

# REQUEST FOR ADDITIONAL INFORMATION NO. 177-1932 REVISION 1

2/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation  
Application Section: 19.2.4.1

QUESTIONS for Structural Engineering Branch 1 (AP1000/EPR Projects) (SEB1)

19-291

DCD Section 19.2.4.1 describes the analysis of ultimate containment pressure capacity and states that the containment capacity is 216 psig. The applicant's calculation for ultimate capacity was performed using a simplified approach (stated to be conservative) and did not use a detailed finite element (FE) model to capture nonlinear material behavior, as recommended in Regulatory Guide 1.136, "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments." Absent a detailed FE analysis, it is not clear how stress concentrations resulting from structural discontinuities (e.g. containment penetrations, cylindrical shell-to-upper dome interface, and the wall-to-floor interface) are considered in the analysis of ultimate containment pressure capacity.

Further, the Level 2 PRA described in Section 19.1.4.2 uses a simplified calculation of capacity based on hoop direction yielding but it is not clear if a single deterministic value is used or if a probabilistic overpressure capacity (fragility) is used. Typically a Level 2 PRA would require a probabilistic description of the overpressure capacity. If a probabilistic definition of the overpressure capacity was used in the Level 2 PRA, the development of the containment overpressure fragility should be described in Section 19.2.4 of the DCD.

a) Staff requests the applicant to provide a summary of the governing failure modes and design margins relative to the design basis internal pressure for the PCCV for critical areas including the cylindrical shell away from discontinuities, the dome, the cylindrical shell to base mat connection, equipment hatch and personnel air lock.

b) Staff requests the applicant to describe the derivation of the containment overpressure fragility and state whether or not any COL action items are required.

c) DCD Section 19.2.4.1 states that a temperature range of 400~600°F was assumed for severe accident conditions and for the analysis of ultimate containment capacity. However, in this section there is no discussion of the basis for the selection of this temperature range. Further, this section does not discuss the affects of these temperatures on the concrete containment.

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To address this concern, the staff requests the applicant to provide a basis for assuming 400~600°F for the severe accident conditions and describe how temperature effects on concrete strength are addressed in the calculation of ultimate pressure capacity of containment.

d) DCD FSAR Section 19.2.4.1 describes the analysis of containment ultimate capacity. However, this section does not state how dead loads are considered in the analysis. RG 1.136, "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments." states that dead loads should be considered in containment loadings.

To address this concern, the staff requests the applicant to provide a description of how dead loads are considered in the calculation of ultimate pressure capacity of containment.