RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 661-5129 REVISION 2**
SRP SECTION:	**03.08.01 – Concrete Containment**
APPLICATION SECTION:	**3.8.1**
DATE OF RAI ISSUE:	**11/15/10**

QUESTION NO. RAI 03.08.01-13 (03.08.01-26):

In the response to Question 03.08.01-8, MHI states that the stress analyses of the PCCV show that besides small localized areas, the prestressed concrete of the PCCV remains in compression under mechanical loads. Cracking of the PCCV occurs due to accidental thermal loading; however, the maximum Safe Shutdown Earthquake (SSE) and the maximum thermal load are not considered to act concurrently in the analyses which is permitted by American Society of Mechanical Engineers (ASME) Section III CC-3230(c), which states that "the maximum effects of Pa, Ta, Ra, Rr, and G shall be combined unless a time-history analysis is performed to justify the lower combined values". The staff is not entirely convinced by the Applicant's statement that the lower combined values can be justified. MHI is requested to provide the actual timelines for each of the loads, and to provide the rationale supporting the assumptions for the timelines.

MHI further states that the effect of the possible shift of fundamental frequency of the PCCV due to concrete cracking will enveloped by the wide range of different subgrade conditions considered. The staff disagrees with this statement. The effect of concrete cracking and the different subgrade conditions are two different factors. They should not be mixed. MHI is requested to provide information that supports their assumption that the fundamental frequency shift is accounted for by using the wide range of subgrade conditions.

ANSWER:

This answer revises and replaces the previous MHI answer that was transmitted by letter UAP-HF-10357 (ML110100363).

Design of US-APWR prestressed concrete containment vessel (PCCV) considers the loading conditions identified in ASME Section III, Division 2, Table CC-3230-1. The PCCV design considers that the Table CC-3230-1 category Abnormal/Extreme Environmental individual loads act concurrently. The global design of the PCCV shell is controlled by safe-shutdown earthquake (SSE), Pa, and Ta, while Ra, Rr and G loads are localized events. These local effects are considered in the design of the penetration components backed by concrete, i.e., penetration sleeves. The penetration sleeves are designed to loads equal to or greater than the design basis accident loading and the resulting applied loads, i.e., combined global plus local forces and moments, are maintained within code allowables. A timeline is not furnished because the loads, SSE, Pa, Ta, Ra, Rr and G are considered to act concurrently.

The response to Question 03.08.01-8 of RAI 490-3732 has been updated and no longer contains the statement that the effect of the possible shift of fundamental frequency of the PCCV due to concrete cracking will be enveloped by the wide range of different subgrade conditions. The US-APWR standard plant reactor building (R/B) complex seismic analyses now 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.

Thus, the effects of frequency shifting due to cracking are considered in the soil-structure interaction analyses for the standard plant seismic design.

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 a Technical/Topical Report.

This completes MHI's response to the NRC's question.