**REQUEST FOR ADDITIONAL INFORMATION 97-1551 REVISION 1**

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US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation
Application Section: 19.1

QUESTIONS for PRA Licensing, Operations Support and Maintenance Branch 1 (AP1000/EPR Projects) (SPLA)

19-183

In Section 6A.5.1.4 “Test and Maintenance” of the PRA report (MUAP-07030, Rev 1) it is stated that the emergency feedwater (EFW) pumps are tested every three months. The following statement is also made in Section 6A.5.1.4: “Periodic tests for the motor-driven and the turbine-driven emergency feedwater pumps are performed through the minimum flow line. In addition, pump flow tests are performed through test lines to check the pump operability.” From these statements it is not clear whether both types of tests (i.e., the one through the minimum flow line and the full flow test) are performed every three months. Please explain how the frequency of each of these tests is used to calculate failure probabilities, such as failure of pumps to start or motor-operated valves to open on demand. Also, please discuss how the 24-month testing frequency of components (e.g., check valves or motor-operated valves) located downstream of each test line was taken into consideration in assessing their failure probabilities. In addition, it is stated in Section 6A.5.1.4 that “During test and maintenance, isolation valves for each EFW pump discharge tie line are all kept open.” The human error to fail to close some of these valves following test or maintenance and, thus, the failure to separate the four trains does not appear to have been modeled in the PRA. Please explain, including assumptions and design features that are available, if any, to prevent such human errors.

19-184

In Section 6A.5.2.2.1 “Loss of Offsite power” of the PRA report (MUAP-07030, Rev 1) it is stated: “Two of four EFW pumps must supply feedwater to the associated SGs if the EFW pump discharge tie-line isolation valves are kept closed without power supply from the offsite power.” However, the staff notices that these motor-operated valves are supplied by dc power. Please clarify.

19-185

It is stated in Section 10.4.9.2.2 of the Design Control Document (DCD): “The manual valves in the suction line flow paths from the EFW pits to the M/D and T/D EFW pumps are normally closed.” However, these manual valves are modeled in the PRA as “locked open” during normal operation at power. Please clarify.

19-186

It is stated in Section 10.4.9.2.1 (item D) of the DCD: "Two 50% EFW pits are provided. Both EFW pits together contain the minimum water volume required for maintaining the plant at hot standby condition for 8 hours and performing plant cooldown for 6 hours until the RHRS can start to operate." However, in the PRA a 24-hour mission time was considered for sequences with successful delivery of emergency feedwater (EFW) with no credit for operator action to supply water from the demineralized water storage tank. Furthermore, the need to remove heat using the residual heat removal system (RHRS), even before 24 hours into the accident, was not modeled. Please explain.

19-187

A failure to open probability of 7E-4 per demand is assumed for the normally locked closed manual isolation valves VLV-006A and VLV-006B (PW2A and PW2B in the PRA) located in the line connecting the two EFW pits and for the manual isolation valve VLV-004 (PW3XV in the PRA) from the secondary tank (demineralized water storage tank) to the line connecting the two EFW pits. Please explain the basis of the assumed failure probability in terms of testing frequency and other relevant testing or monitoring requirements for these manual valves. Also, please explain why the operator failure to open valve VLV-004 (PW3XV in the PRA) has not been modeled in the PRA.

19-188

The emergency feedwater (EFW) line control throttle motor-operated valves (AWAA, AWBA, AWCA and AWDA) regulate feedwater flow to the steam generators (SGs). Since these valves are not in the EFW pump test lines, they are tested and verified every 24 months (US-APWR PRA Section 6A.5.3). It is assumed that failure to control is due only to demand stresses during their 24-hour mission time (no standby stresses during the 24 months between testing are considered). Please provide the basis for this assumption. Also, please explain why (1) the common cause failure (CCF) of the control valves to control the flow and (2) instrumentation and control (I&C) failures are not modeled in the PRA.

19-189

No common cause failure (CCF) of the emergency feedwater (EFW) pit water level sensors (other than miscalibration) is modeled in the PRA. Miscalibration is considered for the sensors of each pit separately (i.e., no miscalibration error across all sensors is considered). Please discuss.

19-190

The following statement is made in Section 10.4.9.2.2 of Revision 1 of the Design Control Document (DCD): "Upon LOOP, the main feedwater pumps trip and the water level of the SGs initially lowers and then recovers gradually upon initiation of the EFW

flow. To maintain the adequate range of water level in SGs, the EFW flow rate is manually controlled by the operator from the MCR." Please discuss how the operator failure to manually control the EFW flow rate was addressed in the PRA.

19-191

The assumed unavailability of the EFW pumps due to maintenance outage (4E-3/demand for the M-D pumps and 5E-3/demand for the T-D pumps) is based on operating reactor experience and technical specifications (TS). In the US-APWR design, the outage of a single EFW system train is not a limiting condition for operation and, therefore, the average outage time of an EFW pump can be much higher than it is for operating reactors. Please address this issue for the EFW system (and for any other systems that are impacted by this issue).