

REQUEST FOR ADDITIONAL INFORMATION 867-6174 REVISION 3

11/14/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 06.03 - Emergency Core Cooling System
Application Section: 6.3

QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects)
(CIB1)

06.03-103

The US-APWR safety injection (SI) pumps will be required to mitigate the entire range of small and large break loss of coolant accidents (LOCAs). The US-APWR Design Control Document (DCD) states that the design flow of each pump is 1540 gallons per minute (gpm) and the minimum flow is 265 gpm through the pump minimum-flow loop. Therefore, the pumps will be required to operate at flows significantly less than their best efficiency flow condition. When the pumps automatically actuate following a LOCA occurrence, they will run at these lesser flow conditions for a significant period of time before system pressure drops sufficiently to allow flow closer to the best efficiency point. Even with only one pump running, the smallest break LOCA would result in flows significantly less than best efficiency flow. When running at these low flow conditions the SI pumps may encounter recirculation cavitation. Recirculation cavitation is known to cause significant vibration and can damage pump impellers, wear rings, seals, shafts, and bearings within a short time period. By RAI 6.3-85, the NRC staff requested MHI to provide a description of the pump functional qualification and testing that will demonstrate the design-basis capability of the pumps for their required mission times under recirculation cavitation conditions. By letter dated July 8, 2011, MHI provided design criteria for the pumps and stated that MHI would request time-proven pumps to the vendors or request evaluations for pumps that do not have enough past records. The NRC staff does not consider the MHI response to fully describe the functional qualification and testing to demonstrate SI pump capability under recirculation cavitation conditions. Therefore, the staff requests MHI to specify in the US-APWR DCD that SI pump functional qualification will be accomplished in accordance with ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," as accepted in Revision 3 to Regulatory Guide 1.100, "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," and will demonstrate the design-basis capability of the pumps for their required mission times under recirculation cavitation conditions. In addition, the staff requests that MHI specify in the US-APWR DCD that the US-APWR will be designed to allow full flow testing of safety-related pumps in the Inservice Testing Program consistent with Commission policy for new reactor designs.