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Joseph J. DiNunno
John E. Mansfield
Jessie Hill Roberson

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004-2901
(202) 694-7000

00-0001883



September 20, 2000

The Honorable Carolyn L. Huntoon
Assistant Secretary for
Environmental Management
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Dr. Huntoon:

The Hanford Spent Nuclear Fuel Project (SNFP) is critical to resolving the spent fuel vulnerabilities identified in the Defense Nuclear Facilities Safety Board's (Board) Recommendation 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*. The project provides for the removal, conditioning, and interim dry storage of the deteriorating spent N-Reactor fuel stored underwater in the aging basins at the K-Reactors.

The Board has previously pointed out deficiencies in the SNFP related to design, safety documentation, and resolution of technical issues. Many of these deficiencies have been resolved. However, with the approach of the November 2000 milestone date for fuel movement, a number of important issues remain open. Accordingly, the Board requests a response to issues summarized in the enclosed report whose resolution is necessary to support safe and reliable operation of the SNFP facilities.

If you have comments or questions on this matter, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "John T. Conway", is written over the typed name and title.

John T. Conway
Chairman

c: The Honorable Ernest J. Moniz
Mr. Mark B. Whitaker, Jr.
Mr. Keith A. Klein

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

September 12, 2000

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: Donald J. Wille

SUBJECT: Review of Technical Issues Associated with Spent Nuclear Fuel Project, Hanford Site

This report documents open issues associated with the Spent Nuclear Fuel Project (SNFP) at the Hanford Site. These issues were identified by the staff of the Defense Nuclear Facilities Safety Board (Board) on the basis of previous site reviews and selected reviews of final safety documentation for the project. These open issues were most recently discussed with SNFP personnel during video conferences held on August 22 and 24, 2000. The Department of Energy's Richland Operations Office (DOE-RL) and the contractor indicated that all open issues identified by the Board's staff will be resolved by the project and issue closure reports will be provided to the Board's staff for review.

Runaway Thermal Reactions. The Board's staff notes that the contractor's analytical calculations show runaway thermal reactions to be highly unlikely in some cases because of design changes made to reduce that probability. The calculations are extensive and have undergone peer review; however, the models used in these calculations have not been verified by prototypical experiments or production experience and represent only analytical predictions. In addition, the cleaning and drying operations for the SNFP include processes not previously used on damaged uranium fuel elements.

Facility workers could receive very high doses and work areas could be significantly contaminated if a runaway reaction occurred. The Board's staff has emphasized, and DOE-RL and the contractor have agreed, that additional mitigative systems for defense in depth and contingency procedures for such an event would be appropriate. The following open issues require action by the project:

- As approved by DOE-RL in July 2000, the design of the knockout pots will be changed to include copper cooling surfaces. This change will improve heat conduction and provide increased margin against a runaway reaction. The replacement pots are being procured and will be installed after initiation of fuel removal operations. The knockout pots currently installed in the basin do not have copper cooling surfaces and so will be subject to a loading limit. The loading limit is to be determined and included in the operating procedure.

- The operating procedure for the Primary Cleaning Machine should identify possible indications of a runaway reaction. The procedure should also identify preventive/mitigative actions to be taken in response to these indications.
- The procedure for the Fuel Retrieval System should identify possible indications of a runaway reaction. The procedure should also identify preventive/mitigative actions to be taken in response to these indications.
- The procedure for loading the Multi-Canister Overpack (MCO) should identify possible indications of a runaway reaction. The procedure should also identify preventive/mitigative actions to be taken in response to these indications.
- The procedure for transport of the MCO/cask from the K-Basins to the Cold Vacuum Drying Facility (CVDF) should include a requirement to measure the pressure of the MCO/cask head space if the transfer exceeds 24 hours. If an excessive pressure is measured, it could indicate a runaway reaction. The procedure should identify preventive/mitigative actions to be taken under these circumstances.
- The procedure for receiving the MCO/cask at the CVDF should include a requirement to measure the pressure of the MCO/cask head space upon receipt. If an excessive pressure is measured, it could indicate a runaway reaction. The procedure should identify preventive/mitigative actions to be taken under these circumstances.

Worker Protection. In previous discussions with the SNFP, the Board's staff expressed concern about potential radiation exposures to facility workers due to a possible spray leak from the Integrated Water Treatment System (IWTS). Similar concerns existed with regard to potential hazards to facility workers from other events, such as the potential runaway reaction. Since the hazard analyses reviewed by the Board's staff do not address qualitative estimates of possible exposure to K-Basin workers for these events, the staff is concerned that appropriate and adequate controls may not have been identified for the protection of K-Basin workers.

The Board's staff planned to address these worker protection concerns during an onsite review of applicable procedures and discussions with appropriate project personnel in August 2000. Because of contractor workload, the Board agreed with the DOE-RL request that this visit be postponed until the contractor's Operational Readiness Review (ORR) for the SNFP had started. Based on the current project schedule, the Board's staff has scheduled this site visit for the week of October 2, 2000. It is expected that any concerns identified on worker protection would be resolved by DOE-RL prior to facility operation.

Criticality Reviews. Based on reviews of Criticality Safety Evaluation Reports (CSERs), the Final Safety Analysis Report, and the DOE Safety Evaluation Report for the K-Basins, the following open issues require action by the project.

- Los Alamos National Laboratory recently completed an upgrade (version 4C) of the Monte Carlo N-Particle (MCNP) computer code used in the preparation of the

K-Basin CSERs, correcting 40 errors in the program. An earlier version, MCNP-4B, was used by the SNFP as this was the version approved for project use. A limited review is under way and needs to be completed to ensure that the MCNP upgrades have no significant impact on previous criticality calculations.

- The staff notes that the Criticality Safety Support Group (CSSG), established in accordance with the Board's Recommendation 97-2, conducted an independent review of criticality safety for the MCO in August 1999. The CSSG's report concludes that the MCO and baskets are criticality safe as designed and do not require further modification. At odds with this conclusion is the CSSG's statement that the MCO evaluations lack sufficient detail in some areas to allow a complete, independent review. The report also notes that some assertions and assumptions made in the CSERs are not supported by technical details. The project should assess the completeness of the MCO evaluations and CSERs in view of the statements in the CSSG report and provide the results of the assessment and any corrective actions to the Board's staff for review.

Reviews of Electrical and Instrumentation and Control Systems. The following electrical and instrumentation and control systems open issues require action by the project.

- During a previous site review of the safety-significant electrical power system, the Board's staff raised the issue of the adequacy of the diesel generator (DG) to start and support all the loads in the CVDF. During the conference, project personnel presented load calculations, recently evaluated transient time-current characteristics of the DG and major loads, and built-in time delays in the DG circuitry to demonstrate that the capacity of the DG is not challenged during startup of the major loads. The Board's staff concurs with this approach and will review the completed calculations when they are available.
- The recent DG trip on high cooling water temperature and an engineering resolution based on root-cause analysis were discussed. Several design modifications (e.g., larger radiators, bigger intake openings) are being considered by the DG vendor and the project to resolve this issue. The selected modification and the basis for its adequacy will be provided to the Board's staff for review.
- In the enclosure to a letter from the Board dated December 1, 1998, the staff addressed the issue of the margin in the set point for the high-temperature trip for the cask annulus in the CVDF. Project personnel have prepared a set point calculation and will confirm the adequacy of the margin. The enclosure to the Board's letter also raised the issue that the existing alarm system for water level in the cask annulus may not be able to withstand a seismic event. Project personnel will evaluate and confirm the adequacy of this system to meet the seismic requirements.
- In the enclosure to a letter from the Board dated February 25, 1998, the staff addressed the issue of the calibration of the electrical switchgear protective relays in

the K-West Basin facility. The project has completed all work on the protective relays manufactured by General Electric Company. However, an evaluation to confirm the status of the solid-state trip devices manufactured by ITE needs to be performed.

MCO Cask Drop. As previously identified by the project, a postulated drop of a loaded MCO transfer cask into the South Loadout Pit in the K-Basin would likely cause failure of the wall-to-floor joint resulting in excessive basin leakage. DOE-RL and the project planned to address this accident by (1) obtaining and implementing guidance from the Navy Crane Center on minimizing the probability of a cask drop; (2) providing sealant injection equipment to mitigate potential basin leaks in the unlikely event of a drop, including procedures and training in the use of that equipment; and (3) installing a maximum-thickness crushable pad below the Cask Loadout System in the South Loadout Pit (item 3 has been accomplished).

The Navy Crane Center (NCC) conducted an assessment of hoisting and rigging for the SNFP during the week of May 22, 2000. The NCC stated that they consider the K-West 32 ton bridge crane safe, but noted several deficiencies which could affect reliable service during critical lifts. The project developed a plan to implement the recommendations; however the Board's staff considers the implementation to be untimely. The planned ORR lifting demonstrations with a dummy loaded MCO /cask represent an equal risk of a wall-to-floor joint failure as the post-ORR lifts of an MCO /cask loaded with radioactive fuel. Prior to lifting heavy loads in the K-West Basin, such as during the ORR with dummy fuel in the MCO/cask assembly, the following open issues require action by the project:

- The last load test of the K-West 32 ton bridge crane was in November 1999, when repairs were made to the main hoist electric brake. This load test was done using 24 tons, which is only approximately 80 percent of the weight of a loaded MCO/cask. The contractor has indicated that upgrades are planned for the crane's programmable logic controller and that the load test will be performed following these upgrades. The current schedule has the load test being performed in October 2000, which is after the planned ORR lifting demonstrations with a dummy loaded MCO/cask. The K-West 32 ton bridge crane should be load tested using a load equal to a fully loaded MCO/cask assembly.
- The K-West 32 ton bridge crane has had a history of electrical faults and trips since it was redesigned. Following the upgrades and load test identified above, the contractor plans to exercise the crane, but a schedule has not been established. The K-West 32 ton bridge crane should be extensively exercised to verify reliability.
- The sealant injection equipment designed to mitigate potential basin leaks in the unlikely event of a cask drop, including appropriate procedures, training and drills in the use of that equipment, should be available prior to the planned ORR lifting demonstrations with a dummy loaded MCO/cask. A drill demonstrating the use of the sealant injection system, without using actual sealant, should be conducted.