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TOKYO, JAPAN

February 19, 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-09057

Subject: MHI's Responses to US-APWR DCD RAI No.163-1923 Revision 0

Reference: 1) "REQUEST FOR ADDITIONAL INFORMATION NO. 163-1923 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 January 23, 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.163-1923 Revision 0."

Enclosed is the responses to Questions 05.04.07-1 through 05.04.07-6 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.163 Revision 0

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

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Contact Information

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Enclosure 1

UAP-HF-09057
Docket No. 52-021

Responses to Request for Additional Information No.163-1923
Revision 0

February 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

2/19/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 163-1923 REVISION 0**
SRP SECTION:	**05.04.07 – RESIDUAL HEAT REMOVAL SYSTEM**
APPLICATION SECTION:	**5.4.7**
DATE OF RAI ISSUE:	**1/23/2008**

QUESTION NO.: 05.04.07-1

RAI 5.4.7-1

DCD Tier 2 Section 5.4.7.2 describes the CS/RHR pump minimum flow line and pump testing during normal operations. The staff requires the reference or additional information be provided relative to the mini-flow line in order to ensure compliance with the in-service inspection requirements of 10 CFR 50.55a(g) pertaining to RHRS pump testing and the guidelines of Generic Letters GL 88-04 and GL 89-04:

a. Confirm adequate sizing of the line and presence of an installed flow measurement device; and describe the design function of the installed flow restrictor to preclude pump damage during testing.

b. Describe the CS/RHR pump testing during normal operations.

c. Address whether a single failure can result in conditions causing a "dead-head" no flow condition of the CS/RHR pumps during min-flow operation.

This information is needed in order to ensure that potential generic deficiency associated with in-service testing of pumps utilizing minimum flow lines as described in Generic Letter 89-04 has been adequately addressed.

ANSWER:

Each CS/RHR pump has a dedicated full-flow line and the full-flow line is used for in-service testing. The minimum flow line is not the only flow path during in-service testing. Since each CS/RHR train is independent of other trains and have dedicated full-flow and minimum flow lines installed the RHRS design complies with GL 89-04 and BL 88-04. The RHRS configuration is shown in Figure 5.4.7-2.

a. The CS/RHR pump minimum flow line size is 3-inch and a flow instrument is installed each of these lines as shown in Figure 5.4.7-2.

b. Each CS/RHR pump can be tested during normal operations. Pump testing is performed using the full-flow line and the RWSP. The pump takes suction from the RWSP and returns water to

the RWSP through the full-flow line. During this operation, pump flow rate and discharge pressure can be confirmed.

c. Since each CS/RHR pump has a minimum flow line installed and each train is independent of the others, there is no potential for a "dead-head" (no flow) condition due to failure of the other trains. Also, since there are no active components in the flow path during minimum flow operation, the possibility of such a condition is very low (Only locked-open manual valve, orifices and heat exchangers are in the flow path during minimum flow operation). This configuration is shown in Figure 5.4.7-2.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There are no impacts on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

2/19/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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APPLICATION SECTION:	**5.4.7**
DATE OF RAI ISSUE:	**1/23/2008**

QUESTION NO.: 05.04.07-2

RAI 5.4.7- 2

The US-APWR RHR is provided with a leakage detection system designed to detect and minimize the leakage from those portions of the RHR system outside of the containment structure that contain or may contain radioactive material following an accident. The DCD also states that plant programs and procedures will detect, monitor, and control RHR leakage. DCD Tier 2 Section 5.2.5.3.1 describes the RHRS leakage detection instrumentation; and the requirements for a leakage control program, including schedule for re-testing, are addressed in DCD Tier 2 Chapter 16, Technical Specification 5.5.2, "Programs and Manuals – Primary Coolant Sources Outside Containment." However, in order for the staff to complete its review of the RHRS design and determine that the design basis meets the design requirements of 10 CFR 50.34(f)(2)(xxvi), additional information regarding the RHRS leakage detection system and initial testing of the leakage detection system is required. Provide the reference or additional information describing the leakage detection system outside the containment and identify the initial test of DCD Tier 2 Section 14.2 in regard to testing of the leakage detection system.

ANSWER:

RHRS leakage detection system is included in Equipment and Floor Drainage Systems described in Chapter 9, Subsection 9.3.3. Instruments for leakage detection are described in Subsection 9.3.3.5.

Initial testing of the leakage detection is described in Chapter 14, Subsection 14.2.12.1.77, "Miscellaneous Leakage Detection System Preoperational Test". The initial testing of the ESF equipment room leakage detection is included in this test. The acceptance criteria for this test refers to subsection 9.3.3 which includes level instrumentation and alarms for the ESF equipment rooms.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There are no impacts on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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APPLICATION SECTION:	**5.4.7**
DATE OF RAI ISSUE:	**1/23/2008**

QUESTION NO.: 05.04.07-3

RAI 5.4.7-3

In the US-APWR DCD Subsection 5.4.7.2.3.6, "Mid-loop and Drain Down Operations", Part E, "Water supply from spent fuel pit", the applicant states when the water level of RCS abnormally drops whereby none of the RHR pumps can be operated because of air intake, the operator can manually configure the interface between the spent fuel pit (SFP) and RHR to provide SFP water to the reactor vessel. The piping at the SFP structure is physically located four feet below the normal SFP water surface and the water is supplied to the RHR by gravity. Based on the review of Section 5.4.7, the SRSB staff has several questions:

1) Is the approximately 34,042 gallons injected to the RHR system sufficient inventory to recover RHR level to allow restart of the RHR pumps?

2) In startup test 14.2.12.1.22, "Residual Heat Removal System (RHRS) Preoperational Test", Objective 5 is to demonstrate proper operation of the RHRS during low RCS water level (e.g., mid-nozzle level) and to verify sufficient margins exist to prevent vortexing or air entrainment in the suction lines and Test Method 4 verifies operation of the RHRS during RCS mid-loop hot leg water level operation, no provision was found to verify proper configuration interface between the SFP and RHR. Explain why a test is not needed to verify proper operation of the SFP gravity drain injection to the RHR.

ANSWER:

1) The initial water volume of SFP does not matter since SFP water is supplied from RWSP using the refueling water recirculation pump during gravity injection. The purpose of this operation is to supply water into the core to compensate for the transpiration that is due to decay heat, rather than to allow restart of the RHR pumps.

2) Startup test 14.2.12.1.22 will be revised to add the SFP gravity drain injection to the RCS.

Impact on DCD

This revision impacts the DCD revision 1 in, Subsection 14.2.12.1.22, "Residual Heat Removal System (RHRS) Preoperational Test" as follows:

A. Objectives

<u>7. To demonstrate proper operation of the SFP gravity drain injection to the RCS.</u>

C. Test Method

5. Operation of the SFP gravity injection to the RCS during mid-loop operation is verified.

D. Acceptance Criteria

7. The SFP water can be injected to the RCS by gravity during mid-loop operation.

Impact on COLA

There are no impacts on the COLA.

Impact on PRA

There is no impact on the PRA.

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SRP SECTION:	**05.04.07 – RESIDUAL HEAT REMOVAL SYSTEM**
APPLICATION SECTION:	**5.4.7**
DATE OF RAI ISSUE:	**1/23/2008**

QUESTION NO.: 05.04.07-4

RAI 5.4.7-4

In the DCD Section 5.4.7, it is not apparent that the applicant describes the reasons for the RHRS satisfying the requirements of GDC 4. Provide the reference that describes the RHRS in regard to satisfying GDC 4 requirements that SSCs important to safety be designed to accommodate the effects of and be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accident conditions, including dynamic effects of such events as flow instabilities and water hammer.

ANSWER:

The DCD Subsection 5.4.7 will be revised to add description of the RHRS design that satisfies the GDC 4 requirements.

Impact on DCD

This revision impacts revision 1 of the DCD at the last bullet of Design Bases in Subsection 5.4.7.1, as follows:

- The RHRS system is designed for protection against missiles (Refer to Section 3.5), protection against dynamic effects associated with the postulated rupture of piping and pipe whipping (Refer to Section 3.6), discharging fluids inside and outside the containment (Refer to Section 3.4), fires, loss-of-coolant accidents loads, ~~and~~ seismic effects (Refer to Section 3.7)<u>, and to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents (Refer to Section 3.11)</u>.

Impact on COLA

There are no impacts on the COLA.

Impact on PRA

There is no impact on the PRA.

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2/19/2009

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APPLICATION SECTION:	**5.4.7**
DATE OF RAI ISSUE:	**1/23/2008**

QUESTION NO.: 05.04.07-5
RAI 5.4.7-5
To complete the review of the RHRS in accordance with SRP 5.4.7 and RG-1.68, provide the P&IDs of the RHRS and systems that interface with the RHRS.

ANSWER:

The P&ID of the RHRS is shown in Figure 5.4.7-2.

The locations of P&IDs of the systems that interface with the RHRS are shown as follows:

RCS:	Figure 5.1-2
CSS:	Figure 6.2.2-1
CVCS:	Figure 9.3.4-1
SFPCS:	Figures 9.1.3-1 and 9.1.3-2
CCWS:	Figure 9.2.2-1

Impact on DCD

There are no impacts on the DCD.

Impact on COLA

There are no impacts on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

2/19/2009

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Docket No. 52-021

RAI NO.: **NO. 163-1923 REVISION 0**

SRP SECTION: **05.04.07 – RESIDUAL HEAT REMOVAL SYSTEM**

APPLICATION SECTION: **5.4.7**

DATE OF RAI ISSUE: **1/23/2008**

QUESTION NO.: 05.04.07-6

RAI 5.4.7-6

In the US-APWR DCD, rev. 1, subsection 5.4.7.1, "Design Bases," the applicant states, "The RHRS pressure boundary and pressure boundary components are designed to meet ... RG 1.139." In June 2008, the NRC withdrew Regulatory Guide 1.139, "Guidance for Residual Heat Removal" (see Federal Register Notice 73 FR 32750).

Since March 2007, SRP 5.4.7 has referenced Branch Technical Position (BTP) 5-4, "DESIGN REQUIREMENTS OF THE RESIDUAL HEAT REMOVAL SYSTEM." Verify that DCD section 5.4.7 meets the requirements of BTP 5-4 as stated in SRP 5.4.7. Provide the results of this verification. If necessary, revise DCD section 5.4.7 and provide markups of the revisions.

ANSWER:

The first bullet of Design Bases, Subsection 5.4.7.1, will be revised to refer to Branch Technical Position (BTP) 5-4 instead of RG 1.139. Compliance with BTP 5-4 is shown as follows:

I Functional requirement for taking to cold shutdown	
a. Capability using only Safety-grade systems.	Described in Subsection 5.4.7.2.3.4
b. Capability with either only onsite or only offsite power and with a single failure (limited action outside control room to meet the single failure criterion).	Same as above
c. Reasonable time for cooldown assuming most limiting single failure and only offsite or only onsite power.	Same as above
II. RHR isolation	Described in Subsection 5.4.7.1 and 5.4.7.2.2.3
III. RHR pressure relief Collect and contain relief discharge.	Described in Subsection 5.4.7.2.2.3
V. Test requirement Meet Regulatory Guide 1.68. For PWRs, test plus analysis for cooldown under natural circulation to confirm adequate mixing and cooldown within limits specified in EOP.	Described in Subsection 5.4.7.2.4, 14.2.12.1.22 and 14.2.12.2.3.9

VI. Operational procedure Meet Regulatory Guide 1.33. For PWRs include specific procedures and information for cooldown under natural circulation.	Described in Section 13.5
VII. Auxiliary feedwater supply Seismic Category I supply for auxiliary feedwater for at least 4 hours at hot shutdown plus cooldown to RHR cut-in based on longest time for only onsite or only offsite power and assumed single failure.	Described in Subsection 10.4.9

Impact on DCD

This revision impacts revision 1 of the DCD in Subsection 5.4.7.1, first bullet as follows:

- The RHRS pressure boundary and pressure boundary components are designed to meet GDC 2, GDC 4, GDC 5, GDC 19 Control Room, GDC 34, and BTP 5-4~~RG 1.139~~.

Impact on COLA

There are no impacts on the COLA.

Impact on PRA

There is no impact on the PRA.