95-0004075

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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

August 14, 1995

Mr. Mark Whitaker
Department of Energy
1000 Independence Avenue
Washington, DC 20585

Dear Mr. Whitaker:

Enclosed for your information and distribution are 12 Defense Nuclear Facilities Safety Board staff reports. The reports have been placed in our Public Reading Room.

Sincerely,

George W. Cunningham
Technical Director

Enclosures (12)

8/31/95
NOTE: There are only 11 letters included with this transmittal since one letter (DNFSB 95:4078) had been sent previously as 95:3400 on 7/25/95.

95-0004086

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

June 16, 1995

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: William Yeniscavich

SUBJECT: Review of Reservoir Unloading and Tritium Storage at Savannah River Site

1. **Purpose:** This trip report documents a Defense Nuclear Facilities Safety Board (Board) staff review at Savannah River Site (SRS) on June 7-8, 1995, by W. Yeniscavich, R. W. Barton and M. J. Merritt. The following items were reviewed:

   - Progress in unloading expired tritium reservoirs,
   - Status of design and delivery of Hydride Storage Vessels (HSVs), and
   - Status of design and delivery of Highly Invulnerable Encased Safes (HIVES).

2. **Summary:**

   a. All highest risk reservoirs have been unloaded except for three reservoirs which are awaiting special unloading fixtures. The three reservoirs are in a glove box to provide secondary containment. Completion of this milestone resolves the staff concerns with highest risk reservoirs identified in the previous SRS trip report (Michael J. Merritt, dated March 23, 1995).

   b. A new staff concern has been identified. Reservoirs within their design life, may be used for long-term storage of tritium gas, rather than storing the tritium as a solid tritide. As a tritide the chance of accidental loss of tritium is greatly reduced.

   c. Procurement of the HSVs has been delayed because of the inability to load the titanium bed with hydrogen at room temperature. It is estimated by the staff that this problem will cause a three month delay in acquiring the HSVs. Delivery is estimated by the staff for January 1996, which is still approximately six months before the lack of additional gas storage capacity, will cause a slowdown in Replacement Tritium Facility (RTF) operations.

d. Delivery of HIVES has slipped from February 1996 to June 1996. The staff believes this delay along with delays during the past two years in procuring HIVES was caused by the low priority assigned to this work.

e. A design review meeting between SRS personnel and the Board staff on the HSV and HIVES will be held at the Board on July 12, 1995. Design information will be presented by cognizant engineers from SRS.

3. **Background:** A large inventory of loaded tritium reservoirs exists at SRS. The reservoir design laboratories (Sandia National Laboratory and Los Alamos National Laboratory) have stated that as reservoirs age, the potential for a leak increases and that these reservoirs should not be used for storage of tritium. Reservoirs are being unloaded with priority being given to those that have exceeded design life criteria. These reservoirs have been ranked into categories A, B and C, with the greatest potential for leak being Category A. However, even with this expedited effort, a large inventory of loaded tritium reservoirs will continue to exist beyond the year 2000.

Excess tritium beyond the current storage capacity at SRS will be recovered from reservoirs as they are unloaded. This excess tritium will be stored in newly designed HSVs using a titanium bed. Since this is the first time that a titanium bed has been used in the weapons complex for storage of tritium, a review of the design for the safe storage of tritium will be conducted by the staff. The HSVs are scheduled for first use as early as October 1995. They must be available by mid-1996 to avoid a slowdown in RTF unloading operations.

Some of the storage facilities at SRS are vulnerable to earthquake or tornado damage. The potential for damage to reservoirs and HSVs stored in these facilities will be reduced by storing the reservoirs and HSVs in newly designed HIVES. The HIVES are scheduled for initial use in February 1996. Timely delivery of the HIVES is desirable. Late delivery will prolong the vulnerability of reservoirs and HSVs.

4. **Discussion/Observations**

a. Reservoir Unloading.

Reservoirs are being unloaded at a higher rate than was predicted in January 1995. High priority has been given to unloading Category A (highest risk) reservoirs and all Category A reservoirs have been unloaded, except for three that are awaiting special fixtures. These reservoirs have been placed in a glove box to provide secondary containment because of their higher potential for leaking. The remaining expired reservoirs, Categories B and C, will be unloaded by mid-1998. With the unloading of these expired reservoirs, the potential for a leak to develop in the reservoir inventory that remains is significantly reduced. Continual monitoring is required to insure that the remaining reservoirs in inventory are unloaded before they exceed their design life.

After 1998, a large inventory of reservoirs, within design life, will still exist at SRS. Both Westinghouse Savannah River Company (WSRC) and DOE/SR interpret that the reservoir design laboratories allow long-term storage of tritium in reservoirs as long as the reservoirs do not exceed design life. DOE (DP-24) discussed this issue with the design laboratories and got confirmation of the WSRC and DOE/SR interpretation.

When large numbers of reservoirs are being stored together, the potential exists for a large tritium gas release. However, when stored as a tritide on the titanium beds in HSVs, the chance of an accidental loss of tritium is greatly reduced. The staff believes it would be prudent to unload all reservoirs as quickly as feasible and store the tritium as a solid tritide in HSVs.

Assuming no additional gas storage containers are available for tritium, the first slowdown in RTF operations occurs in mid-1996. The HSVs currently being designed will be used to provide the additional gas storage capacity. No contingency plans are available nor are any being developed to provide alternate gas storage capacity should the HSVs fail to be available when needed.

b. Hydride Storage Vessel.

Funding has been approved for the procurement of 35 HSVs. The conceptual design and a procurement specification have been completed. Final design and certification to the American Society of Mechanical Engineers Code (Section VIII, Division 1, Lethal Service) will be performed by the fabrication vendor. A delay in placing the purchase order has been caused by the inability to load the titanium bed with hydrogen at room temperature. Additional testing is required to establish the titanium form and the bed loading parameters before the purchase order is placed.

Experiments are being conducted on two forms of titanium: rough shaped, sintered metal pieces about 1/4-inch diameter; and 1/4-inch diameter rod pieces approximately 1/4-inch in length. The sintered metal pieces are the same form used successfully by other organizations, and were obtained from the same vendor (Ergenics) that supplied the other organizations. The rods were obtained to a commercial specification from a titanium material supplier (G&S Titanium). Rods are preferred because of their lower cost and ready availability.

Experiments at SRS on both materials have failed to load the titanium with hydrogen. The procedure consists of a 550°C bake out, room temperature loading, and 550°C unloading. SRS was able to load the titanium by heating to high temperatures, but not at room temperature. SRS believes there is some permeability barrier, such as an oxide,

which is preventing room temperature loading. SRS is continuing to investigate this problem and will also be meeting with other organizations with experience in this technology in late June 1995. SRS also noted that the addition of heating equipment may be required in the RTF for loading the HSVs.

It is estimated by the staff that the resolution of this loading problem will cause a three month delay in delivery of the HSVs. Delivery is now estimated by the staff to be January 1996, which is still about six month ahead of RTF operations.

A review of the HSV design including resolution of the hydrogen loading problem will be presented to the Board staff by SRS personnel on July 12, 1995.

c. Highly Invulnerable Encased Safes.

Funding has been approved for the procurement of 50 HIVES. The HIVES design is complete and a purchasing specification is being prepared. This will be a build-to-design order.

Delivery of the HIVES is scheduled for June 1996, four months later than the delivery date given in the April 1995 Tritium Storage Plan. The actual fabrication time for the HIVES is two months, while the remaining ten months are for specification preparation and approval, and for procurement. In the opinion of the staff, this is not an aggressive schedule.

The considerable delay in the HIVES schedule over the past two years was attributed by WSRC to the reversal in the SRS storage plan approach from long-term tritium storage in reservoirs to the current reservoir unloading activity. To the staff it appears that the delay was caused by the low priority given to the procurement and installation of HIVES.

No technical problems are known to exist with the HIVES design. SRS personnel will review the HIVES design with the Board staff on July 12, 1995.

5. Future Staff Actions:

The HSV and HIVES designs will be reviewed by the Board staff on July 12, 1995. Progress on HSV loading, storage, and unloading will be reviewed for potential impact on SRS tritium facilities. Procurement and utilization of HIVES will be monitored, along with the progress in reservoir unloading.