


MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

September 3, 2010

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-10242

Subject: MHI's Responses to US-APWR DCD RAI No.607-4778 Revision 2

References: 1) "Request for Additional Information No. 607-4778 Revision 2, SRP Section: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation," dated July 20, 2010.

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. 607-4778 Revision 2".

Enclosed are the responses to the RAI 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,



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

Enclosure:

1. Responses to Request for Additional Information No. 607-4778 Revision 2

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

Contact Information

C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373-6466

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Enclosure 1

**UAP-HF-10242
Docket Number 52-021**

**Responses to Request for Additional Information No.607-4778
Revision 2**

September, 2010

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: NO. 607-4778 REVISION 2
SRP SECTION: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation
APPLICATION SECTION: 19
DATE OF RAI ISSUE: 07/20/2010

QUESTION NO. : 19-438

The staff reviewed the initiating event frequencies for: LOCAs (inadvertent transfer of RCS out of the RCS), Loss of RHR caused by other failures (LORHR), and Loss of Component Cooling Water/Essential Service water (LOCS). The staff noted that these initiating event frequencies were calculated using fault tree analysis. Initiating event frequencies should be calculated using operational data such as EPRI TR-1003113, "An Analysis of Loss of Decay Heat Removal Trends and Initiating Event Frequencies (1989- 2000)." Please revise the initiating frequencies for LOCA, LORHR, and LOCS to reflect US shutdown operational data.

ANSWER:

Initiating event frequency of LOCAs will be revised to the operational data in EPRI TR-1003113, which is recommended by the NRC staffs. On the other hand, in order to reflect the US-APWR design feature (i.e., four completely independent RHR, CCW and ESW trains), the frequencies of LORHR and LOCS are estimated by the fault tree analysis. Detail for the basis is as follows:

MHI has checked the EPRI TR-1003113 and found the data for LOCAs and LORHR. However, there is no data for LOCS (See Tables 19.438-1 and 19.438-2). Table 19.438-3 shows the re-assessed results using the operational data in EPRI TR-1003113. Discussion about each of the results is summarized as follows;

- With regard to the frequency of LOCAs, the CDF has been estimated to be 1.7E-07/R.Y. The initiating event frequency of LOCAs will be changed based on EPRI TR-1003113 instead of the human error for the spurious opening of the motor-operated valve.
- With regard to the frequency of initiating event LORHR, the CDF based on the operational data was estimated to be 1.8E-06/R.Y. The shutdown data from US plants that have two RHR trains were collected for the EPRI database. However, the US-APWR is assumed to have higher reliability than the generic US plants because the US-APWR has four completely independent RHR trains. In order to reflect the design feature of the US-APWR to the PRA model, the frequency of LORHR will be kept by calculating with the FT analysis

instead of EPRI TR-1003113. Use of the fault-tree analysis to estimate initiating event frequency to reflect the plant-specific design is described in Table 4.5.1-2 (c) of ASME RA-Sb 2005 (earlier version) and in Table 2-2-1.4 (c) in ASME/ANS RA-Sa-2009 (the latest version).

- With regard to the frequency of initiating event LOCS, there is no database in EPRI-TR-1003113. In order to reflect the design features of US-APWR component cooling water and essential service water system in the PRA model, the frequency of LOCS will be kept by calculating with the FT analysis.

For the LPSD PRA, the initiating event frequency of LOCAs will be changed based on the operational data in EPRI TR-1003113. On the other hand, LORHR and LOCS are estimated by fault tree analysis according to the current methodology.

Impact on DCD

LPSD PRA results will be revised to reflect the change of initiating event frequency of LOCAs in the DCD tracking report by the end of this year.

Impact on COLA

There is no impact on COLA.

Impact on PRA

The initiating event frequency of LOCAs will be changed based on the operational data in EPRI TR-1003113.

Table 19.438-1 EPRI TR-1003113 Table 7-1 for LOCAs and LORHR

IE	Frequency (/h)	Remark
LOCA	5.4E-06	
LORHR	1.0E-04	Mid-loop operation
	2.4E-05	Except for mid-loop operation

Table 19.438-2 Initiating Event Frequency for the US-APWR based on EPRI TR-1003113 Table 7-1

POS	Duration (Hr)	Initiating Event Frequency (/RY)				Ratio	
		DCD		RAI 19-438		RAI 19-438/ DCD	
		LOCA	LORHR	LOCA	LORHR	LOCA	LORHR
3	2.3	1.0E-04	3.0E-07	6.2E-06	2.8E-05	6.2%	9200.0%
4-1	39.2	1.0E-04	8.9E-06	1.1E-04	2.0E-03	105.8%	22022.5%
4-2	12	1.0E-04	1.6E-06	3.2E-05	6.0E-04	32.4%	37500.0%
4-3	6	1.0E-04	7.9E-07	1.6E-05	3.0E-04	16.2%	37974.7%
8-1	55.5	1.0E-04	9.5E-06	1.5E-04	2.8E-03	149.9%	29210.5%
8-2	12	1.0E-04	1.6E-06	3.2E-05	6.0E-04	32.4%	37500.0%
8-3	11	1.0E-04	1.4E-06	3.0E-05	5.5E-04	29.7%	39285.7%
9	10	1.0E-04	1.3E-06	2.7E-05	1.2E-04	27.0%	9230.8%
11	43.5	1.0E-04	5.7E-06	1.2E-04	5.2E-04	117.5%	9157.9%

*Note: Initiating event frequency of LOCS is unchanged from the DCD case, which is estimated by fault tree analysis.

Table 19.438-3 LPSD CDF based on EPRI TR-1003113 Table 7-1

Item	CDF	ratio
Base case	2.2E-07	-
Case 1 (LOCA)	1.7E-07	0.8
Case 2 (LORHR)	1.8E-06	8.2
Case 3 (Both)	1.8E-06	8.2