RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

12/27/2013

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 equivalent static loading was evaluated utilizing static accelerations obtained from the results of the ACS-SASSI dynamic analysis described in Section 3.7 of the US-APWR DCD and Technical Report MUAP-10006. The effects of basemat uplift were considered in the analyses with the use of Surface-to-Surface contact elements as described in the response to RAI 1045-7141 Question 03.08.05-51. 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 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.

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 for the considered soil profiles. 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 were analyzed in the basemat design at the extreme stiffness conditions 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 for the basemat analysis.

Impact on DCD

DCD Table 3.8.1-4 has been revised as shown in Attachment 1.

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.

Table 3.8.1-4 Summary of PCCV Models and Analysis Methods

Model	Analysis Method	Program	Purpose
FE shell	Static linear and response spectrum	ANSYS	To calculate PCCV shell stress including the buttresses and vicinity of the large openings such as the equipment hatch and personnel airlocks To calculate local shell stress in vicinity of main steam pipes and feedwater pipes
FE shell	Static linear	ANSYS	To calculate local shell stress in PCCV liner plate
FE solid (basemat)	Static linear using non-linear contact elements	ANSYS	To calculate PCCV basemat stress and strain. Refer to Subsection 3.8.5.4 for further description of the basemat model.

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Note 1: Equivalent Static Method used with accelerations obtained from SASSI Dynamic Analysis