

REQUEST FOR ADDITIONAL INFORMATION 669-5219 REVISION 2

11/29/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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

QUESTIONS for PRA and Severe Accidents Branch (SPRA)

19-492

The staff has reviewed the US-APWR midloop risk analysis which dominates the US-APWR shutdown risk results. In Table 19-119, page 19.1-963, of the DCD, the applicant states that, "for manual operation, one hour is conservatively assumed to be the allowable time until exposure of reactor core." Based on the information in the DCD and the PRA, the staff is concerned that midloop operations are not being conducted in a manner that is consistent with staff guidance from GL 88-17 and industry guidance in NUMARC 91-06 which could lead to reduced times to core uncover and core damage. As stated in GL 88-17 Section 2.1.1, Pressurization, "Inappropriate use of SG nozzle dams can lead to complete core voiding within 15 or 20 minutes of a loss of RHR." It also states, "Cold leg openings can allow water to be ejected from the vessel following loss of DHR until sufficient water is lost that steam is relieved by clearing of the crossover pipes." In page 2.7.1, Recommendation, GL 88-17 states, "We recommend that licensees consider removing a pressurizer manway (if analysis shows this to provide a sufficient vent path) or otherwise create a suitable opening if a pressurization potential exists so as to limit the pressurization which could follow loss of DHR while nozzle dams and the reactor vessel head are in place." The staff requests the following information:

- (a) The staff requests MHI to document in the DCD in Chapter 19 Table 19-119 and Section 5.4.7.2.3.6, what large path will be opened in POS 4-2 to prevent pressurization of the upper plenum of the reactor vessel before the steam generators channel head manway covers are opened to install and remove nozzle dams. If a pressurizer manway is not used, please provide the staff with an analysis to show that this vent path is sufficient.
- (b) The staff requests MHI to document in Table 19-119 and Section 5.4.7.2.3.6 of the DCD that the COL applicant will implement procedures and administrative controls to assure that all hot legs are not blocked simultaneously by nozzle dams unless a vent path is provided that is large enough to prevent pressurization of the upper plenum of the reactor vessel.
- (c) The staff learned during recent conference calls that the installation and removal of the In-core Instrumentation System (ICIS) will not be done at mid-loop but will be done when the RCS level is approximately one foot below the flange. Please document this assumption in 5.4.7.2.3.6 and Chapter 19 Table 19-119 of the DCD.
- (d) The staff is requesting MHI to document in Section 5.4.7.2.3.6 and Table 19-119 of the DCD to provide an analysis to support whether Gravity Injection is feasible in POS 4-2 and POS 8-2 given the large RCS vent assigned to prevent RCS pressurization given a postulated loss of RHR.

REQUEST FOR ADDITIONAL INFORMATION 669-5219 REVISION 2

- (e) The staff is requesting MHI to revise the PRA and Chapter 19 of the DCD based on the answers to questions (a)- (e).

19-493

The staff has reviewed Chapter 19 of the DCD and the US-APWR shutdown PRA and finds insufficient justification to support that POS 8-1, midloop after refueling, is the limiting operational state. Based on information that MHI has provided, it appears that POS 4-2 and POS 4-3, midloop before refueling, are the limiting operational states due to high decay heat load. The staff also found POS durations that are not consistent with US refueling outage data. Therefore, the staff has the following questions.

- (a) MHI is requested to document in Section 5.4.7.2.3.6 and Chapter 19 of the DCD operational activities to be conducted during midloop that are not related to steam generator nozzle dam installation or removal.
- (b) MHI is requested to document in Section 5.4.7.2.3.6 and Chapter 19 of the DCD at what RCS vessel level will de-tensioning of the reactor head studs in preparation for reactor vessel head removal will be performed. The staff understands that this evolution will be performed at flange level but was analyzed to occur at midloop.
- (c) MHI is requested to document in Section 5.4.7.2.3.6 and Chapter 19 of the DCD at what RCS vessel level will tensioning of the reactor head studs in preparation for reactor vessel head installation will be performed. The staff understands that this evolution will be performed at flange level but was analyzed to occur at midloop.
- (d) MHI is requested to document in Chapter 19 of the DCD and the shutdown PRA a summary of the POSs considered in LPSD, including the state of the RCS, effectiveness of SG and gravity injection, key activities performed, etc. for each POS.
- (e) MHI is requested to use US refueling outage data to develop POS durations for POSs 4-1, 4-2, 4-3, 8-1, 8-2, and 8-3 or justify why US refueling outage data does not apply. Please revise the DCD and PRA as appropriate.
- (f) The staff learned that the duration of POS 4-3 has been extended from 6 hours to 39 hours to account for ICIS removal from the top of the RV head. Please revise the results, dominant sequences and sensitivity studies in the DCD and LPSD PRA, as appropriate.

19-494

The staff has reviewed MHI's response to RAI 19-442. Based on the US-APWR shutdown risk results on page 19.1-146 of the DCD, the shutdown CDF equals the shutdown LRF frequency. No credit was given for containment closure in the risk assessment. In their response to RAI 19-442, MHI reported that the USAPWR shutdown CDF removing all equipment not required by TS to be $2.1E-5$ per reactor year. This result means that the LRF removing all equipment not required by Technical Specifications (TS) to be $2.1E-5$ per reactor year which exceeds the Commission's safety goals for new reactors. The staff concludes that voluntary initiatives must be implemented by the COL applicant for the USAPWR design to meet the Commission's safety goals. The staff is requesting MHI to consider adding shutdown TS in accordance with Criterion 4 of 10CFR50.36 (c)(2)(ii) so that this design meets the Commission's

REQUEST FOR ADDITIONAL INFORMATION 669-5219 REVISION 2

safety goals for new reactors without voluntary initiatives or justify in the DCD why these actions are not necessary.