

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

June 3, 1993

**MEMORANDUM FOR:** G. W. Cunningham

**COPIES TO:** Board Members

**FROM:** D.L. Burnfield

**SUBJECT:** Spent Fuel Storage - Status of DNFSB Staff Review of Spent Fuel Storage in the Basins at Savannah River Site

1. **Purpose:** This report documents the status of reviews of spent fuel storage basins at various DOE defense nuclear facilities at the Savannah River Site. It also covers attendance at the April 28-29, 1993, DOE workshop on this subject, a trip to the Hatch Plant near Vadalia Georgia on April 30, and initial reviews of the SRS reactor storage basins and the Receiving Basin for Offsite Fuel (RBOF).
2. **Observations to Date:** To better understand the technical issues relevant to wet storage of spent fuel at DOE Defense Nuclear Facilities, the DNFSB staff initiated a cross-cutting review of fuel storage basins. The staff has reviewed the commercial standards associated with spent fuel storage, reviewed the DOE documentation available at the DNFSB, attended a workshop and a DOE briefing to the Board on spent fuel storage, discussed actions taken at a similar commercial fuel storage facility, and performed a review of selected facilities at SRS. The major observations that have been made based on the SRS review are:
  - a. Although the interim program outlined by DOE HQ is based on the premise that the spent fuel will be transferred to dry storage at a later date, SRS has initiated no actions along these lines. The DOE SR Operations Office Manager believes that the fuel should be reprocessed and is not concerned that the dry storage option is not actively being pursued at SRS. In support of this position, several Westinghouse Savannah River Company personnel indicated that the corrosion dynamics for aluminum (Al) clad fuel that has been stored underwater for an extended period of time is not well understood and that there are no performance data on the dry storage of such fuel. Leaving this issue unresolved may result in a worsened condition in the near future. The fuel could deteriorate significantly and both options would become more difficult to pursue.

- b. As reported earlier to the Board, the fuel stored in the SRS reactor basins is experiencing galvanic corrosion of the cladding. This corrosion is caused by the electrolytic coupling of the stainless steel hangers with the Al clad fuel bundles. It is centered in an area which would serve as the lifting point for the fuel. Although it does not appear that the cladding has been corroded to the point that the fuel elements are structurally degraded, it is probable that the corrosion rate will increase in time. The expected increase in the corrosion rate is based on discussions with corrosion experts from the various sites who explained that the passivity of the Al alloys would gradually break down with time and the corrosion would proceed through a transition period where the corrosion dynamics increases significantly. In addition, a review of applicable text books indicates that the water chemistry of the basins may not be maintained in the optimum band. The combination of these two effects would result in the degradation of the fuel elements more rapidly than had previously been predicted.
- c. The corrosion of the fuel in the reactor basins has proceeded to the point that fission products (primarily  $^{137}\text{Cs}$ ) are present in the water in measurable quantities. The water from the pool is purged to a leaching bed at regular intervals throughout the year. The environmental management group at the site considers the presence of  $^3\text{H}$  in the ground water surrounding the basins an indication that either the basins are leaking or that significant quantities of  $^3\text{H}$  are diffusing through the basin walls. Although the current levels of contamination do not exceed any of the current standards, the continued operation of the basins will result in continued degradation of the surrounding environment.
- d. The magnitude of the leak rate can not be determined because there are no leak detection devices for the SRS basins. The amount of makeup water required for the basins varies dramatically. For example, L-reactor basin requires several hundred gallons per day, while K-reactor has a significant amount of in leakage from plant systems and requires no makeup water. In addition, makeup water provided to the reactor basins is well water and contains a significant amount of dissolved solids. These dissolved solids are known to contribute to the corrosion of the fuel.
- e. Criticality calculations are performed by the separations group for the fuel in the RBOF facility and by the SR Technology Center for the reactors. The SR Technology Center performs backup calculations for RBOF when a significantly new type of fuel is received or when changes in conditions of the fuel or basin warrant such action. Based on discussions with the Technology Center and the separations personnel, the performance of the SR Technology Center does not appear to be as disciplined as the performance of the separations group. The SAR, which documents the hazard associated with potential accidents, is ten years old and has not been updated to meet recent requirements. The initial review of

the methods used to perform a criticality analysis indicated that the methodology was satisfactory.

- f. The reactor basins are either in a standby condition or are about to be transferred to a standby condition. Safety enhancing ventilation and emergency lighting system upgrades at L-reactor basin were halted because of budgetary concerns. The workers still operate the facility much as they did prior to shut down. They are therefore, exposed to essentially the same risks as if the facility was in operation. Yet, no plans are included to upgrade equipment before movement of fuel for either processing or transfer to dry storage. In addition, no containment or confinement system exists for these facilities.

### **3. Background:**

- a. The staff's effort was initiated in late March 1993. It is being spearheaded by Dan Burnfield, who has obtained assistance from many of the technical staff. In order to make the most out of the efforts that have already been expended by the staff, all currently available information was reviewed. In addition, applicable commercial standards and national consensus standards were reviewed. (A detailed listing of the standards used to develop this work sheet will be provided as an attachment to the next status report.) A work sheet was prepared, based on a review of these documents, to ensure that consistent reviews will be conducted at the sites. Copies of this work sheet are being provided to the Program managers.
- b. A detailed agenda was provided to DOE, (J. Jicha EM-37) requesting a staff briefing on the fuel basins. This briefing was later expanded by DOE and resulted in a DOE site workshop where the material that Jicha presented to the Board on May 11, 1993 was developed. Dan Burnfield and Larry Zull attended this workshop. A draft report of this workshop was issued by Larry Zull on May 27, 1993.
- c. It was determined that the staff would benefit from discussions with representatives from a commercial facility regarding the actions being taken in the commercial nuclear industry. Hatch Plant was chosen because of its proximity to SRS and the prior association of the technical staff with the management of the facility. Dan Burnfield toured the facility on April 30, 1993, combining this trip with a previously scheduled trip to SRS. Based on this trip the work sheets were revised to reflect actions being taken at Hatch.
- d. SRS was chosen as the first site to review because (1) the staff is familiar with the site and the amount of material being stored there, (2) recent issues regarding the corrosion of the fuel cladding in the basins at K-reactor, L-reactor and P-reactor, and (3) request by Paul Gubanc to review the RBOF facility. Dan Burnfield

reviewed the storage of fuel at these facilities on May 3-5, 1993. Discussions centered on the RBOF facility for the first day and on the reactor basins for the second day. The staff accompanied the managers of RBOF and the L-reactor basin on management tours on May 5, 1993. Detailed deficiency listings were prepared by the managers and copies were obtained.

4. **Future Actions:** Detailed observations are in the process of being recorded in the work sheets. These work sheets will be included in the file being assembled to support this effort. It is the intent of the staff to keep the Board informed of the actions being taken in this effort via frequent status reports (following each trip and as needed) and by briefings to the Board as required. Future trips have been scheduled for Hanford, Idaho, and Savannah River (tours of K and P Reactor basins and discussions and tours of basins in the H and F separations areas). A final report will be completed about the middle of July to document the comprehensive efforts of the staff.