RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

08/01/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 1040-7139 REVISION 3**
SRP SECTION:	**03.08.01 – Concrete Containment**
APPLICATION SECTION:	**3.8.1**
DATE OF RAI ISSUE:	**07/01/2013**

QUESTION NO. 03.08.01-17:

On April 3, 2013, the applicant submitted a markup of DCD Tier 2 Section 3.8 to provide updated information related to a seismic design change.

In Subsection 3.8.1.4, "Design and Analysis Procedures," the first sentence of the second paragraph (page 3.8-9) states, "The PCCV [prestressed concrete containment vessel] analysis methods are summarized in Table 3.8.1-4."

The last row of Table 3.8.1-4, "Summary of PCCV Models and Analyses Methods," indicates that for the basemat analysis, finite element (FE) solid is used and only the static condition is considered. The applicant is requested to provide a justification for not including the dynamic analysis of the earthquake load. Also, in Table 3.8.1-4, the boundary condition for the ANSYS model is not specified.

ANSWER:

Seismic induced loading was evaluated by utilizing equivalent static accelerations from a Safe-Shutdown Earthquake (SSE) and the associated dynamic analysis results described in Section 3.7 of the Design Control Document (DCD). A response spectrum analysis approach is not appropriate for use in basemat design evaluations that utilize non-linear contact elements in the supporting boundary conditions. As stated in Section 3.8.5.4.2, "Non-linear contact elements are used in the FE model to determine the interaction of the R/B complex basemat with the overlying structures and with the soil subgrade. The model is capable of determining the degree of uplift of the basemat from the soil subgrade in non-linear analyses. The three-dimensional FE model of the basemat includes the structures above the basemat and their effect on the distribution of loads on the basemat."

The model was analyzed for combinations of the North-South, East-West, and vertical components of the SSE accelerations, which were developed for the foundation analysis from the SASSI time-history results. The maximum nodal acceleration was extracted for each node on every major floor elevation in each superstructure. The extracted values were averaged over each floor slab to generate a single equivalent static seismic acceleration for each slab in each superstructure.

For the foundation analysis for both soil profiles that were considered, the accelerations in the X, Y, and Z directions over uncracked and cracked structural stiffness conditions are enveloped for the reactor building (R/B) Complex structures from the dynamic analysis. Thus, the static analysis considers loading conditions equivalent to that of a dynamic analysis, justifying the exclusion of the dynamic analysis of the earthquake load.

Six subgrade conditions were reviewed as boundary conditions for stiffness in the static analysis. Two subgrade conditions at the extreme stiffness conditions were selected to envelope the anticipated site conditions: Soil Profile #1 (soft soil, 270/500) and Soil Profile #6 (hard rock, 2032/100). Additional details on the basemat boundary conditions are provided in Subsection 3.8.5.4.3.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical/Topical Report

There is no impact on the Technical/Topical Report.

This completes MHI's response to the NRC's question.