REQUEST FOR ADDITIONAL INFORMATION 804-5938 REVISION 3

8/11/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 03.12 - ASME Code Class 1, 2, and 3 Piping Systems and Piping Components and Their Associated Supports
Application Section: 03.12

QUESTIONS for Engineering Mechanics Branch 1 (AP1000/EPR Projects) (EMB1)

03.12-26

DCD Tier 2, Section 3.12.3.4 states that seismic analysis of piping system is not performed using the time-history method. However, DCD Tier 2, Appendix 3C and section 3.9.3.1.4 states that RCL piping dynamic analysis is performed using time-history direct integration, the time-history modal, or response spectra methods. The staff is requesting MHI to clarify the difference by revising Section 3.12.3.4.

DCD Tier 2, Figure 3.8.3-2 showed SG lower support structure drawing. Two supports (parallel to hot leg) of SG lower lateral support structure functioned as non-linear one-direction supports. In general, non-linear dynamic analysis is analyzed using time-history direct integration method. The response spectra method or time-history modal is used in linear elastic dynamic analysis. The staff is requesting MHI to provide basis for using time-history modal, or response spectra methods for the non-linear support system. The staff also requests MHI to clarify which method is used for the RCL piping analysis and put the correct method in the DCD.

In RAI 03.12-16 response, MHI stated that SG lower lateral support will be installed to not restrain thermal expansion. The gap between SG and SG lower lateral support will be adjusted so that support will come in contact with SG only during operating condition. Figure 3.8.3-2 (Sheet 3 of 4) does not provide sufficient detail, the staff is requesting MHI to provide lower lateral support structure information and geometrical thermal calculation to ensure that there is enough clearance between the two supports closer to hot leg and SG during cooldown.

03.12-27

DCD Tier 2, Section 3.12.2 states that Codes and standards used in the design of piping systems and piping supports are consistent with 10 CFR 50, Appendix A, GDCs 1, 2, 4, 14, and 15 as described in Section 3.1, and 10 CFR 50, Appendix S.

DCD Tier 2 Section 3.12.2.1 states that piping design for the US-APWR uses the 1992 Edition including 1992 addenda of the ASME Code, Section III, Division 1, Subsections NB, NC, and ND. The staff noted that use of the 1992 Edition including 1992 addenda of the ASME Code alone does not meet 10 CFR 50.55a. The staff also noted that MHI does not mention the design is consistent with 10 CFR50.55a in DCD Tier 2 Section

3.12. The staff is requesting MHI to revise the DCD to assure the piping design to be consistent with 10 CFR 50.55a and also address the limitations and modifications described in 10 CFR 50.55a(b)(1).

03.12-28

DCD Tier 2, Subsection 3.12.3.6 states that "The equivalent static method is consistent with the guidelines of SRP Section 3.9.2.II.2(ii)." The staff noted that the correct guidelines is SRP Section 3.9.2.II.2.A(ii). The staff requests the applicant to revise the DCD to correct this typo.

DCD Tier 2, Section 3.12.5.7 states that "The environmental impact on fatigue of ASME Code, Section III (Reference 3.12-2), Class 1 piping follow the requirements delineated in RG 1.207, Rev.1 (Reference 3.12-26)." The staff notes that RG 1.207, Rev.1 does not exist. The staff requests the applicant to remove Rev. 1.

DCD Tier 2, Section 3.12.5.15 states that where integral welded attachments to piping are used in restraint design, standard industry practices and ASME Code Cases identified in Subsection 3.12.2.2 are used. The staff requests the applicant to discuss what kind standard industry practices are to be used for integral welded attachments for piping and update DCD to add a description of these standard industry practices.

03.12-29

DCD Tier 2, Section 3.12.5.9 discussed thermal cycling in piping connected to the RCS. In their RAI 3.12-17 response (ML0933380324), MHI stated that the piping is routed such that a stratified surface boundary does not occur at horizontal pipe bends and elbows. However, MHI did not provide discussion for the piping routing methodology in the DCD mark-up. The staff is requesting MHI to provide piping stratification prediction method. In general, US utilities followed MRP-146 model for predicting and evaluating thermal cycling for PWR stagnant lines. MHI provided research results of ICONE 10-23340 and ICONE 11-36214. However, ICONE 11-36214 identified that predictive accuracy of the evaluation method is about ± 20 percent from the limited experiment data. If MHI model is not consistent with MRP-146 model which has shown benchmarking results to be effective in predicting the location of thermal cycling in branch line attached to RCL, MHI should identify the difference and provide justification.

In their RAI 3.12-17 response, MHI stated that as verification of actual equipment, confirmation is made such that there is no stratification surface boundary (top of cavity flow) at pipe bends and elbows migrating horizontally from vertical risers by performing temperature measurement for actual equipment of isolated branch pipes around RCS during initial startup test. However, the staff reviewed DCD Chapter 14 verification programs which did not mention any activity related to the stratification surface boundary verification. The staff is requesting MHI provide additional information for the test abstract including stating the standard operating conditions in DCD Chapter 14 that identifies the Objective, Prerequisites, Test Method, Data Required, and Acceptance Criteria for unisolable piping connected to the RCS to address NRC Bulletin 88-08. In

general stratification verification monitoring activity shall be the COL's responsibility. However, this activity has not been listed as COL action item in the DCD. The staff asked MHI to clarify the responsibility. If this activity is to be completed by COL, the DCD should be modified to add this activity as a COL action item.

In the response, MHI provided the Table to address detection of leakage of the safety-related valves, the staff is requesting MHI to put this information in DCD mark-up.