RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

03/29/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 958-6608 REVISION 1**
SRP SECTION:	**03.08.03 – Concrete and Steel Internal Structures of Steel or Concrete Containments**
APPLICATION SECTION:	**3.8.3**
DATE OF RAI ISSUE:	**09/05/2012**

QUESTION NO. 03.08.03-91:

The staff evaluated the applicant's response to RAI 858-6126, Question 03.08.03-38, dated February 28, 2012, regarding the design, mix and construction issues associated with mass concrete. The response discussed one major issue associated with the use of mass concrete: cracking due to high heat generation or shrinkage deformation. However, to fully address the RAI question, the applicant is requested to provide the following information:

1. Regarding the design heat/temperature loads, provide more detailed information to support the conclusion that the design heat loads for SC structures from the internal containment vessel (CV) temperature surpass the heat generation from mass concrete casting. For example, describe (a) the temperature in the concrete core and at the surface, and maximum temperature difference, (b) how the direction of the gradient (i.e., higher inside temperature than outside) affects the comparison, and (c) the forces across the section which could assist in the comparison.

2. Explain how other effects of mass concrete are addressed such as volumetric changes due to the mass concrete. Also, indicate whether the provisions and guidance provided in ACI 207.1R will be used; otherwise, provide alternate justification or methods to address the effects of mass concrete.

3. For the consistency between the DCD and the RAI response, revise the contents in these two documents regarding the issues associated with mass concrete, as well as the techniques to address the issues and the corresponding ACI standards that are followed. For example, some of the concrete mixture and construction techniques discussed in the RAI response are not included in DCD Section 3.8, while the volume changes in mass concrete and the use of running chilled water lines are discussed in DCD Section 3.8 but not in the RAI response.

ANSWER:

Detailed discussion of the steel-concrete (SC) module fabrication and construction practices to be implemented for the US-APWR are provided in Technical Report MUAP-12006, Rev. 0, Steel Concrete (SC) Wall Fabrication, Construction and Inspection.

Technical Report MUAP-12006, Rev. 0, includes applicable codes and standards; module fabrication; transportation; erection (construction sequence); concrete placement; construction tolerances; inspection before, during, and after construction; and Quality Assurance (QA)/Quality Control for SC structures.

1. The increasing temperature due to concrete placement occurs in the short term, so it is treated as negligible load for the design of heat/temperature. If the load due to mass concrete placement is calculated to surpass the design load, the temperature is controlled by adopting temperature control methods. Additional information on controlling the temperature of the concrete are provided in Technical Report MUAP-12006, Rev. 0, Section 3.5.

2. Other effects of mass concrete such as volumetric changes due to the mass concrete are addressed in Section 3.5 of Technical Report MUAP-12006, Rev. 0. Construction for mass concrete shall meet American Concrete Institute (ACI) 304R-00 and ACI 207.1R-05. Regarding volumetric changes of mass concrete, basically volumetric changes are caused by “drying shrinkage,” “autogenous shrinkage,” or “thermal expansion.” For “drying shrinkage” and “autogenous shrinkage,” these shrinkages are to be controlled and minimized by the appropriate mixing design. Additional information on controlling the volumetric changes of the concrete are provided in Technical Report MUAP-12006, Rev. 0, Section 3.5.

3. Information on fabrication, construction and inspection including information related to mass concrete for SC structures is addressed Section 3.5 of Technical Report MUAP-12006, Rev. 0.

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.