John T. Conway, Chairman
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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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November 14, 2002

The Honorable Jessie Hill Roberson
Assistant Secretary for Environmental Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Ms. Roberson:

During a May 22–23, 2002, review of the structural design and supporting analysis for the low-activity waste (LAW) and high-level waste (HLW) facilities of the Hanford Waste Treatment Plant, the Defense Nuclear Facilities Safety Board (Board) requested that a structural analysis summary report for each facility be prepared and forwarded to the Board for review. In performing previous reviews, the Board has found these reports to be useful, and has, for example, used them in the examination of the K-Reactor Structure at the Savannah River Site.

This request was prompted by the Board's experience that such a report is necessary for assessing structural design and supporting analysis adequacy for very large, complex structures such as the Waste Treatment Plant facilities to identify the potential presence of important, yet subtle modeling and/or computational anomalies. These summary analyses explain the predicted behavior of the building and the resulting load-resisting mechanisms by examining structural deformation plots and interpreting building response(s) using fundamental principles of structural mechanics, as well as force, load, and moment diagrams. Hence, the report is referred to as a "load path report." The analytical results are usually presented graphically, supported with sufficient background and other critical information.

A recent review by the Board's staff of a preliminary version of the HLW "load path report" highlighted the need for clarification of the content of this report. The details of the staff's observations are presented in the enclosed summary.

The Board considers it is generally necessary that "load path reports" be prepared for important structures. Therefore, these reports need to be prepared for the LAW, HLW, and Pretreatment facilities. The enclosed information is being provided for your use in developing the "load path reports" for these facilities. Please contact me if you have any questions.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.
Mr. Roy Schepens

Enclosure

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Additional Considerations—High-Level Waste Building "Load Path Report"

- Include a discussion of the overall analysis approach that includes consideration of material property and modeling uncertainties.

- Include references to design criteria documents and summarize key design criteria provisions.

- Include a summary of the functional design requirements for the structural steel and concrete members including use of a maximum demand/capacity ratio of 0.85.

- While a description of the seismic load path was requested to validate the adequacy of the model and analysis results, the report should also contain a section summarizing the results and conclusions of the analysis process for all loads and the controlling load combinations.

- As a minimum, the following attributes should be discussed. Additional attributes should be included that will facilitate understanding of the building structural response.

  - The intent of all unique design considerations. For example, the four concrete towers at elevation 49' resist north-south induced seismic loads of the adjacent steel frame but only one tower is utilized to resist load in the east-west direction. The design consideration prompting this decision should be presented.

  - When comparing horizontal shear distribution predicted on the basis of shear stiffness at a specific elevation with the results from the Georgia Tech Structural Design Language (GT STRUDL) computer program, demonstrate how shear center and center of mass offset influences these results.

  - Confirm that utilizing the envelope of static equivalent accelerations and the acceleration results from the System of Analysis for Soil-Structure Interaction (SASSI) computer program as input to the GT STRUDL analysis of HLW does not inadvertently mask induced torsional load affects due to acceleration gradients that might be critical to the design of the steel frame.

  - Floor slabs are used to transfer in-plane shear between adjacent walls. The finite element models used do not appear to have sufficiently refined element representations to accurately reflect local shear and bending affects. Discuss how the floor slabs have been designed and analyzed to include horizontal shear stresses as well as applicable code provisions of American Concrete Institute 349-01, *Code Requirements for Nuclear Safety Related Concrete Structures*.

  - In previous discussions, Bechtel National Incorporated suggested that the floor slab flexibility influences in-plane shear distribution between walls. Confirm the validity of this supposition.