[DNFSB LETTERHEAD]

June 11, 1996

The Honorable Thomas P. Grumbly
Under Secretary of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Mr. Grumbly:

The Defense Nuclear Facilities Safety Board's (Board) staff review team visited the Hanford Site on May 28, 1996, and reviewed design and construction activities for the Canister Storage Building (CSB). The review revealed that the issue with defining and implementing design criteria for the CSB raised by the Board has not been resolved. This and other issues described in the enclosed report, if not resolved in a timely manner, could impact the completion of the CSB and may result in delaying the removal of the N-Reactor fuel from the K-Basins.

This report is provided for your review and use. If you need any additional information on this matter, please let me know.

Sincerely,

John T. Conway
Chairman

c: The Honorable Alvin L. Alm
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

June 7, 1996

MEMORANDUM FOR:	G. W. Cunningham, Technical Director
COPIES:	Board Members
FROM:	A. H. Hadjian
SUBJECT:	Structural Review of the Canister Storage Building at the Hanford Site

1. **Purpose:** This report documents Defense Nuclear Facilities Safety Board's (Board) staff and outside expert's review of the design and construction activities of the Canister Storage Building (CSB) at the Hanford Site. The review was conducted at the site on May 28, 1996, by staff members Asa Hadjian and Don Wille, and outside expert John Stevenson. The report also incorporates comments received from outside experts Paul Rizzo and William Hall based on their review of certain CSB related documents.

2. **Summary:** The review revealed that the issue with defining and implementing design criteria for the CSB raised by the Board has not been resolved. Although construction of the CSB is in progress, the design criteria are not completely in place. Moreover, the communication of evolving design criteria to the design agent has been hampered by contractual constraints. These issues, if not resolved in a timely manner, could impact the completion of the CSB and result in delaying the removal of N-Reactor fuel from the K-Basins.

   The phased approach to safety analysis, design, and construction has resulted in an unnecessary risk (retrofits and/or delays) that would have been avoided if preliminary designs of the deck, superstructure, ventilation stacks, and the Multi-Canister Overpacks (MCOs) handling machine for all required loads were adequately incorporated in the final analysis of the substructure.

   Significant questions were raised regarding the adequacy of the seismic analysis of this deeply embedded structure. These questions are already being pursued by the Board's staff.

3. **Background:** The CSB is one of the five subprojects comprising the Spent Nuclear Fuel Project (SNFP). The objective of the SNFP is the expedited removal of N-Reactor fuel from the K-Basins. The original CSB of the Hanford Waste Vitrification Plant (HWVP) has been selected to serve as the staging and storage facility for the spent fuel from the K-Basins. The spent fuel will be stored in MCOs until a spent fuel stabilization facility is available. After the stabilization of the spent fuel, the MCOs will be returned to the CSB for interim storage until their final disposal. The CSB is being designed and built on a fast track schedule to meet the Department of Energy's (DOE) commitments to Board Recommendation 94-1. The site excavation, the foundation, and part of the substructure are already in place from the earlier HWVP

project. Because of schedule constraints, a phased design and construction plan has been adopted. Construction of the CSB substructure walls has already been resumed. Submittal to DOE of the construction packages for the deck and superstructure is scheduled for June 28 and August 15, 1996, respectively.

4. **Discussion/Observations:**

   a. **Design Criteria.** An earlier staff report (November 20, 1995) on the CSB identified the major issue that definitive design criteria were not completely in place while final design of the CSB was in progress. This and other issues were transmitted to DOE (Mr. Conway to Mr. Grumbly, December 15, 1995). Although the response from DOE (Mr. Alm to Mr. Conway, May 24, 1996) does address all of the issues raised, two critical observations are in order: (1) at this late date, while concrete is being placed at the CSB, the commitments are primarily written in the future tense; and (2) while modifications to existing design criteria have been incorporated in several documents, they have not been communicated to the CSB design agent for immediate implementation because of contractual constraints.

      At the end of June 1996 DOE will be asked to approve the CSB deck construction package. The Board's technical staff believes that the design criteria issues raised earlier by the Board should be incorporated in the ongoing design before proceeding with the next phase of construction. The recent review revealed the continuing issue with defining and implementing design criteria for the CSB. These issues could impact the completion of the CSB as well as the design/construction of the related cold vacuum drying and hot conditioning facilities for the spent fuel. Some examples of failure to resolve design criteria issues in a timely fashion include:

      - The decision as to the extent to which the facility should be hardened for tornado/wind loads, missiles (tornado generated and small airplane crash), man-induced hazards and H2 deflagration/detonation is still pending, and could significantly alter decisions made regarding loads on the substructure and the deck.

      - There is still confusion regarding the design life of the CSB structures (75 years of "service life" is stated, versus the 40 years of design life). It should be recognized that any increase of life span would adversely impact probabilistically based loads, such as natural phenomena hazards (MPH). Thus, there is risk in delaying this decision.

      - It is puzzling to note that maximum precipitation for flood is based on a return period judged to be 10,000 years and snow load only on 100 years. There is no technical analysis to substantiate the contention that the return period for the maximum precipitation is 10,000 years; and furthermore, the 100-year snow loading is inappropriate for critical structures.

      - The final Geomatrix hazard study results have not yet been incorporated in

design documents. Additionally, design documents need to be updated for tornado and snow loads

b. **Structural Modeling.** Several questions concerning the structural modeling of the CSB exist:

- The modeling of the side soil and the soil beneath the basemat of the substructure is not in accord with standard practice (e.g., ASCE 4 Standard and the SASSI Code). This will affect both the earth pressure loads on the exterior walls and the soil-structure interaction analysis results.

- The seismic excitation of this significantly embedded substructure is achieved in a fashion that is new and needs to be verified. The computer code used for this analysis does not have direct capabilities to account for soil-structure interaction. There are state-of-the-art codes that would have provided more defensible results.

- Information on the acceleration time-histories used in the dynamic analysis was scant. Important ground motion characteristics, such as long period motions, adequate peak ground velocity and displacement, may be lacking in these records.

- Since only one vault will be used for the K-Basin fuel and only one set of ventilation stacks will be constructed, a design based on three fully loaded vaults and three sets of ventilation stacks may not bound the worst design conditions for all structural load carrying elements. It is standard practice to use checkerboard loading patterns to capture the maximum forces in walls and slabs.

- The modeling of the total structure does not follow accepted and reasonable design practice in that the deck, superstructure, ventilation stacks, and the MCO handling machine have not been adequately incorporated in the final analysis of the substructure. The inadequacy is a result of the indecision regarding the hardening of the superstructure for external loads.

c. **Other observations:**

- Older versions of standards are being referenced and possibly used, such as UCRL-15910 in lieu of 1020-94; and ASCE 7-88, which was updated in 1993 and again in 1995. For example, the latest revision of ASCE 7-95 reflects improved design against wind effects.

- The independent review by the design agent is performed in house. By itself this may not be an issue; however, the review does not seem to have been probing nor in sufficient detail to raise any significant issues.

- The Nuclear Regulatory Commission (NRC) equivalency evaluation continues to be confusing. Even though seismic is the only significant load considered in the design to date, an exception is taken to the requirements of Appendix A of 10CFR100 for the determination of the seismic load on the facility. Therefore, an implication of NRC equivalency may be misleading. The Board's technical staff does not plan to assess NRC equivalency of this facility design.

- The Safety Evaluation Report issued by the Department of Energy - Richland Operations Office (March 1996) for construction of the CSB substructure contained a number of items that were resolved for restart of construction; however, additional actions by the CSB Project are still outstanding.