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TOKYO, JAPAN

November 4, 2009

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-09511

Subject: MHI's Responses to US-APWR DCD RAI No.464-3520 Revision 0

Reference: 1) "REQUEST FOR ADDITIONAL INFORMATION 464-3520 REVISION 0, SRP Section: 05.04.07 – Residual Heat Removal (RHR) System Application Section: 5.4.7, QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)" dated October 6, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No.464-3520 Revision 0."

Enclosed are the responses to Questions 05.04.07-7 through 05.04.07-11 that are contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

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

Enclosure:

1. Responses to Request for Additional Information No.464 Revision 0

CC: J. A. Ciocco
C. K. Paulson

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NRO

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Docket No. 52-021
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Enclosure 1

UAP-HF-09511
Docket No. 52-021

Responses to Request for Additional Information No.464-3520
Revision 0

November 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/4/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 464-3520 REVISION 0**
SRP SECTION:	**05.04.07 – RESIDUAL HEAT REMOVAL SYSTEM**
APPLICATION SECTION:	**5.4.7**
DATE OF RAI ISSUE:	**10/6/2009**

QUESTION NO.: 05.04.07-7

In Table 15.6.5-1 the ASTRUM run conditions for LBLOCA the maximum safety injection temperature is 120 deg-F. Also, in Table 15.6.5-2 SBLOCA inputs, the maximum accumulator temperature is 120 deg-F. The staff requests that the applicant confirm that there are temperature sensors and indications (alarms) in the control room that alert operators when RWSP water is greater than 120 degs-F. If no alarm is present discuss how the temperature is monitored and controlled by plant personnel to avoid the maximum 120 degs-F.

ANSWER:

As stated in DCD Subsection 6.3.5.4, a temperature channel is installed on the RWSP. This channel provides temperature indication and low temperature alarm in the MCR and RSC.

High temperature alarm is considered not to be necessary because of the following reasons:

- RWSP is located inside the containment and its water temperature depends on ambient temperature. The containment air temperature is controlled bellow 120 deg F, so potential to be over 120 deg F is very low. (In Note in SR 3.5.4.1 of the STS, NUREG-1431 Revision 3.1 states that RWST temperature surveillance is only required when ambient air temperature exceeds the limits. This concept of STS is the same of the US-APWR)

With regard to accumulator temperature, the same reason is applied.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/4/2009

US-APWR Design Certification

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RAI NO.:	**NO. 464-3520 REVISION 0**
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APPLICATION SECTION:	**5.4.7**
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QUESTION NO.: 05.04.07-8

The staff requests the applicant provide information about the flow rates during SFP gravity injection into RHR. Specifically, the flow rate of the refueling recirculation pump used to refill the RWSP and the flow rate from the SFP into the RHR.

ANSWER:

The flow rate during SFP gravity injection into RHR is approx 195 gpm. The details have been provided in RAI No.39, 19-44, UAP-HF-08200.

During SFP gravity injection, the refueling recirculation pump transfer water from RWSP to SFP. Its flow rate (the pump capacity) is 200 gpm. Therefore, there is sufficient capacity to supply water to the RWSP.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 05.04.07-9

The response to RAI 5.4.7-6 (RAI 163-1923, MHI Ref: UAP-HF-09057, dated 2/19/2009, ML090540469) provided a list of what subsections in the DCD address compliance with BTP 5-4. After reviewing the listed subsections, the staff indentified multiple areas where more information is needed to show the RHRS design basis is in compliance with BTP 5-4. Please provide additional references or revise the DCD to comply with the following requirements of BTP 5-4:

a. Functional Requirement C: The system shall be capable of being operated from the control room with either only onsite or offsite power available.

b. Pump Protection Requirements: The operating procedures of any RHR system shall have provisions to prevent damage to the RHR system from overheating, cavitation, or loss of adequate pump suction fluid.

c. Test Requirements: The isolation valve operability and interlock circuits must be designed so as to permit online testing when operating in the RHR mode. Testability shall meet the requirements of Institute of Electrical and Electronics Engineers Std 338-1987 and RG 1.22.

d. Test Requirements (1): The programs for PWRs shall include tests with supporting analysis to confirm that adequate mixing of borated water added before or during cooldown can be achieved under natural circulation conditions and permit estimation of the times required to achieve such mixing.

e. Address whether a COL Item should be created to comply with the "Operational Procedures" requirement in BTP 5-4.

ANSWER:

The additional references are shown as below:

a. Functional Requirement C: The system shall be capable of being operated from the control room with either only onsite or offsite power available.	Described in Subsection 5.4.7.2.3.4 and Subsection 7.4.1.
b. Pump Protection Requirements: The operating procedures of any RHR system shall have provisions to prevent damage to the RHR system from overheating, cavitation, or loss of adequate pump suction fluid.	Described in Subsection 13.5.2.
c. Test Requirements: The isolation valve operability and interlock circuits must be designed so as to permit online testing when operating in the RHR mode. Testability shall meet the requirements of Institute of Electrical and Electronics Engineers Std 338-1987 and RG 1.22.	Described in Subsection 5.4.7.2.5.
d. Test Requirements (1): The programs for PWRs shall include tests with supporting analysis to confirm that adequate mixing of borated water added before or during cooldown can be achieved under natural circulation conditions and permit estimation of the times required to achieve such mixing.	Described in Subsection 14.2.8.2.1.
e. Address whether a COL Item should be created to comply with the "Operational Procedures" requirement in BTP 5-4.	Operational Procedure is described in Subsection 13.5.2. COL Items related to operational procedures are described in this Section. So there is no need to create COL Item in Subsection 5.4.7.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 05.04.07-10

The DCD states that each RHR relief valve has a relief capacity of approximately 1,320 gpm at an approximate set pressure of 470 psig with an inlet and outlet size of 6 inches. Tier I, Table 2.4.2-5 does not include an ITAAC item associated with verifying the CS/RHR relief valve capability. MHI is requested to provide an ITAAC or explain why no ITAAC is needed.

ANSWER:

The CS/RHR pump suction relief valve is belongs to RHR system. Therefore, ITAAC item associated this valve is described in Tier 1, Table 2.4.4-5, 8.e. Please see this Table.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 05.04.07-11

Gas accumulation can cause water hammer, gas binding in pumps, and inadvertent relief valve actuation that may damage pumps, valves, piping, and supports and may lead to loss of system operability. Recently, GL 2008-01 (ML080110126) provided past instances of gas accumulation in operating plants and discussed the regulatory requirements related to gas accumulation prevention.

Have potential pathways for gas intrusion in the CS/RHR system been evaluated? If so, identify the pathways. What features are present in the US-APWR design which prevent gas accumulation to ensure CS/RHR system operability? What design features and operating procedures include means for detecting and controlling gas accumulation?

Describe the ITAAC test conditions for the CS/RHR pumps, NPSH (Tier 1, Table 2.4.5-5, 8f) test. Explain why these test conditions are conservative especially with regard to gas entrainment and its effect on NPSH.

ANSWER:

Potential gas intrusion in the CS/RHR system has been evaluated. DCD Subsection 6.2.2.2 states the design feature to preclude potential void. This feature is that the potential void is periodically excluded by dynamic venting during inservice testing. Please see DCD Subsection 6.2.2.2.

With regard to issue of nitrogen in the accumulator, the US-APWR design precludes this issue by the following features:

- The nozzles from RHR pump discharge line to the RCS is separated to the accumulator injection line. By this design, there are two check valves between the accumulator system and the RHR system, so potential to leak into the RHR system with dissolved water is decreased. (Ref: DCD Table 6.3-4, Sheet 14 of 15)
- In addition, there is normally closed valve between the accumulator system and the RHR system because RHR system is not used as low head injection system.

With regard to issue of air ingestion during mid-loop operation, DCD Subsection 5.4.7.2.3.6 states the design feature to preclude this issue. Please see DCD Subsection 5.4.7.2.3.6.

The ITAAC test condition for the CS/RHR pumps (Table 2.4.5-5, 8f) is mid-loop operation mode because this mode is the lowest water level as RHRS and the most severe condition for gas entrainment.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.