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TOKYO, JAPAN

June 25, 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-09337

Subject: MHI's Responses to US-APWR DCD RAI No. 378-2672 Revision 0

Reference: 1) "Request for Additional Information No. 378-2672 Revision 0, SRP Section: 04.04 – Thermal and Hydraulic Design, Application Section: 4.4.2.2.2", dated May 29, 2009

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "MHI's Responses to RAI No. 378-2672 Revision 0".

Enclosed is the response to 1 RAI 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,

Y. Ogata

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

D081
NRO

Enclosures:

1. MHI's Response to RAI No. 378-2672 Revision 0

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

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Docket No. 52-021
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Enclosure 1

UAP-HF-09337

MHI's Responses to RAI No. 378-2672 Revision 0

June 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/25/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 378-2672 REVISION 0**
SRP SECTION:	**04.04 – THERMAL AND HYDRAULIC DESIGN**
APPLICATION SECTION:	**4.4.2.2.2**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 04.04-7

In Design Control Document, Section 4.4.2.2.2. "Hot Cannel Factors", the subsection describing the heat flux engineering hot channel factor, F_Q^E, which is used to account for variation in fabrication for fuel pellet diameter, density, and enrichment, it is stated that no DNB penalty is required due to such a small local heat flux spike. Reference is made to WCAP-8174-P-A for justification. The tests described in this reference are specifically for reactor designs which utilize the Westinghouse mixing vane design and fuel manufacturing tolerances. Provide a discussion of the applicability of these tests to the US-APWR design.

ANSWER:

In the US-APWR core and fuel design, F_Q^E is estimated 1.03 as described in DCD Subsection 4.4.3. F_Q^E represents the possibility of a local power spike caused by the local fabrication variance of fuel pellet diameter, density and enrichment. This F_Q^E effect is actually covered by $F_{\Delta H}{}^E{}_{,1}$, which is also defined as 1.03 for the US-APWR and is taken into consideration in the DNBR analysis as an overall rod power uncertainty of the hot rod. Therefore, the F_Q^E effect will not be double-counted in the DNBR analysis using VIPRE-01M.

Besides, such a small local power spike has only a negligible effect in DNBR analysis as described in DCD Subsection 4.4.2.2.2, because Tong's F-factor displaced the power spike effect in the DNBR calculations. Although the referred rod bundle test of Ref. 04.04.7-1 was for the standard grid design of Westinghouse fuel, nevertheless, the local power spike effect in the test was conservatively predicted by Tong's F-factor (Ref. 04.04.7-1). Thus, Tong's F-factor was applied for the DNB test results with MHI grid design (Ref. 04.04.7-2).

As a result, it is concluded that F_Q^E needs not to be included in the DNB analysis for the US-APWR core design using VIPRE-01M.

References

04.04.7-1 Hill, K. W., Motley, F. E., and Cadek, F. F., "Effect of Local Heat Flux Spikes on DNB in Non Uniform Heated Rod Bundles," WCAP-8174-P-A, February 1975.

04.04.7-2 "Thermal Design Methodology," MUAP-07009-P, May 2007.

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.