US-APWRRAIsPEm Resource

From:	Ciocco, Jeff
Sent:	Monday, April 22, 2013 2:18 PM
To:	us-apwr-rai@mhi.co.jp; US-APWRRAIsPEm Resource
Cc:	Pohida, Marie; Mrowca, Lynn; Reyes, Ruth
Subject:	US-APWR Design Certification Application RAI 1020-7081 (19)
Attachments:	US-APWR DC RAI 1020 SPRA 7081.pdf

MHI,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, MHI requests and we grant 45 days to respond to the RAI. We will adjust the schedule accordingly.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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REQUEST FOR ADDITIONAL INFORMATION 1020-7081

Issue Date: 4/22/2013

Application Title: US-APWR Design Certification - Docket Number 52-021

Operating Company: Mitsubishi Heavy Industries

Docket No. 52-021

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

QUESTIONS

19-584

The staff has reviewed the applicant's latest draft response to RAI 669-5219, Question 19-494 provided at the public meeting, and RAI 924-6352, Question 19-570 (Question 2), and RAI 899-6281, Question 19-566. The staff believes that options for TS coverage of Safety Injection (SI) and Containment Closure are needed to meet: (1) the Commission Goals for New Reactors, (2) 10CFR50.36(c)(2)(ii)(D) (Criterion 4), and 10CFR52.47(a)(4) . The staff's conclusion is based on the MHI's sensitivity study removing all equipment not required by TS (which estimated CDF to be 2E-5) , and staff review of Table 19.1-91, Dominant Cutsets of POS 8-1 for LPSD PRA (Sheet 1 of 10). In cutset numbers 1, 6, and 9, if all voluntary initiatives are removed, the frequency of the cutset becomes the initiating event frequency. Since containment closure is not required before boiling, the CDF equals LRF which exceeds the Goals for new reactors. The same risk conclusions apply to POS 4-3.

The staff reviewed the sensitivity studies in RAI Question 19-570 (Question 2) and noted that voluntary initiatives (which can be withdrawn at any time without prior staff approval) appear to be credited in these calculations, so the risk significance of containment closure and SI based on the level of protection provided to the public by regulations is reduced. It is important to note that containment closure and safety injection have been identified to be important based on operating experience as described in GL 88-17 and operating experience is identified as a factor in applying Criterion 4.

The staff has reviewed the applicant's response to RAI Question 19-566 which discusses containment closure. In response to RAI 19-493, in POS 4-2 and POS 4-3 (midloop before refueling), the time to RCS boiling is 20 minutes, and the time to core uncovery is 1.7 hours. Based on the response to RAI 19-566, time for hatch closure is 50 minutes based on Japanese experience. According to MHI, an optimized case for hatch closure using assumptions such as pre-staging (a common industry practice) estimated a time to closure of approximately 30 minutes. This optimized hatch closure time does not meet staff expectations as described in GL 88-17 which recommends a PWR licensee being able to close containment prior to exceeding RCS temperatures of 200 degrees F. Based on GL 88-17 and 10CFR52.47(a)(4) which requires, " adequacy of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents", the containment should not be opened unless it can be closed before boiling with any vent present in the RCS to assure that containment can be closed before a postulated core damage event. The staff also noted that MHI implemented a design change to use the non-safety related Alternate AC (AAC) power source (which is not required to be operable in Modes 5 and 6) to power the equipment hatch hoist in addition to offsite power. Chapter 8 of the DCD states "In the US-APWR design, power to the shutdown buses can be restored from the AAC sources within 60 minutes and, hence, coping analysis for a duration of 60 minutes is performed. Availability of power from the AAC GTG to one Class 1E 6.9kV bus within 60 minutes is verified by actual field testing." The staff has the following questions:

1. How does MHI justify the four hour containment closure time specified in TS considering a time to RCS boiling of only 20 minutes with respect to GL 88-17 and Criterion 4?

2. Given a loss of offsite power, how is containment closure feasible before RCS boiling (20 minutes) given that power to the equipment hatch hoist is provided by non-class 1E power that might not be available for 60 minutes?

19-585

The staff has reviewed MHI's response to RAI 924-6352, Question 19-568 and the draft revised response provided at the public meeting. The response states, " The purpose of operator isolation of the low-pressure letdown line is to stop the RCS inventory reduction that would occur with CVCS operation, not to protect the CS/RHR pump against potential air ingestion. Thus, the time for operator action is based on isolating the letdown line before reaching the top of the reactor core (4.77 feet below main coolant piping, MCP, hotleg center) rather than level reaching 0.33 inches above hotleg mid-pipe, which is associated with potential air ingestion." In POS 4-3 and POS 8-1, with the RCS vented via the pressurizer post RCS boiling and the vessel head installed, level indication could read higher than actual RCS level due to water entrained in the pressurizer since the upper level taps are connected to the pressurizer spray lines. Also, the staff learned that the hot leg level indication is not safety related (and therefore not required to be operable by TS).

The staff does not have sufficient justification to support that the CDF due to overdraining and failing to control level at midloop has a frequency which could be orders of magnitude lower than PWR operating data based on: (1) the potential inaccuracies of level indication post boiling, (2) the level indication is not safety related (sensor and signal processing are safety related), and (3) the failure probability of the operator to inject SI and charging after RCS water level reaches the top of the core before core damage appears to 1E-4 based on the cutsets. The staff has the following questions:

(1) How were the potential RCS level indication inaccuracies post boiling accounted for in the human reliability assessment in Chapter 19 for all impacted HEPs in the USAPWR shutdown PRA?

(2) The staff believes that the potential RCS level indication inaccuracies post boiling should be identified in the risk insights table (DCD Table 19.1-118). How is this risk insight and other risk insights from Table 19.1-118 of the DCD captured in the integration of the human reliability analysis and the human factors engineering program as described in Chapter 18 of the DCD?

(3) Since the level indication is not safety related, please describe what RCS level indication that would be available to the operator given a loss of offsite power.

(4) For POS 4-2 and POS 4-3, what is the time from core uncovery to the onset of core damage? How was this reduced time accounted for in the failure probability of the operator

to initiate safety injection?

19-586

The staff has reviewed the applicant's response to RAI 983-6953, Question 19-580. The staff understands that, "the igniters are required to mitigate a challenge to containment integrity from hydrogen detonation from both at-power and LPSD severe accident sequences". The staff also learned from inspections that licensees cover igniters to protect them during outage work in containment. To help the COL licensee maintain a containment closure capability consistent with GL 88-17 and 10CFR52.47(a)(4) "adequacy of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents". Please clarify in the risk insights table (Table 19.1-119), Chapter 19 of the DCD, and DCD Section 5.4.7 how many igniters are needed to keep the conditional containment failure probability below 0.1 due to hydrogen deflagration and detonation at shutdown. Is the success criteria 11/20 as referenced in RAI 871-6121?

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