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TOKYO, JAPAN

July 11, 2012

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-12196

Subject: MHI's Amended Response to US-APWR DCD RAI No. 897-6280 Revision 3 (SRP 05-04 Branch Technical Position)

Reference: 1) "Request for Additional Information No. 897-6280 Revision 3, SRP Section: 05-04 Branch Technical Position - Design Requirement of the Residual Heat Removal System, Application Section: 5.4.7" dated January 30, 2012.

2) MHI letter UAP-HF-12061, "Response to Request for Additional Information No. 897-6280 Revision 3, SRP Section: 05-04 Branch Technical Position-Design Requirement of the Residual Heat Removal" dated March 8, 2012.

3) MHI letter UAP-HF-12172, "MHI's US-APWR DCD RAI No.925-6413 Revision 3 (SRP Section 05.04.07)" dated June 25, 2012.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Amended Response to Request for Additional Information No. 897-6280 Revision 3".

Enclosed is the amended response to Question 05-04 Branch Technical Position-1 that is contained within Enclosure 1. This response revises Footnote 4 of Figure 1 in the previous response transmitted in Reference 2 to be consistent with Reference 3.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittal. His contact information is provided below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
Director - APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

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NRO

Enclosure:

1. Amended Response to Request for Additional Information No. 897-6280 Revision 3

CC: J. A. Ciocco
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Enclosure 1

UAP-HF- 12196
Docket No. 52-021

Amended Response to Request for Additional Information
No. 897-6280 Revision 3

July 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

07/11/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 897-6280 REVISION 3**

SRP SECTION: **05-04 BRANCH TECHNICAL POSITION**

APPLICATION SECTION: **5.4.7**

DATE OF RAI ISSUE: **01/30/2012**

QUESTION NO.: 05-04 Branch Technical Position-1

In DCD Section 5.4.7.2.3.6, "Mid-loop and Drain Down Operations" the RCS water level should be maintained higher than 0.33 feet above the loop center with an RHR flow of 1,550 to 2650 gpm. The staff has the following questions:

1. Is the 0.33 feet above the loop center the minimum value including uncertainties?
2. What controls or systems are in place to ensure the minimum mid-loop level is not violated?
3. What tests and/or analyses, at the most limiting RHR flow rate and mid-loop water level, have been performed to ensure that air entrainment and potential vortexing do not challenge the RHR pump safety functions? Describe how the tests and/or analyses are applicable to the US-APWR RHR inlet design.

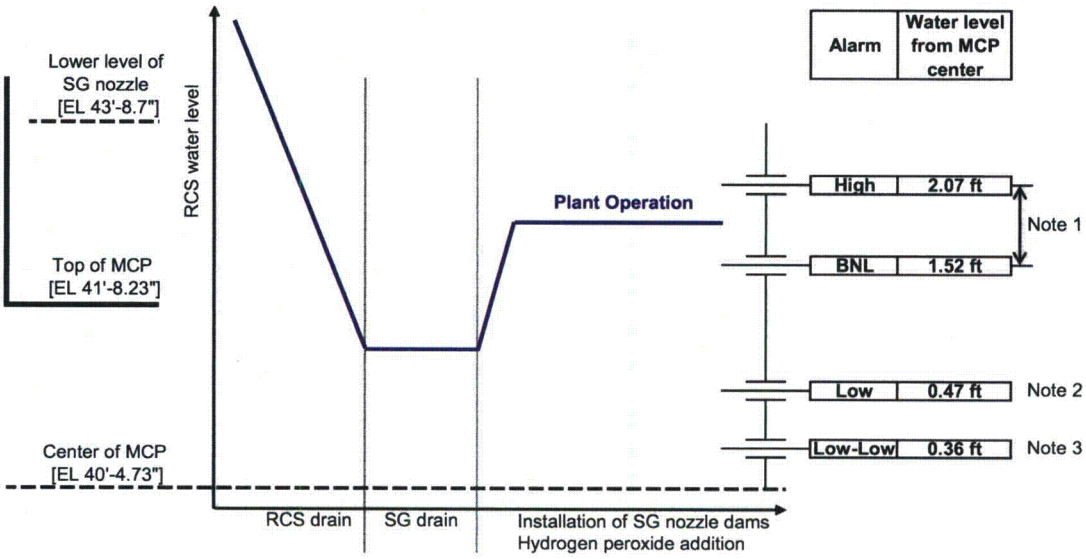
ANSWER:

1. The 0.33 feet above the loop center is the minimum analytical value without any intrinsic uncertainty. This value is the basis for the refueling operation and the alarms for the RCS water level. However, the Low-Low water level alarm is set to 0.36 feet above the center level of Main Coolant Pipe (MCP) to account for the instrument uncertainty (.03 feet). (Please see Figure 1)

2. The Chemical and Volume Control System (CVCS) is used for RCS water inventory control during mid-loop operation. The RCS water inventory is controlled by balancing between letdown flow rate and charging flow rate. The narrow range RCS water level instruments monitor the water level and function to alert the operator of decreasing RCS water level.. As shown in Figure 1, Below Normal Level (BNL), Low, and Low-Low alarms are installed to alert to the operator. Additionally, a low pressure letdown line isolation valve interlock actuated by the Low set point is installed as a back-up to manual operation. The operability of this interlock is required by the Technical Specifications (DCD Rev.3, Chapter 16, LCO 3.9.6, B3.9.6).

3. MHI has confirmed that in existing Japanese plants, RHR pumps could operate at a flow

rate of 2,645gpm (600 m3/h) at the center level of the MCP with no significant air ingestion. In addition, MHI performed a scale model test, which modeled the Japanese APWR MCP and RHR pump suction. The test result confirms the relation between RHR pump flow and the MCP water level that air ingestion will occur. Based on this experience and testing and since the RHR inlet configuration of the US-APWR is similar to the Japanese plant, this flow rate limit is applicable to the US-APWR design.



Note
1. Normal operating level is between High and BNL, excluding SG drain.
2. Low signal actuates automatic isolation for low-pressure letdown line.
3. Low-Low signal alerts operators of the need to manually align RCS for gravity injection from SFP.
4. Pre-operational testing for the CS/RHR pump is performed both at Low-Low water level and above Low water level.

MCP: main coolant piping
BNL: below normal level

Figure 1 RCS Water Level and Water Level Alarm during the Mid-loop Operation

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

There is no impact on the Topical Report / Technical Report