REQUEST FOR ADDITIONAL INFORMATION 799-5877 REVISION 3

8/5/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 03.07.03 - Seismic Subsystem Analysis
Application Section: 3.7.3

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

03.07.03-6

In Subsection 3.7.3.1.2 of DCD (R3), “Single DOF, Single Mode Dominant or Rigid Structures and Components”, the second bullet of the first paragraph (page 3.7-47) states, “The equivalent static seismic load for the direction of excitation is defined as the product of the component mass and the seismic acceleration value corresponding to the natural frequency of the support from the applicable ISRS.”
The SRP Acceptance Criteria 2.A.ii(3) (page 3.9.2-11 to -12) of SRP 3.9.2 states, “In addition, for equipment which can be modeled adequately as a one-degree-of-freedom system, the use of a static load equivalent to the peak of the floor response spectra is acceptable.” Therefore, per SRP 3.9.2, the peak acceleration of the ISRS should be used not the acceleration value corresponding to the natural frequency of the support from the applicable ISRS. The Applicant is requested to provide justification for calculating the equivalent static load using the spectral acceleration corresponding to the natural frequency of the support rather than the peak spectral acceleration from the ISRS at the base of the support. The uncertainties in the natural frequency estimation of the supports need to be addressed in the discussion.

03.07.03-7

In Subsection 3.7.3.1.7.1 of DCD (R3), “Uniform Support Motion Method”, the first paragraph (page 3.7-50) states, “The contribution from the seismic anchor motion of the support points is assumed to be in phase and is added algebraically as follows:…”
According to SRP Acceptance Criteria 9 of SRP 3.7.3, when analyzing equipment with multiple support points, the support displacements should be imposed on the supported equipment in the most unfavorable condition. The Applicant should demonstrate that assumption that the motion of the various support points is in phase is consistent with considering the effects of the various support points in the most unfavorable condition.

03.07.03-8

In Subsection 3.7.3.3 of DCD (R3), Analysis Procedure for Damping", the third paragraph (page 3.7-52), states "Piping systems are analyzed for SSE using 4% damping. Alternatively, frequency dependent damping values may be utilized as noted and described in Tables 3.7.3-1(a) and 3.7.3-1(b). The seismic analysis of piping and other mechanical subsystems is addressed in further detail in Sections 3.9 and 3.12."

The Applicant is requested to clarify if frequency-dependent damping values are used for the reactor coolant loop piping (RCL) in the SSI analysis for the US-APWR standard plant design. If so, the Applicant is requested to describe how these values were used in the ACS- SASSI analyses.

03.07.03-9

In Subsection 3.7.3.9 of DCD (R3), "Methods for Seismic Analysis of Aboveground Tanks", the third paragraph (page 3.7-54) states, "The horizontal response analysis considers both the impulsive mode (in which a portion of the water moves in unison with the tank wall) and the horizontal convective mode (water motion associated with wave oscillation)."
SRP Acceptance Criteria 14 (page 3.7.3-6) of SRP 3.7.3 states in the last sentence of the first paragraph, "The SSI effects may also be very important for tank responses, and they may need to be considered for both horizontal and vertical motions." The Applicant is requested to confirm that the SSI effects were considered in the seismic analyses of above tanks. If not, the Applicant is requested to provide justification for not considering the SSI effects. If yes, the Applicant is requested to provide specific technical details as to how the SSI effects were considered in the analyses.

03.07.03-10

In Subsection 3.7.3.1 of DCD (R3), "Seismic Analysis Methods", the fourth paragraph (page 3.7-46) states in part, "The new translational time history at the interface location is generated by algebraic summation of the translational acceleration time history at the reference location and the time-history contribution arising from the rocking and torsional effects of the intervening structural element."
The Applicant is requested to explain how algebraic summation is performed for the translational time history and for the rocking and torsional time histories. If the different directions of excitation are analyzed separately, how will the results of the translational time histories be summed algebraically. The Applicant's response should address the analyses approach used with both the computer codes SASSI and ANSYS.

03.07.03-11

In Subsection 3.7.3.1 of DCD (R3), "Seismic Analysis Methods", the fourth paragraph (page 3.7-46) states in part, "The new translational response spectra are obtained by absolute sum of the translational response spectra at the reference location and the contributions arising from the rocking and torsional effects of the intervening structural element."
The Applicant is requested to explain how the absolute sum for the translational response spectra and rocking and torsional response spectra is performed. The Applicant's response should address analyses with both SASSI and ANSYS.