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TOKYO, JAPAN

March 3, 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-09068

Subject: MHI's Response to US-APWR DCD RAI No. 176-1987 Rev. 1

Reference: 1) "Request for Additional Information No. 176-1987 Revision 1, SRP Section: 15.00.03 – Design Basis Accidents Radiological Consequence Analyses for Advanced Light Water Reactors, Application Section: 15.0.3" dated 2/3/2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") documents entitled "Response to Request for Additional Information No. 176-1987 Rev. 1".

Enclosed are the responses to 2 RAIs contained within References 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. Response to Request for Additional Information No. 176-1987 Revision 1

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

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Enclosure 1

UAP-HF-09068
Docket No. 52-021

Response to Request for Additional Information No. 176-1987
Revision 1

March 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

03/03/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.176 REVISION 0**
SRP SECTION:	**15.00.03 – Design Basis Accidents Radiological Consequence Analyses for Advanced Light Water Reactors**
APPLICATION SECTION:	**15.0.3**
DATE OF RAI ISSUE:	**02/03/2009**

QUESTION NO. : 15.00.03-27

In order to verify compliance with the guidelines of SRP 15.0.3 Acceptance Criterion 1 [based on 10 CFR Part 50, Section 50.34(a)(1)], as it relates to evaluation and analysis of fission product releases, the pH of the containment sump water must be raised above 7.0 after a LOCA to prevent revolatilization of iodine. The staff requests additional information in order to complete its confirmatory calculation of the sump pH.

DCD Section 15.6.5.5.1.1 provides specific assumptions about contents of water that are released from the primary system into the containment during a DBA. However, the staff requests additional information related to the following two topics:

a) What are total elemental amounts for fission products released from fuel and into containment water? This information is especially important for volatile elements which may affect the pH like I and Cs (including Br and Rb), and should include stable isotopes such as I-127, I-129, Cs-133, Cs-135, and Br-81.
b) What is the total estimated volume of water in the RCS that empties into containment during accidents? Additionally, what values of the chemical parameters listed in DCD Table 5.2.3-2 were assumed in the applicant's calculation, if different from those listed in the DCD? The specific concentrations assumed for boric acid and LiOH are required since Table 5.2.3-2 provides a range for these two parameters.

ANSWER:

a) All isotopes of I (3.4E+02 mol) and Cs (3.9E+03 mol) included in the ORIGEN-2 code output, including stable nuclides like I-127, are taken into account in the pH analysis;

however, isotopes of Br, including Br-81, and Rb are not considered. Br has a chemical behavior similar to that of I, while Rb has a chemical behavior similar to that of Cs. Rb is a strong base like Cs. Additionally, the released reactor fission product nuclide inventory of Rb is greater than that of Br. As a result, inclusion of Br and Rb in the pH analysis tends to increase the pH of sump water. Thus, Br and Rb are conservatively not considered in the sump water pH analysis.

b) The pH analysis assumes that 134,730 gal of RCS water will be discharged into containment during the accident. DCD Table 5.2.3-2 provides normal and limiting values of chemical additives and impurities in the RCS water. None of these parameters are specific to the accident analysis. The accident analysis concentration of boric acid is assumed to be 4,200 ppm, while contribution from LiOH is conservatively neglected in the pH analysis.

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

03/03/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.176 REVISION 0**
SRP SECTION:	**15.00.03 – Design Basis Accidents Radiological Consequence Analyses for Advanced Light Water Reactors**
APPLICATION SECTION:	**15.0.3**
DATE OF RAI ISSUE:	**02/03/2009**

QUESTION NO. : 15.00.03-28

In order to verify compliance with the guidelines of SRP 15.0.3 Acceptance Criterion 1 [based on 10 CFR Part 50, Section 50.34(a)(1)], as it relates to evaluation and analysis of fission product releases, the pH of the containment sump water must be raised above 7.0 after a LOCA to prevent revolatilization of iodine. The staff requests additional information in order to complete its confirmatory calculation of the sump pH.

The calculation of pH requires knowledge of all possible constituents in the water, consistent with the guidelines in Section 3.1.2 above. It is possible that acids produced by radiolysis in containment may lower the pH over time, and these should be considered for completeness.

The staff, therefore, requests the following information:

a) What is the dose rate to primary system water from all sources during the course of the accident?
b) Provide estimates for the amount (mass) of electrical cable jacketing exposed to radiation in containment, the dose rate of that radiation, and the approximate temperature in containment during accidents.

ANSWER:

a) Regarding the integral absorbed dose in the liquid phase of containment (from all sources) during the accident, refer to Table 15.00.03-28-1 below.

b) For the estimated accident, the amount of cable within containment is assumed to be 6,000 kg, and three temperature cases are considered: 50, 100, and 150°C. As for integral absorbed dose to the electrical cable, refer to Table 15.00.03-28-1 below.

Table 15.00.03-28-1: Absorbed Doses Used in pH Analysis

Time (hr)	Integral absorbed dose for electrical cable jacketing exposed to radiation in containment (kGy)	Integral absorbed dose for water exposed to radiation in containment (kGy)
0.1	2.6E+01	2.5E+00
0.2	5.2E+01	4.9E+00
0.3	7.6E+01	7.1E+00
0.4	1.0E+02	9.2E+00
0.5	1.2E+02	1.1E+01
1	2.3E+02	1.9E+01
2	4.0E+02	3.2E+01
3	5.3E+02	4.1E+01
5	7.3E+02	5.6E+01
10	1.1E+03	8.7E+01
20	1.5E+03	1.3E+02
30	1.8E+03	1.6E+02
50	2.3E+03	2.0E+02
70	2.6E+03	2.4E+02
100	3.1E+03	2.8E+02
200	4.2E+03	3.9E+02
300	4.9E+03	4.8E+02
400	5.5E+03	5.6E+02
500	5.9E+03	6.2E+02
600	6.3E+03	6.8E+02
700	6.5E+03	7.3E+02
720	6.6E+03	7.4E+02

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.