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TOKYO, JAPAN

March 10, 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-09083

Subject: MHI's Responses to US-APWR DCD RAI No. 148-1700 Revision 1

Reference: 1) "Request for Additional Information No. 148-1700 Revision 1, SRP Section: 19-Probabilistic Risk Assessment and Severe Accident Evaluation, Application Section: 19.1," dated January 9, 2009
2) Letter MHI Ref: UAP-HF-09046 from Y. Ogata (MHI) to U.S. NRC, "MHI's Responses to US-APWR DCD RAI No.148-1700," dated February 6, 2009

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document as listed in Enclosure.

Enclosed is the second response to the RAIs contained within Reference 1. In the initial responses submitted with Reference 2, MHI committed to submit responses to19-275 within 60 days after RAI issue date.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittal. 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.148-1700 Revision 1

CC: J. A. Ciocco
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Docket No. 52-021
MHI Ref: UAP-HF- 09083

Enclosure 1

UAP-HF-09083
Docket No. 52-021

Response to Request for Additional Information
No. 148-1700 Revision 1

March 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

3/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO. 148-1700 REVISION 1**

SRP SECTION: **19 – Probabilistic Risk Assessment and Severe Accident Evaluation**

APPLICATION SECTION: **19.1**

DATE OF RAI ISSUE: **1/9/2009**

QUESTION NO. : 19-275

Please address the following questions related to the heating, ventilation and air conditioning (HVAC) system discussed in Attachment 6A.14.4 of Revision 1 of the USAPWR PRA report.

(a) The following statement is made (Section 6A.14.4.1.1): "The PRA models the HVAC systems that have the potential to significantly impact the mitigation system functional reliability. Discussion is provided below for each HVAC system listed above, describing how it impacts the reliability of mitigation function and how it is treated in the model." However, the provided discussion is not detailed enough to show why most of these mitigating systems do not need HVAC for at least 24 hours following an accident. For example, it is stated that the turbine-driven (T-D) emergency feedwater (EFW) pumps can operate under high ambient air temperature conditions and, therefore, HVAC is not modeled in the PRA. More detailed information is needed to qualify how these assumed "high ambient air temperature conditions" compare to the design limit. On the other hand, if the T-D EFW pumps can operate at high ambient air temperature conditions, they have a design feature credited in the PRA which must be listed in the appropriate Chapter 19 section (Table 19.1-115) of the US-APWR design control document (DCD). Also, no discussion is provided about the impact, and modeling in the PRA, of the loss of HVAC to the main control room (MCR).

(b) It is stated that HVAC of class 1E electric areas is not modeled in the PRA because it is running during normal operation and, therefore, its reliability during the mission time needed to mitigate an accident is expected to be high. However, this argument is not supported by the failure probabilities reported in Table 6A.14.4-4. For example, the probabilities of an essential chiller unit or an HVAC fan to fail to run for 24 hours are about 2E-3 and their associated common cause failure (CCF) probabilities, which are not reported, are most likely in the 1E-4 to 1E-5 range. These probabilities do not appear to be negligible since the availability of important safety systems, such as the class 1E electrical systems, is impacted. Please discuss.

(c) Common cause failure (CCF) of chillers (even all four) is modeled, as the reported results for large release frequency (LRF) as well as the results for internal fires and floods indicate. However, there is no

discussion or reference about this modeling in Attachment 6A.14.4 where the HVAC system is discussed. Please explain..

ANSWER:

Answer to question (a)

Impact of loss of HVAC in MCR and EFWP area are described below.

MCR : The operator actions in the MCR can be also implemented with the remote shutdown consol (RSC). The HVAC for the RSC is diverse from that of MCR. Therefore the loss of HVAC is not modeled for operator actions in the MCR.

EFWP area : EFW turbine-driven pumps are designed to operate for several hours without HVAC. In PRA, the HVAC for EFW turbine-driven pumps is not modeled because recovery of core cooling by RHR is expected during this time. On the other hand, EFW motor-driven pumps have low resistance to high temperature compared with turbine-driven pumps and are cooled only with HVAC instead of both CCW and HVAC unlike other safety-related pumps. Thus EFW motor-driven pumps are judged to be inoperable in case of loss of HVAC without performing the ambient temperature analysis. Therefore the loss of HVAC is modeled for EFW motor-driven pumps.

Design features of the T-D EFW pumps and the diversity of HVAC between MCR and RSC that are credited in the PRA will be listed in Chapter 19 section (Table 19.1-115).

Answer to question (b)

If the HVAC of the Class 1E electrical area should stop during an accident, the ambient temperature rise is judged to be suppressed because it takes enough time for the ambient temperature to rise due to heat generation of electrical equipments and because operations such as opening the doors and installation of temporary fans by the personnel are expected. Therefore the loss of HVAC is not modeled for electrical equipments.

Operator actions, such as opening the doors and installation of temporary fans, expected after the loss of room cooing of the Class 1E electrical area that are credited in the PRA will be listed in Chapter 19 section (Table 19.1-115).

Answer to question (c)

Failures of chiller units are modeled only for the HVAC system of the motor driven EFW pump areas. Common cause failures between the two chiller units are modeled. The group size of common cause failure of chiller units was set to four since there are actually four chiller units when the chiller units for the turbine driven EFW pumps rooms are counted. In other words, the extra two chiller units considered in the common cause size group are the failure of chiller units of the turbine driven EFW pump rooms. When focusing on the probability of common cause failure involving the chiller units of the motor driven EFW pump room HVAC, this common cause failure model adequately calculates its probability.

Impact on DCD

Following key assumptions and insights will be added in Table 19.1-115.

- EFW turbine-driven pumps are designed to operate for several hours without HVAC.
- HVAC of the n MCR and RSC are diverse.
- Operations such as opening the doors and installation of temporary fans will be performed in the event of loss of HVAC of the Class 1E electrical area.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.