RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 852-6003 REVISION 3**
SRP SECTION:	**03.07.02 – Seismic System Analysis**
APPLICATION SECTION:	**3.7.2**
DATE OF RAI ISSUE:	**10/24/11**

QUESTION NO. RAI 03.07.02-125:

In Section 5.3 of MUAP-10001(R3), "Development of the R/B Complex Dynamic FE Model," the 6th paragraph (Page 5-81) states, in part: "The thickness of the PCCV is also simplified for ease of modeling. Only the large equipment hatch is modeled and the elements modeling the buttresses on the East and West sides of the structure are not offset with respect to adjacent elements."

To help the staff better understand the development of the R/B complex model, the applicant is requested to provide information to the following questions: What is the actual thickness of the PCCV used in the FE model? Are the wall shell elements modified to reflect the increased thickness of the PCCV at the equipment hatch? How does this change (in stiffness) affect the design forces in the PCCV, equipment hatch, and associated SSCs responses? Also, would deleting the equipment hatch from the Dynamic Model altogether be acceptably accurate for the current purpose, and simplify the model? Or, is the inclusion of the equipment hatch intended to allow evaluation of local effects in that area?

ANSWER:

Technical Report MUAP-10001, Rev. 3 has been superseded and the relevant information on the modeling, analysis methodology, and results have been incorporated into Technical Report MUAP-10006, Rev. 3. Technical Report MUAP-10001, Section 5.3.1 is Section 02.5.1.1 in Technical Report MUAP-10006, Rev. 3.

Refer to Figure 02.5.1.1-4 and Table 02.4.1.1.1-1 for configuration of the prestressed concrete containment vessel (PCCV) dynamic finite element (FE) model and the element types used in this model, respectively. The actual thicknesses of the PCCV used in the FE model are as follows:

The wall shell elements of the dynamic model are modified with coarser thickness stepping than that used in the detailed FE model and still reflect the increased thickness of the PCCV at the equipment hatch. The variations in the FE thicknesses, which reflect the increased thickness at the equipment hatch and buttresses are chosen for purposes of accurately representing the overall dynamic properties of the PCCV to ensure accurate seismic responses consisting of accelerations and in-structure response spectra (ISRS) for associated structures, systems, and components (SSCs) responses. These changes (in stiffness) of the dynamic model affect the local stress distribution of forces for the PCCV equipment hatch in that the use of average shell thicknesses near the equipment hatch alters local force distribution near the perimeter of the equipment hatch. The offsets at the buttresses are not included in the dynamic model but are included in the detailed FE model. The buttress offset changes (in stiffness) also affect local stress distribution of forces for the PCCV in that the stiffer buttresses restricting deformation under loads alters local force distribution near the edge of buttresses.

Inclusion of the equipment hatch in the dynamic model is not intended to allow direct evaluation of local effects in that hatch area but to enable realistic seismic forces to be transferred from the dynamic model to the detailed FE model used for structural design.

The PCCV equipment hatch is modeled in the ACS-SASSI dynamic FE model and in the ANSYS detailed FE model to accurately represent the actual configuration of the PCCV in its soil-structure interaction seismic (SSSI) response analyses and its structural design. Because the PCCV equipment hatch is included in the model, there is no need to address deleting the equipment hatch to simplify the dynamic FE model.

Similarly, it is not intended to use the dynamic FE model to allow direct evaluation of local effects near the buttresses. Therefore, there is no impact from exclusion of the offset at the buttresses in the dynamic model. The local effects are evaluated using the detailed FE model.

Sections 02.5.1.3.2 and 02.5.1.5.2 of Technical Report MUAP-10006, Rev. 3, respectively, demonstrate that the dynamic FE model adequately captures the dynamic properties of the detailed FE model used for structural design of the PCCV, and that the ANSYS model developed for input into ACS SASSI has been properly translated into the ACS SASSI 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.