Operations*—WSRC is headed toward the development of a complicated administrative program that will use numerous plant parameters to calculate the maximum allowable time before the next mixer pump runs for Tanks 48 and 49. The June 16, 1997, staff report identified that simple Limiting Conditions for Operation specifying pump run intervals for major phases of the ITP process would be simpler and easier to implement effectively. The staff is still pursuing this issue and will discuss it further with the Department of Energy Savannah River Operations Office (DOE-SR) when the draft SAR and TSRs for ITP become available (November 1997).

*Backfit Analyses*—WSRC has developed a backfit analysis process for determining whether upgrades or compensatory measures are needed for existing equipment that is designated as safety class or safety significant in the new SAR. The March 15, 1997, and June 16, 1997, staff reports identified that there were some systematic problems in the methodology used and in the resulting backfit analyses. WSRC subsequently agreed to correct specific problems with particular backfit packages, to correct the generic problem that alternatives evaluated (e.g., new equipment vs. added administrative controls) were not being documented, and to make it clear that the methodology was not intended to be applied routinely to new facility design and construction in lieu of appropriate standards. It is still not clear that the methodology will ensure that the periodicity of surveillances used as compensatory measures has a technical basis. The staff will check the updated backfit packages, as well as any new packages, and will evaluate the equipment, controls, and compensatory measures identified in the draft SAR and TSRs (November 1997). Backfit analyses for other high-level waste facilities will be checked once they have been completed.

*Cooling Systems for ITP*—The April 15, 1997, staff report on ITP identified that it was unclear how temperatures in Tanks 48 and 49 would be kept low enough to avoid excessive benzene generation from tetraphenylborate in the tanks. Further discussions with WSRC and DOE-SR indicate that controls on the tanks' radionuclide loading and on pump operations should adequately prevent unacceptable temperature increases.

*Other*—The May 7, 1997, report also identified the need for lightning protection for the safety-class backup nitrogen system and the benefits of improving ITP instrument trending, test, and surveillance programs. WSRC is installing lightning protection throughout ITP, and had previously planned to do so. The staff will revisit the instrumentation programs before ITP resumes operations.

**High-Level Waste Tanks.** The staff reports discussed the following issues.

*TSR Implementation and Backfit Analyses*—The March 15, 1997, report on high-level waste tanks identified that a concern identified in a February 3, 1997, staff trip report (that WSRC planned to implement new TSRs for the tank farms before performing backfit analyses for the required equipment) had not yet been addressed. The February 3, 1997, report was forwarded to DOE by the Board on April 18, 1997. The issue was revisited during the August 20–22, 1997, staff visit to SRS. DOE-SR and WSRC now plan to prioritize the backfit analyses to ensure that the most important evaluations (e.g., adequacy of the flammable gas monitors in the waste tanks) are completed before the TSRs are implemented in the spring of 1998. As is being done for ITP, the staff will review the backfit analyses as they are completed.

*Unreviewed Safety Question Process*—The April 15, 1997, report on high-level waste tanks identified that WSRC was referring some potential unreviewed safety questions (USQs) to a “New Information” process, and spending months attempting to resolve the safety issues without entering the formal USQ process or implementing formal interim controls. DOE-SR subsequently acted to impose a limit on how long potential USQs could be evaluated before entering the formal USQ process.

*Tank Overheating*—The April 15, 1997, report on high-level waste tanks identified that WSRC calculations showed that a tank overheating event could have significant off-site consequences, and that WSRC was developing improved analyses and controls. This issue was revisited during the August 20–22, 1997, staff visit to SRS; it is still unresolved. The staff will continue to follow WSRC’s efforts to adequately address the potential for tank overheating.

*Hydrogen Deflagration in a Tank*—The April 15, 1997, and May 7, 1997, reports on high-level waste tanks identified that WSRC was planning to eliminate the existing requirement to ventilate the high-level waste tanks routinely to prevent hydrogen from accumulating. WSRC planned instead to implement TSRs that would require monitoring flammable gas concentrations. The proposed TSRs required ventilation only if elevated flammable gas concentrations were detected. The basis for this requirement was a probabilistic analysis that concluded that the new control scheme would result in an annual deflagration probability slightly less than  $10^{-6}$ . The April 15, 1997, report identified that WSRC could not technically justify the frequency assumed in the probabilistic analysis for tanks exceeding the lower flammability limit. On April 18, 1997, the Board expressed its concern regarding this issue to DOE in a letter forwarding a February 3, 1997, report of an earlier staff visit to SRS.

This issue was revisited during the August 20–22, 1997, staff visit to SRS, and is still unresolved. WSRC now plans to require tank ventilation, but not in the form of a Limiting Condition of Operation or a TSR. The staff will continue to follow this issue.

*Siphon Breaks*—The April 15, 1997, report on high-level waste tanks identified that WSRC had not completed calculations demonstrating the adequacy of siphon breaks for the high-level waste transfer lines.

The calculation was received at the Board during the week of September 1, 1997, and will be reviewed shortly.

*Other*—The May 7, 1997, report also identified the benefits of improving ITP instrument trending, test, and surveillance programs, and the potential need for lightning protection in the tank farms. The staff will revisit the instrumentation programs prior to TSR implementation in early 1998. The staff will continue to follow lightning protection issues in the tank farms.

**Consolidated Incinerator Facility (CIF).** The June 17, 1997, report identified that continued problems caused by inadequate conduct of operations indicated the need for further improvements. The staff is monitoring operational occurrences at CIF, and will conduct a focused review of conduct of operations if improvement is not evident.