

REQUEST FOR ADDITIONAL INFORMATION 603-4666 REVISION 2

6/25/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 03.07.02 - Seismic System Analysis
Application Section: 3.7

QUESTIONS for Structural Engineering Branch 1 (AP1000/EPR Projects) (SEB1)

03.07.02-9

In RAI 495-3980, question 03.07.02-3, the staff asked when the structural reports for the T/B, A/B, and AC/B will be available for review. In response, MHI stated their commitment to comply with the guidelines of SRP 3.7.2 for non-Seismic Category I structures, but also stated that detailed design reports for the non-Seismic Category I structures are outside the scope of the SRP acceptance criteria 3.7.2.11.8 and will be ready for NRC audit prior to start of construction of the non-Category I structures.

The staff does not accept MHI's response. Per SRP 3.7.2.I.8, and 3.7.2.II.8, staff is required to review the seismic design criteria for the design of seismic category I and seismic non-category I structures that are part of the US-APWR standard plant. In order to complete its review of the seismic design of Category I structures, the staff needs to review design criteria for the non-Seismic Category I structures to account for their interaction with Category I SSCs.

When will the structural reports for the T/B, A/B, and AC/B, be made available to the staff?

(Related RAIs 3.7.2-6, 3.7.2-16, and 03.07.02-3 {Q 30})

References:

MHI's Responses to US-APWR DCD RAI No. 212-0950; UAP-HF-09188; dated May 7, 2009; ML091320443.

MHI's Responses to US-APWR DCD RAI No. 495-3980; UAP-HF-10029; dated February 2, 2010; ML100360838.

[SEB question 36]

03.07.02-10

The staff's review of MUAP-10001 (R0) has resulted in several observations that question the adequacy of the seismic lumped mass stick models that MHI propose to use for computing the design basis seismic responses of SSCs. The staff's guidance to develop adequate number of discrete mass degrees of freedom in dynamic modeling of lumped mass stick models is provided in SRP 3.7.2.II.1.A.iv and DC/COL-ISG-1

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(ML081400293). Staff expects MHI to demonstrate that the lumped mass stick models of the PCCV, PS/B, and other structures are properly developed to include adequate number of discrete mass degrees of freedom in dynamic modeling.

The staff requires technical bases and justification to the following observations in order to evaluate the adequacy of the proposed lumped mass stick models.

1. The SSI and structural seismic models should be adequately refined to sufficiently capture the high frequency contents of the horizontal and vertical input seismic spectra in the structural response. The interim staff guidance DC/COL-ISG-1 requires that the range of high frequency to be transmitted should cover a model refinement frequency of at least equal to 50 Hz. The 40 Hz cutoff frequency of for the SDOF oscillators described in Sections 4.3.2 and 5.3.1.1 is not in conformance with the guidance of ISG-1, which recommends that models be sufficiently refined to transmit frequencies up to 50 Hz.
2. The fundamental mode and corresponding mass participation in the X and Y directions (Figures 5.3.3.2-1 and 5.3.3.2-2) from the lumped mass stick model is different than that from the detailed three-dimensional model. Discuss its significance on the validity of the lumped mass stick model.
3. The mass participation response in vertical direction (Figure 5.3.3.2-3) is shown to be less than 100%. Discuss the adequacy of the vertical seismic model and how the missing mass is accounted for in calculating the vertical seismic responses.
4. The seismic response of PCCV based on the lumped mass stick model is under predicted (e.g. 22% in Figures 5.3.3.3-4 and 5.3.3.3-9) compared to the response based on the refined 3D finite element model.
5. The seismic response of PS/B based on the lumped mass stick model is under predicted (e.g. Figures 5.4.2-13, 5.4.2-15) compared to the response based on the refined 3D finite element model.
6. There appears to be a relative scarcity of SASSI analysis points near the fundamental frequency in the ANSYS dynamic model transfer functions in X and Y directions (Figure 5.4.2-7 and 5.4.2-8). This introduces the potential for error in the SASSI interpolation scheme if the dominant frequency shifts for any reason. Discuss its significance on seismic responses computed based on the SASSI model.
7. In order to estimate the extent of concrete cracking, MHI in section 4.5.1 references Appendix 3H of the US-APWR DCD, Rev. 2 to estimate stress level in structural members. A validation of the initially assumed locations and extent of cracking should be provided considering stress levels based on design load combinations that include seismic forces from the analyses of lumped mass stick models developed to include adequate number of discrete mass degrees of freedom.

[SEB question 37]