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TOKYO, JAPAN

May 29, 2012

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-12130

Subject: **MHI's Amended Response to US-APWR DCD RAI No. 530-3989 Revision 0 (SRP 04.04)**

Reference: [1] "Request for Additional Information No. 530-3989 Revision 0, SRP Section: 06.02.02 – Containment Heat Removal System –Application Section: 6.2." dated October 14, 2011.
[2] MHI Letter UAP-HF-10066, "MHI's Response to US-APWR DCD RAI No. 530-3989 Revision 0 (SRP 04.04)" dated March 4, 2010.
[2] MHI Letter UAP-HF-12020, MUAP-08013 Revision 3, "US-APWR Sump Strainer Downstream Effects" dated May 2012.
[3] MHI Letter UAP-HF-12131 "MHI's 2nd Amended Response to US-APWR DCD RAI No. 815-5986 Revision 3 (SRP 06.03)" dated May 2012.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Amended Response to Request for Additional Information No. 530-3989 Revision 0 ."

Enclosed is the amended response to Question 04.04-40 that is contained within Reference 1. This response supersedes the previous response to Question No. 04.04-40 that was transmitted in Reference 2.

The enclosed RAI response is related to the debris transport time calculation described in Appendix-E of Reference 3 related to GSI-191. MHI changed the design of the recirculation water flow path during post-LOCA conditions, as described in response to RAI 815-5986 in Reference 4, after the RAI in Reference 1 was issued. The response to RAI 530-3989 Question No. 04.04-40 was subsequently revised (see Enclosure 1) in order to reflect this design change.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

Y. Ogata

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

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NRO

Enclosure:

1. Amended Response to Request for Additional Information No. 530-3989 Revision 0

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-12130
Docket No. 52-021

Amended Response to Request for Additional Information No. 530-3989 Revision 0

May 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

5/29/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 530-3989 REVISION 0

SRP SECTION: 04.04 – THERMAL AND HYDRAULIC DESIGN

APPLICATION SECTION: 4.4

DATE OF RAI ISSUE: 2/1/2010

QUESTION NO.: 04.04-40

From Figure 3-8 "Schematic of Return Water and Hold-up Volumes" and Table 3-10 "Upstream Effect Hold-up Volumes" found in report MUAP-08001-NP (R2) "US-APWR Sump Strainer Performance" (ADAMS ML090050042), the "ineffective pools" described in MUAP-08013-P (R0) are: (a) the reactor cavity – 491.7 m3, (b) the containment recirculation air distribution chamber (including ducts) -128.1 m3, (c) the containment reactor coolant drain pump room (including containment drain sump) – 343.5 m3, (d) the recessed pits in the refueling cavity – 70.7 m3, and (e) an additional, for conservatism, hold-up volume – 90 m3. These volumes (total 1,124.1 m3) need to fill to the RWSP drain elevations before debris in these volumes can reach the RWSP, essential they need to fill and overflow.

(a) From Figure 3-8 identified above, it is not clear if some of the smaller volumes would fill and overflow before the larger volumes and allow debris to enter the RWSP earlier than calculated since the calculation is based on filling the total volume before debris is assumed to enter the RWSP. Explain how the evaluation results in a conservative assessment of the time delay for debris to enter the RWSP.

The 519.7 m3 volume, "return water on the way to the RWSP" as described in MUAP-08013-P (R0), is identified in MUAP-08001-NP (R2) as: (a) the containment spray droplets & saturated steam (including the empty spray header rings & pipes) – 249.7 m3, (b) condensate water on the various surfaces – 85 m3, and (c) the water stream on the floor (including reactor cavity floor) – 185 m3. Based on the minimum RWSP level, an additional volume of 80 m3 is included in the evaluation. These volumes are essentially added to the "ineffective pools" volume to perform the time delay calculation, making the "ineffective pools" volume larger, to 1,723.8 m3. The time delay is based on the maximum SI and CS/RHR pumping rate of 0.99316 m3/sec.

(b) Provide the details of the analyses used to develop these volumes. How is the initial RCS water inventory, estimated to be about 490 m3, and the liquid volume of one accumulator, estimated to be about 60 m3 - which is assumed to spill out the break - accounted for in the evaluation? These volumes would rapidly enter the containment, on the order of 20 to 30 seconds following an LBLOCA.

(c) Some of these volumes are "fluids in motion," for example the condensate is running down the containment wall into the lower volumes and the water stream on the floor is also running to the lower volumes. Explain why none of these fluids contribute to filling the "ineffective pools," but only delay the time for these pools to fill and overflow into the RWSP. Explain the physical significance of these volumes as they relate to time delay evaluation.

ANSWER:

(a) As described in Enclosure 2 of the response to RAI 815-5986 (Reference 1), MHI changed the design of the recirculation flow path during post-LOCA conditions and re-evaluated the debris transport time to the core as shown in Enclosure 3 of the response to RAI 815-5986 (Reference 1). The evaluation is also described in Appendix-E of Technical Report MUAP-08013 "US-APWR Sump Strainer Downstream Effects" (Reference 2).

(b) The RCS inventory and accumulator volume is accounted for in the debris transport time evaluation described in (a) because the transport time calculation evaluates the fill-up time of the buffer area using the blowdown water volume from a broken pipe section and that volume includes the RCS and accumulator water volume.

(c) Volumes of "fluid in motion" such as condensate water, streaming water on floors, etc. go down to the buffer area, also called "ineffective pools", first. After the buffer area is filled, the water overflows to the RWSP.
The debris transport time calculation described in Appendix-E of Reference 2 evaluates the fill-up time assuming the water released from a pipe break immediately flows into the buffer area. Realistically, the blowdown water streams on the containment floor and becomes "fluid in motion" and goes down to buffer area continuously. Therefore, the "fluid in motion" can be taken into account in the transport time calculation. However, the water volume labeled "fluid in motion" is conservatively neglected in the debris transport calculation in Appendix-E of Reference 2.

References

1) MHI Letter No. UAP-HF-12131 "MHI's 2nd Amended Response to US-APWR DCD RAI No. 815-5986 Revision 3 (SRP 06.03)", dated May 2012.
2) MHI Letter No. UAP-HF-12140, MUAP-08013 Revision 3, "US-APWR Sump Strainer Downstream Effects", May 2012.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical/Topical Report

There is no impact on the Technical/Topical Report.