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May 15, 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-09229

Subject: MHI's Response to US-APWR DCD RAI No. 309-2345 Revision 1

Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") the document entitled "MHI's Response to US-APWR DCD RAI No. 309-2345 Revision 1". The material in Enclosure 1 provides MHI's response to the NRC's "Request for Additional Information (RAI) 309-2345 Revision 1," dated April 2, 2009.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc., if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,



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

Enclosures:

1. MHI's Response to US-APWR DCD RAI No. 309-2345 Revision 1 (non-proprietary)

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

Contact Information

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DOS/ NRO

Enclosure 1

UAP-HF-09229
Docket No. 52-021

MHI's Response to US-APWR DCD RAI No. 309-2345 Revision 1

May 2009

(Non-Proprietary)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

5/15/2009

**US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021**

RAI NO.: NO. 309-2345 REVISION 1
SRP SECTION: 15.04.02 – UNCONTROLLED ROD ASSEMBLY WITHDRAWAL AT POWER
APPLICATION SECTION: 15.4.2
DATE OF RAI ISSUE: 4/02/2009

QUESTION NO.: 15.4.2-1

Discuss in detail the radial and axial power distributions used in the analysis and verify that the power peaking factors are at the design limits for a given power level.

ANSWER:

The radial and axial power distributions are considered as part of the simplified DNBR lookup table method used in MARVEL-M. This DNBR lookup table method was described in detail in the response to RAI 2.1-2 on the Non-LOCA Methodology Topical Report (MUAP-07010). This response was submitted by MHI letter UAP-HF-08141, dated August 22, 2008.

In this analysis, the DNBR lookup table uses DNBRs calculated by VIPRE-01M using the radial and axial power distributions described in DCD Subsections 4.4.4.3.1 and 4.4.4.3.2, respectively.

As stated in DCD Subsection 4.4.4.3.1, for partial power (i.e., less than full power) operation, a deeper control rod insertion limit than that at rated thermal power (RTP) operation requires relaxation of the $F_{\Delta H}^N$ limit shown below. This relaxed $F_{\Delta H}^N$ limit is used in the VIPRE-01M analysis for establishing the DNBR lookup table.

$$F_{\Delta H}^N = F_{\Delta H}^{RTP} [1 + 0.3(1 - P)]$$

where:

$F_{\Delta H}^N$: the limit at partial power

P : the fraction of RTP

$F_{\Delta H}^{RTP}$: the limit at RTP (1.73)

The design axial power distribution shown in Figure 4.4-4 in DCD Chapter 4 is used for all of the

DNBR analyses for uncontrolled control rod assembly withdrawal at power regardless of the core power level.

This design axial power distribution is used in most DNBR analyses that include determination of the core thermal limit and safety analyses in which the axial power distribution does not change significantly. In the actual plant, when the axial power distribution is skewed towards either the upper half or the lower half of the core during AOOs, the over temperature ΔT core protection setpoint will be activated at a lower core power level than that corresponding to the more axially symmetric power distributions, as described in DCD Subsection 4.4.4.3.2.

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

5/15/2009

**US-APWR Design Certification
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RAI NO.: NO. 309-2345 REVISION 1
SRP SECTION: 15.04.02 – UNCONTROLLED ROD ASSEMBLY WITHDRAWAL AT POWER
APPLICATION SECTION: 15.4.2
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QUESTION NO.: 15.4.2-2

Explain what is meant by a uniform radial power distribution resulting from RCCA bank withdrawal as stated in the last paragraph in Section 15.4.2.3.3. Intuitively, one would expect radial power peaking within the assemblies from which the RCCAs are being withdrawn.

ANSWER:

The uncontrolled control rod assembly withdrawal at power is characterized by the withdrawal of rods in a symmetric (or "uniform") pattern. The phrase "uniform radial power distribution" used in the last paragraph of DCD Subsection 15.4.2.3.3 was used to explain that no significant skewing in the radial power distribution occurs. As the reviewer pointed out, the local power in the assemblies from which the RCCAs are being withdrawn could become larger than that before withdrawal, however, the relative power peaking is always within the design limit since the control rod positions assumed in this analysis are within the allowable range during normal operation.

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.