DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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

January 16, 2009

Gerald L. Talbot Jr.
Assistant Deputy Administrator for
Nuclear Safety and Operations
National Nuclear Security Administration
1000 Independence Avenue, SW
Washington, DC 20585-0701

Dear Mr. Talbot:

Pursuant to the certification mandate provided in Section 3112 of the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, the Defense Nuclear Facilities Safety Board's (Board) staff responsible for certification activities has reviewed Chemistry and Metallurgy Research Replacement (CMRR) design data provided to date by the National Nuclear Security Administration (NNSA). The Board's staff is focusing its review on topics previously raised regarding the CMRR nuclear safety design strategy, the Preliminary Documented Safety Analysis, and design of safety-class and safety-significant systems. Those topics were provided electronically to NNSA on November 20, 2008. The Board's staff has documented specific technical issues on a Findings Form. For purposes of the certification review, the Board's staff considers a Finding a design topic related to a concern raised by the Board's staff regarding the CMRR design that has not been adequately resolved and that could preclude Board certification.

Enclosed is a Findings Form with respect to the issue of CMRR Seismic Design. We ask that you reply within seven calendar days from the date of Board's staff signature on the attached Findings Form, informing the Board's staff when the Finding will have a complete NNSA response. The NNSA response should contain sufficient quantity and quality of technical information necessary for the Board's staff to determine whether the Finding can be resolved. The Findings Form contains a signature block for the NNSA individual with the authority and responsibility for addressing the Finding. Please ensure that this individual signs and dates the returned Findings Form.

Sincerely,

Roy E. Kasdorf
Nuclear Facility Design and
Infrastructure Group Lead

c: Mr. Mike Thompson
Mr. James McConnell
Mr. Patrick Rhoads
Mr. Herman LeDoux
Mr. Mark B. Whitaker Jr.

Board Findings

Chemistry and Metallurgy Research Replacement Facility: Congressional Certification Review

Topic: Site Characterization and Seismic Design

Finding Title: CMRR Seismic Design Issues

Finding: The CMRR project should not proceed into final design until there is high confidence that the CMRR structural capacity is adequate for the PC-3 seismic design ground motions and that there are no significant unresolved design challenges. Structural stiffening recommendations were documented in January 2008 and used to revise the CMRR structural configuration. The general arrangement drawings (9/29/2008 revisions) and the structural drawings (12/01/08 revisions) indicate additional structural changes. The structural behavior must be understood from both a response and design perspective; examples of structural design challenges follow:

(1) The Mezzanine floor has extensive openings, which makes it difficult to adequately transfer forces to walls, especially in the out-of-plane direction of the Wall along Column Line 9 (between the Basement and Laboratory levels). A detailed understanding of lateral load transfer from the Mezzanine floor to the adjoining levels is needed to ensure that design problems will not occur.

(2) It is not clear how the connections between the laboratory columns and the interstitial walls can be designed for seismic forces.

Developing appropriate structural models for both the Fixed Base and Soil-Structure Interaction (SSI) analyses is important to understanding the seismic behavior of the CMRR facility. It is not clear to what level of rigor design control has been implemented between the three design entities (LANL, Sargent & Lundy, and Simpson, Gumpertz, & Heger). The SSI analysis must demonstrate:

(1) That the soil model appropriately models the ground motions and results in realistic ground motions at the foundation level and free field away from the structure.

(2) That the time history relative displacement motions in both NS and EW directions at each level of the CMRR structure (Roof, Interstitial, Laboratory, Mezzanine, and Basement) do not indicate complex structural behavior. The SSI analysis should include the appropriate number of column line intersection nodes to assess this behavior.

(3) How the results (forces and relative displacements) from the 3-D SSI analysis will be transferred to the 2-D structural design model.

In summary, given the recent changes to the CMRR structural configuration, sufficient design information must be provided to have high confidence that a final design solution will be feasible without significant structural changes during final design.

Basis for Finding: DOE O 420.1B (IV) (1) Facility SSCs must be designed, constructed, and operated to withstand NPH, and (2) The design and construction of new facilities and SSCs must address (a) potential damage to and failure of SSCs resulting from both direct and indirect NPH events, and (b) common cause/effect and interactions resulting from failures of other SSCs.

Suggested Resolution or Path Forward: NNSA should provide the following information:

(1) Structural drawings that clearly identify all load carrying structural elements and their dimensions without ambiguity, particularly slab thicknesses;

(2) A detailed lateral load transfer model for the Mezzanine floor that includes all walls up to the Laboratory floor and down to the basement floor. This model should address potential large relative displacements that could develop from higher dynamic modes;

(3) Examples of 2-D strip models for design of NS and EW slab strips interior to the structure. These strips should include appropriate foundation calculations based on CMRR geotechnical data. Documentation of these examples should include discussion of what loads and relative displacements would be applied;

(4) A discussion of how the out-of-plane and in-plane forces/displacements would be used in the design of the Wall along CL 9. Show preliminary design calculations for this wall;

(5) A discussion of how lateral loads on the slab between CL 11 and 12 at the Mezzanine floor level are transferred. Show preliminary design calculations for this slab;

(6) Provide preliminary design details for the NS walls in the Interstitial level, the columns in the Laboratory level, and their connections;

(7) Provide a discussion of how the SSI soil model appropriately models the ground motions given the sloping site conditions with the South face of the building embedded less than the other sides. Demonstrate that the ground motions are realistic at the foundation level and at the free field away from the structure.

(8) Provide a discussion of how forces/displacements from the 3D SSI analysis will be transferred to and designed for in the CMRR 2-D structural design.

(9) Provide a discussion of how the SSI model will address in-structure relative displacement concerns.

(10) Develop and execute a Fixed Base model of the latest CMRR structural configuration to ensure that overall static and dynamic behavior is understood.

NNSA Response:

DNFSB Final Resolution:

DNFSB: Roy E. Kasdorf 1/16/09 Roy Kasdorf Date	NNSA: _____ _____ Date