
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 776-5851 REVISION 3
SRP SECTION: 03.07.02 – Seismic Systems Analysis
APPLICATION SECTION: 3.7.2
DATE OF RAI ISSUE: 06/15/11

QUESTION NO. RAI 03.07.02-74:

Subsection 3.4 of MUAP-11001 (R0), states that “Figure 3.4-1 and Figure 3.4-2, respectively, compare the transfer function amplitudes computed for the horizontal NS and EW seismic responses at the roof elevation (El. 75.9 ft). As indicated from these figures, the correlation between the dynamic properties of the fixed-base lumped-mass stick model and that of the fixed-base FE model are reasonable for the fundamental-mode responses.” The Applicant is requested to address the following staff comments:

- A. The staff noticed that the information presented in Figures 3.4-1 and 3.4-2 are for the two horizontal directions. In order for the staff to assess the accuracy of the lump mass stick model in the vertical direction, the Applicant is requested to provide a figure showing the corresponding comparison of the transfer function amplitudes for the vertical direction.
- B. The lumped mass stick model is used to generate the in-structure response spectra at the top of the basemat for the structural design; therefore, the accuracy of the lumped mass stick model is essential for the structural design. In the above quoted sentence, the Applicant stated that the lumped mass stick model is reasonable for the fundamental-mode response. The Applicant is requested to provide the technical basis and justification to demonstrate that the contribution from the higher modes is negligible and the result is conservative.
- C. In order for the staff to assess the accuracy of the lumped mass stick model, the Applicant is requested to provide a table comparing the modal properties for the lumped mass stick model and the FEM model in the x, y and z directions. The data should include the modal frequencies, mass participation factors, and the cumulative modal participating mass in percentage of the total mass up to the 90 percent of the total mass.

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-11281 (ML11243A163).

Technical Report MUAP-11001 has been superseded and the relevant information incorporated into Technical Report MUAP-10006, Rev. 3. The reactor building (R/B), prestressed concrete containment vessel (PCCV), containment internal structure (CIS), east and west power source

buildings (PS/Bs), auxiliary building (A/B), and essential service water pipe chase (ESWPC) are now structurally integrated and supported on a common basemat to form the R/B complex. Technical Report MUAP-10006, Rev. 3, presents the information relevant to the added A/B and PS/Bs as well as the other buildings that make up the R/B complex.

In the original soil-structure interaction (SSI) related analyses of the A/B documented in MUAP-11001, a lumped-mass stick model was employed to facilitate the SSI analyses by identifying a critical subset of the generic site profiles that control the maximum seismic response parameters and then subsequently dynamic finite element (FE) models were employed for the SSI analyses. This methodology required a validation of the superseded lumped-mass stick model to ensure it adequately captured the dynamic properties of the A/B. The current analysis methodology used for the US-APWR SSI analyses as documented in Technical Report MUAP-10006, Rev. 3 is performed using an ACS SASSI three-dimensional dynamic FE model of the R/B complex, which includes the coupled reactor coolant loop (RCL) lumped-mass stick model. Therefore, the three parts of the above question are no longer directly applicable to the SSI related analyses of the A/B. Technical Report MUAP-10006, Rev. 3 presents the transfer functions at key locations using the combined FE model.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-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.