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May 26, 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-09258

Subject: MHI's Responses to US-APWR DCD RAI No. 329-1860 Revision 0

Reference: 1) "Request for Additional Information No. 329-1860 Revision 0, SRP Section: 10.03 – Main Steam Supply System: DCD Section 10.3" dated May 21, 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. 329-1860 Revision 0."

Enclosed is the responses to Questions 10.3-1 through 10.3-3 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,

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

Enclosure:

1. Responses to Request for Additional Information No. 329-1860 Revision 0

CC: J. A. Ciocco
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Docket No. 52-021
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Enclosure 1

UAP-HF-09258
Docket No. 52-021

Responses to Request for Additional Information No. 329-1860
Revision 0

May 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

05/26/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 329-1860 REVISION 0**
SRP SECTION:	**10.03 – MAIN STEAM SUPPLY SYSTEM**
APPLICATION SECTION:	**DCD SECTION 10.3**
DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO.: 10.3-1

Conformance to GDC 4, as related to environmental and dynamic effects, requires that the safety-related portions of the main steam supply system (MSSS) design should adequately consider water (steam) hammer and relief valve discharge loads to assure that system safety functions can be performed and should assure that operating and maintenance procedures include adequate precautions to prevent water (steam) hammer and relief valve discharge loads. During its review of Section 10.3.2.4, 'System Operation" of the US-APWR DCD, the NRC staff noted that the applicant did not address the issue of water (steam) hammer, relief valve discharge loads, and water entrainment effects as described in GDC 4 ("SRP Acceptance Criteria," Item II of SRP Section 10.3). Therefore, the staff requests the applicant to provide additional information to address these effects.

Further, Item 1 in Section IV, "Evaluation Findings" of SRP Section 10.3 for the MSSS describes that the applicant will review operating and maintenance procedures to alert plant personnel to the potential for, and means to minimize, water (steam) hammer occurrences, and this commitment is to be stated in the applicant's safety analysis report (SAR). However, Section 10.3 of the DCD does not address operating and maintenance procedures that include any precautions to avoid the water (steam) hammer or water entrainment effects. Also, the FSAR does not address any combined license (COL) information item for the COL applicants to develop and implement these procedures. Therefore, the staff requests the applicant to provide additional information to the staff, and also update the DCD to address these effects. Further, the staff requests the applicant to provide a COL information item to ensure procedures are established to preclude water (steam) hammer and water entrainment effects. Furthermore, the staff requests the applicant to provide information pertaining to any analyses performed, if any, in this regard.

ANSWER:

The design bases for the main steam supply system components and piping supports considers steam hammer forces resulting from the rapid closure of the turbine stop valves which has the most rapid closure time in the system connected to the main steam supply system. The design bases for the components and piping support of the main steam supply system consider fluid forces resulting from safety and relief valve operations. DCD 3.12.5.3.5 Fluid Transient Loads describes steam hammer and relief valve discharge load.
Isolation valve operation and drain pot operation considers steam line water entrainment effects. During plant startup and before opening the main steam isolation valve, the downstream piping of the main steam isolation valve is warmed gradually through opening of the main steam bypass isolation valve, thereby preventing water slug formation in the condensate upon the opening of the main steam isolation valve. Main steam lines have drain lines with steam traps and drain pots

upstream of each steam trap. Each trap has piping installed parallel to an automatic power operated valve that opens when a drain pot high level switch activates due to plugging of the steam trap orifice. Simultaneously, a high water level alarm is annunciated to the MCR when the level switch activates.
COL information item regarding development of a milestone schedule for implementation of the procedure will be added.

Impact on DCD

The following description will be added in DCD subsection 10.3.2.4 System Operation:

10.3.2.4.3 Water (Steam) Hammer Prevention

The MSS design considers water (steam) hammer and relief valve discharge loads to assure that system safety functions can be performed. Refer to DCD subsection 3.12.5.3.5 Fluid Transient Loads for a description of steam hammer caused by rapid valve closure and relief valve discharge loads in the piping analysis.
MSIV operation and drain pot operation considers steam line water entrainment effects. Before opening the MSIV during plant start up, main steam piping down stream of the MSIV is warmed gradually by opening the MSBIV, hence, water slug formation in the condensate is prevented. The automatic power operated valve attached parallel to the steam trap opens when the drain pot high level switch activates, and the high level alarm is annunciated to MCR to give warning to the operator.
The Combined License Applicant is to provide operating and maintenance procedures including adequate precautions to prevent water (steam) hammer, relief valve discharge loads and water entrainment effects in accordance with NUREG-0927. The procedures should address:

- Prevention of rapid valve motion
- Introduction of voids into water-filled lines and components
- Proper filling and venting of water-filled lines and components
- Introduction of steam or heated water that can flash into water-filled lines and components
- Introduction of water into steam-filled lines or components
- Proper warmup of steam-filled lines
- Proper drainage of steam-filled lines
- The effects of valve alignments on line coditions.

COL Item 10.3(3) will be added to DCD Section 10.3.7 as shown below:

COL 10.3(3) Operating and maintenance procedures for water hammer prevention
The Combined License Applicant will develop a milestone schedule for implementation of the procedure.

DCD Table 1.8-2 Compilation of All Combined License Applicant Items for Chapters 1-19 (sheet 29 of 44) will be revised as shown below.

COL ITEM NO.	COL ITEM
COL 9.5(9)	*The COL Applicant addresses the emergency communication system requirements delineate in 10 CFR 73.55(f) such that a single act cannot remove onsite capability of calling for assistance and also as redundant system during onsite emergency crisis.*
COL 9.5(10)	*Deleted*

COL 10.2(1)	*Inservice Inspection* *The Combined License Applicant is to develop turbine maintenance and inspection procedure and then to implement prior to fuel load. Plant startup procedure including warm-up time will be completed therein.*
COL 10.3(1)	*FAC monitoring program; The Combined License Applicant ~~is to address preparation~~ will provide a description of ~~a~~ the FAC monitoring program for carbon steel portions of the steam and power conversion systems that contain water or wet steam. The description will be address consistency with Generic Letter 89-08 and NSAC-202L-R3 and will provide a milestone schedule for implementation of the program in accordance with NUREG-0927 and will provide a milestone schedule for implementation of the procedure.*
COL 10.3(2)	*Safety and relief valve information; The Combined License Applicant is to address the actual throat area of the MSSV.*
COL 10.3(3)	*Operating and maintenance procedures for water hammer prevention; The Combined License Applicant will provide a milestone schedule for implementation of the procedure.*
COL 10.4(1)	*Circulating Water System; The Combined License Applicant is to determine the site specific final system configuration and system design parameters for the CWS including makeup water and blowdown.*
COL 10.4(2)	*Steam Generator Blowdown System; The Combined License applicant is to address the discharge to Waste Water System including site specific requirements.*
COL 10.4(3)	*Deleted*
COL 10.4(4)	*Deleted*
COL 10.4(5)	*System Design for Steam Generator Drain; The Combined License applicant is to address the nitrogen or equivalent system design for Steam Generator Drain Mode. (This is dependent on Waste water system design)*

Impact on COLA

Changes made to the DCD will have to be reflected into corresponding sections of the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

05/26/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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SRP SECTION:	**10.03 – MAIN STEAM SUPPLY SYSTEM**
APPLICATION SECTION:	**DCD SECTION 10.3**
DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO.: 10.3-2

MSSS compliance with GDC 34, as relates to residual heat removal (RHR), requires that the safety-related portion of the MSSS is to remove residual and sensible heat from the reactor coolant system (RCS) in pressurized water reactor (PWR) plants (Item 3, Section IV, Evaluation Findings," of SRP Section 10.3). The MSSS of the U.S. APWR provides this function of cooling the RCS by venting SG steam to atmosphere by the main steam depressurization valves (MSDVs). In FSAR Section 10.3.2.4.2, "Emergency Operation," the DCD describes that the MSDVs are used to remove the reactor decay heat and primary system (i.e., RCS) sensible heat in order to cooldown the RCS to the conditions at which the RHR system can perform the remaining cooldown function. In the event that one MSDV is not available, the US-APWR DCD states that the remaining MSDVs are sufficient to cooldown the plant. Further, in Item B, "Main Steam Depressurization Valve," of FSAR Section 10.3.2.3.3, the DCD describes that the MSDVs are designed to provide controlled removal of reactor decay heat, in conjunction with the emergency feedwater system (EFWS), during safe shutdown after a plant transient, accident condition or emergency condition when the turbine bypass system is not available. However, it is not clear how the motor operated MSDVs will function during an accident coincident with a loss of off-site power and what design features are used in the coping analysis for a Station Blackout (SBO) event per 10 CFR 50.63, "Loss of all alternating current power." Therefore, the staff requests the applicant to provide additional information in this regard. Also, the staff requests the applicant to explain the capabilities of the MSDVs cooling the RCS, in case when an MSDV is not available.

ANSWER:

Because MSDVs are three-phase AC motor operated valves, and the valves are activated by converting DC from Class 1E battery into AC with inverters, the valves can be operated during LOOP or SBO condition. However, since the capacity of the battery is adequate only for 2 hours, battery charging from Class 1E GTG during LOOP and from AAC GTG during SBO condition must continue. However, MSDVs are not necessary during SBO condition as shown in response to question no. 10.3-3.

By using MSDVs, MSS functions to cool the RCS in conjunction with the EFWS during safe shutdown. Because 2 of 4 MSDVs have adequate steam release capacity for RCS cooling to RHR entry condition, failure of one MSDV is acceptable.

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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05/26/2009

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QUESTION NO.: 10.3-3

With respect to conformance to 10 CFR 50.63, as it relate to an SBO event, in FSAR Tier 2 Section 10.3.1.1, the DCD states that the U.S. APWR is provided with an alternate alternating current (AAC) power source to cope with an SBO event. The regulatory requirement is that each light-water-cooled nuclear plant must be able to withstand for a specified duration and recover from an SBO event. The factors that are considered for the SBO duration include, but not limited to, redundancy and reliability of the onsite emergency AC power sources. Also, FSAR Tier 2 Section 8.4, "Station Blackout," of the DCD describes the regulatory requirements, recovery from SBO, an analysis, and other SBO pertinent details. However, the DCD does not provide and/or identify any details regarding which components of the MSSS are required to be functional and what their emergency power sources are during an SBO event. FSAR Section 10.3.3 identifies that redundant power supplies are provided to operate MSIVs for containment isolation.
However, the DCD does not address its functionality and emergency power source during an SBO. Additionally, FSAR Tier 2 Section 8.4.3, "Combined License Information," states that no additional information is required to provide by a COL applicant as related to an SBO. In order to complete its review of this area as related to 10 CFR 50.63 requirement for SBO event, the staff requests the applicant to provide design and operating details for the MSSS and its components as related to the SBO.
Also, the staff requests the applicant to provide supporting justification that the AC power source to the MSSS components is adequate to withstand and recover from an SBO event.

ANSWER:

The plant is designed to maintain hot-standby conditions for more than 8 hours during SBO events. During SBO, the MSS can adequately keep the RCS in a hot-standby condition by using 105 % rated steam flow capacity main steam safety valves for decay heat removal in conjunction with feedwater supply from the EFWS. MSDVs are not required to be kept in hot-standby condition.

The AAC GTG can power MSDV via the Class 1E power system until power supply is restored in accordance with DCD subsection 8.4.1.4 Recovery from SBO.

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.