
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

05/31/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 985-6948 REVISION 3

SRP SECTION: 03.08.03 – Concrete and Steel Internal Structures of Steel or Concrete Containments

APPLICATION SECTION: 3.8.3

DATE OF RAI ISSUE: 01/08/2013

QUESTION NO. 03.08.03-108:

The staff reviewed the applicant's response to RAI 905-6311, Question 03.08.03-78 regarding the steel concrete (SC) member design equations used for combined loading conditions.

The RAI response explained that the MHI design philosophy for combined force limits the contributions of the steel plates to tensile stresses only, and this is the basis to determine the required strength of a steel plate by checking the two orthogonal directions independently. The Rankine criterion is used for the steel plate design, that is, the plate can independently develop tension yielding in both orthogonal directions. The staff notes that Rankine criterion is mainly for brittle materials. But for biaxial tensile stress combinations, it is the same as the Tresca yield criterion for ductile materials. According to the Tresca yield criterion for ductile materials, for a plate subjected to tensile stress in one direction and compressive stress in the orthogonal direction, the required strength of the plate should be determined using the summation of the absolute values of the two stresses. The staff understands that the design approach used by MHI to calculate the flexural strength is conservative by neglecting the compression steel; however, it is unclear to the staff how this eliminates the need to check the steel strength for tensile stress in one direction in combination with compressive stress in the perpendicular direction. The forces/stresses come from the building analysis where you may have biaxial tension and compression acting at the same time; they are not a function of what is assumed in the design where the forces are checked for design requirements. Therefore, the staff requests that the applicant provide the technical basis for limiting the contributions of the steel plates to tensile stresses only in the design of US-APWR SC walls for combined forces.

ANSWER:

Technical Report MUAP-11019, Rev. 1, Section 8 - Design for Combined Forces was expanded to address this issue. The effects of biaxial stresses consisting of tensile stress in one direction and compressive stress in the perpendicular direction are addressed directly by using the Tresca yield criterion for the steel faceplates of the steel-concrete (SC) walls. This is discussed in Section 8.3 of Technical Report MUAP-11019, Rev. 1.

The design approach for SC walls subjected to combined forces includes:

Additionally, limits are imposed on the demand-to-capacity ratios in Section 8.7 to include an additional level of conservatism and account for secondary effects.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-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.