RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 490-3732 REVISION 0**
SRP SECTION:	**03.08.01 - Concrete Containment**
APPLICATION SECTION:	**3.8.1**
DATE OF RAI ISSUE:	**11/23/09**

QUESTION NO. RAI 03.08.01-08:

In its response to Question 3.8.1-8, MHI states that an analysis of the PCCV for seismic loadings determined that the resulting shear forces and moments do not cause cracking at the base of the PCCV cylindrical wall. Based on this MHI concludes that concrete cracking has only an insignificant effect on the natural frequencies of the PCCV. In addition, MHI states that investigation of load combinations of ASME Table CC-3230-1 was also conducted and they concluded that the effects of concrete cracking were not extensive enough to significantly affect these natural frequencies. MHI further states that the results of these analyses (which were omitted from the DCD) could be included if converted to ASME code checks.

The applicant is requested to provide the following information:

1. The staff finds MHI's response not acceptable because the concrete cracking may be caused by other loadings, such as the thermal load. The concrete may be already cracked before the SSE event. The applicant is requested to provide the rationale to support the argument that this scenario is not possible.

Also, in the 6th line of MHI's response it states: "….that cracking was not extensive enough to significantly affect the natural frequencies of the PCCV." This terminology is qualitative and the applicant is requested to provide the actual values that describe the extent of concrete cracking, such as providing a map of concrete cracking of the PCCV. In addition, the applicant is requested to explain the meaning of the second paragraph in the response, including what "results" are referred to in the sentence, and why and how would these results be "converted to ASME Code checks."

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-10033 (ML100430768).

The US-APWR standard plant reactor building (R/B) complex seismic analyses consider structural stiffness reduction due to concrete cracking. These analyses create two sets of

response spectra, one for cracked concrete and one for un-cracked concrete. The resultant data sets create an envelope of bounding responses for structural design.

The two levels of stiffness and damping used are:

1. full stiffness (un-cracked concrete) corresponding to lower stress levels; and
2. reduced stiffness (cracked concrete) corresponding to higher stress levels.

Technical Report MUAP-10006, Rev. 3 describes the PCCV (part of the R/B complex) dynamic three-dimensional finite element (FE) modeling approach. These documents describe use of two levels of stiffness and damping for seismic response analyses in order to capture structural stiffness and damping variations caused by concrete cracking.

Technical Report MUAP-10006, Rev. 3, Section 02.4.2.3 and Appendix 2-A, describe the methodology and stiffness reduction used to account for concrete cracking in the pre-stressed concrete containment vessel (PCCV) Dynamic analysis. Subsections 02.4.2.3, 02.5.1.3.2, 02.5.1.5.2, and Appendix 2-A provide additional technical basis details, including PCCV dynamic FE model validation results.

MHI's response in Question 3.8.1-8 of RAI 223-1996 has been revised and the text referenced in the last sentence of the final paragraph of the question (above) does not exist in this updated response.

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.