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April 19, 1993

Dr. Everet H. Beckner
Acting Assistant Secretary for Defense Programs
Department of Energy
Washington, DC 20585

Dear Dr. Beckner:

The Board, its staff and outside experts have met with DOE and WSRC several times to review the adequacy of the structural evaluation of the main building of the Replacement Tritium Facility (RTF). This evaluation is being done by WSRC. The most recent discussions occurred on March 19, 1993 at the DNFSB's offices for the purpose of reviewing and discussing the completed evaluation. While these meetings have been productive and helped to clarify questions that have arisen, the Board is unable to draw complete conclusions regarding the structural adequacy of the main building. The main points of our reviews are further outlined below. Additionally, the briefings and the information received to date have not conveyed to our staff and outside experts sufficient details of evaluation methods and techniques for us to understand and fully concur with the WSRC conclusions. We understand that the final main building structural qualification report is due to be completed by WSRC on April 30, 1993 and we hope that sufficient details and arguments are included to allow the Board to be able to continue and complete its review.

The following is a summary of the issues that have arisen during our review:

1. Controlling Seismic Input Motion - WSRC appears to have used a peak ground acceleration (PGA) of 0.19g at the free field, deconvolved to 0.13g at the foundation level of the main building. This is approximately the same ground motion that was used in the restart evaluation of the K-Reactor Building. The approach used to develop the seismic input motion may not be appropriately conservative for long term evaluation of the main building. Coincident with this is the approach used to evaluate the liquefaction potential of the Tobacco Road Formation, where DOE has chosen to further reduce conservatism. The design response spectrum has been reduced from a traditional spectrum by deaggregation of the response spectrum. This results in a reduction in ground motion energy input in certain frequency ranges, and significantly reduces the number and magnitude of induced cyclic shear stresses in the soil, thus reducing liquefaction potential. The degree of conservatism in this deaggregated approach is difficult for the Board to evaluate when compared to the traditional approach.

2. Soil-Structure Interaction Using SASSI - The computer program SASSI has been used by WSRC to model soil-structure interaction for the main building, and to generate floor response spectra used to evaluate the seismic response of systems and components in the RTF structure. This program is sophisticated and requires a great deal of judgment and expertise for effective use. Traditional analysis of the building in the commercial nuclear industry would suggest the use of SASSI to model soil-structure interaction effects, supplemented with a more classical analysis, where the effects of soil-structure interaction are discreetly modeled as equivalent springs and dampers whose properties are adjusted and conservatively bounded, based on equivalent soil properties derived from the SASSI analysis. The classical analysis would then be used to validate deformation and member loads for developing an understanding of the basic structural behavior of the building. A comparison of this nature enhances the confidence that predicted results are reasonable. Such an approach would strengthen confidence in the credibility of the existing analyses and thus lead to a better understanding of structure behavior.

3. The Use of Uncracked Section Properties to Determine Concrete Stiffness - Uncracked concrete section properties were used by WSRC to predict the stiffness of concrete members in the main building SASSI analysis. Cracking of reinforced concrete not only occurs due to concrete shrinkage and creep effects, but also due to the imposition of loads in the normal as well as the extreme environmental stress ranges. Therefore, it is usually considered prudent to evaluate the effects of cracking by considering reinforced concrete elements primarily subjected to bending to be uncracked in one analysis and compare this to an appropriate analysis that considers cracked sections. A comparison would lead to a determination of the significance of cracking and the need for further consideration of this phenomenon. Such an approach allows an evaluation of the effects of concrete cracking, especially when the structure is heavily loaded, and the effect of such cracking would have on changes of frequency of the structural elements, hence the response to dynamic (seismic) loads. Such an evaluation is desirable.

   Building differential displacements due to soil settlement and liquefaction can also cause cracking of the reinforced concrete structure. A conservative evaluation of this effect is also desirable.

4. The dynamic (seismic) response of the roof girders and supporting columns assumes the mass of soil, roof slab, roof beams, and commodities are rigidly attached to the girders. It has also been observed that the girders are quite flexible and have significant modes of response below 10 Hz. The vertical floor response spectrum at the roof elevation for 5 percent damping has a peak spectral response of about 3g. This is significantly higher than the dynamic (seismic) response value of 0.46g reported to the DNFSB staff and outside experts. A response greater than 1.0g may result in uplift and potential impact

of commodities on their supporting structure. Evaluation of these flexibilities and interactions is desired.

We would like to continue our review of the above. If you need further clarification, please call me.

Sincerely,

John T. Conway
Chairman

Copy to: Mark Whitaker, DR-1