

John T. Conway, Chairman  
A.J. Eggenberger, Vice Chairman  
John W. Crawford, Jr.  
Joseph J. DiNunno  
Herbert John Cecil Kouts

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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



October 9, 1997

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

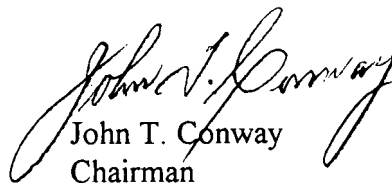
Dear Mr. Alm:

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

April 15, 1997

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

**COPIES:** Board Members

**FROM:** D. Napolitano

**SUBJECT:** Review of Technical Safety Requirements for High-Level Waste Tank Farms, Savannah River Site, March 31–April 1, 1997

### 1. Purpose

This report discusses the development and implementation of new Technical Safety Requirements (TSRs) for the high-level waste tank farms at the Department of Energy's (DOE) Savannah River Site (SRS). The observations presented are the result of a March 31–April 1, 1997, site visit by Defense Nuclear Facilities Safety Board (Board) staff members D. Drop, D. Napolitano, and R. Tontodonato.

### 2. Summary

The SRS tank farms are making progress toward developing new safety controls. Salient points resulting from the Board staff's visit are as follows:

- The rigor of the Critical Lift and Tank Overheating Programs has improved since the last visit by the Board staff.
- The program to prevent hydrogen deflagrations in tanks still lacks a firm technical basis.
- Evidence suggests that SRS tank wastes retain hydrogen. The safety analysis assumes hydrogen is not retained. As of now, SRS is determining whether this issue should enter the Unreviewed Safety Question (USQ) process.

### 3. Background

There is currently an approved Basis for Interim Operations (BIO) document for the SRS tank farms. TSRs associated with the BIO are being implemented in phases. A previous Board staff trip report, dated February 3, 1997, identified issues in three safety programs (Critical Lift, Tank Overheating, and Hydrogen Deflagration) and suggested that the current TSR implementation schedule might lower the present tank farm safety margin.

## 4. Discussion

The following subsections document the staff's observations related to the analysis of hazards, the development and implementation of safety controls, and the methodology for backfitting facilities to support these controls.

**Analysis of Hazards.** The current tank farm safety analysis assumes hydrogen is not retained by SRS high-level waste. However, experience with the currently active waste tanks—the In-Tank Precipitation (ITP) Facility and the Extended Sludge Processing (ESP) Facility—indicates otherwise. Data sets show that small amounts of hydrogen are released when the ITP pumps run. When the ESP tank was slurried in 1993 after having been stagnant for years, the hydrogen level rose sharply from 1 to 6 percent of the lower flammability limit (LFL) and continued to rise until the pumps were shut off. At least one stagnant tank, Tank 35, has also exhibited retention. In 1990, when a valve misalignment caused steam to bubble through the waste, the tank's vapor space hydrogen concentration increased.

The Westinghouse Savannah River Company (WSRC) is using the New Information (NI) process to resolve this issue. This is a contractor-defined process that allows them a “reasonable amount of time” to research an issue and determine whether there is a potential inadequacy in the safety basis. If there is a potential inadequacy, the USQ process is entered. The hydrogen NI evaluation has been ongoing since October 1996. While this research is being conducted, the DOE field office (DOE-SR) has imposed no operational restrictions on agitating the tanks. Since the NI process has been ongoing for some time, SRS' actions do not seem consistent with DOE Order 5480.21, *Unreviewed Safety Questions*. It states that if a situation involves an accident of a different type than previously considered, the USQ process should be entered, and appropriate operational restrictions should be put in place until the issue has been resolved to DOE-SR's satisfaction. Subsequent to the Board staff visit, DOE-SR stated that it is attempting to expedite the NI process and possibly enter the USQ process.

**Development and Implementation of Controls.** Updates to the three accident-prevention programs discussed in the February Board staff trip report are presented below, along with new issues in other programs.

*Critical Lift Program*—Previously, the Board staff identified that WSRC does not know whether its special lifting devices meet safety factor requirements. Archive searches are being performed to resolve this issue, but have not produced results to date. The Rigging Manager has decided to perform design calculations before using equipment without documented factors of safety; this is encouraging.

*Tank Overheating*—The original dose calculations for this event indicated that off-site consequences could be significant. WSRC has taken the initiative to complete new analyses. These refined calculations are preliminary, but they show that tank overheating remains a problem for certain waste configurations. The analyses conclude that present controls on high-efficiency particulate air (HEPA) filter changeout are adequate to mitigate overheating consequences for current waste conditions, but that programs are needed to track waste temperature, heat load, and distribution when transfers begin to alter tank inventories.

*Hydrogen Deflagration in a Tank*—The present safety basis states that a tank deflagration is a Beyond Design Basis Event (BDBE), and therefore the predicted off-site consequences —approximately 1000 rem at the site boundary—can be neglected. The BDBE categorization is the result of a Probabilistic Risk Assessment (PRA) that credits redundant monitoring controls. However, SRS has not been able to justify the accuracy of an assumed PRA value for the frequency at which tanks reach the LFL. As a result, WSRC has now taken the position that the PRA and BDBE categorization are not important because they have already put as many controls in place as is reasonable. The Board staff notes that the new controls eliminate a former requirement to ventilate the tanks proactively. Ventilation, in addition to the new monitoring controls, might increase the safety margin and also ease the PRA analysis burden.

*Waste Transfer Program*—Air holes in pipelines are credited as passive siphon breakers. However, WSRC does not have calculations to show that the breakers are adequate. This issue was raised by the Board staff in December. At that time, WSRC committed to preparing a calculation; this calculation is still being worked on.

*Implementation Schedule*—In its February trip report, the Board staff stated that the tank farm safety margin might be reduced by the plan to implement new TSRs before determining whether equipment upgrades are necessary to support them. The Board staff cited hydrogen deflagration controls as a potential problem area since SRS' new safety strategy eliminates former operational requirements. The DOE field office has still not addressed this issue.

**Backfit Methodology.** The DOE-SR approved *WSRC Backfit Methodology* outlines a procedure for determining whether equipment upgrades and compensatory measures are needed to support TSRs. This document might be used at facilities across SRS. Both the ITP Facility and the F- and H-Canyons have already expressed interest in using it. The Board staff has the following concerns with the backfit methodology:

- The methodology allows compensatory measures to substitute for equipment upgrades, but it does not require that these measures be judged against standards for adequacy. The preliminary backfit for new conductivity probes (leak detectors) is a good example. To compensate for their lack of redundancy, SRS may rely on periodic walkdowns to double check for leaks. This type of compensatory measure has no benchmark standard, and thus sufficiency is largely a subjective decision.
- DOE-SR and WSRC have not formally defined how compensatory measures will be linked to the authorization basis.
- The methodology allows a user to pick and choose which parts of an individual standard will be followed. For example, an engineer may use the *American Society of Mechanical Engineers Boiler and Pressure Vessel Code* (B&PV) design section to find a minimum vessel wall thickness, but neglect the testing, fabrication, and inspection sections. However, the B&PV Code, like many standards, is an integrated document in that all of its parts must be used together to create a conservative design.

- The backfit methodology may be used for new facility construction. The aim here is to promote consistency among facilities. However, the end result might be new facilities that rely on compensatory measures instead of new equipment designed to industry standards.

## **5. Future Staff Actions**

The staff will continue to follow the development and implementation of TSRs at the SRS tank farms. Specific issues to be followed include (1) adequacy of instrumentation and electrical controls, (2) hydrogen retention and deflagration in a tank, (3) deflagration in a transfer facility, (4) justification for siphon breakers, (5) performance of critical lift work, and (6) outstanding NI and USQ issues.