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TOKYO, JAPAN

April 10 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-09162

Subject: MHI's Responses to US-APWR DCD RAI No. 278-2250 Revision 1

Reference: [1] "Request for Additional Information No. 278-2250 Revision 1, SRP Section: 06.02.02 – Containment Heat Removal System - Design Certification and New License Applicants, Application Section: 6.2.2," dated March 13, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Response to Request for Additional Information No. 278-2250 Revision 1".

Enclosure 1 is the response to 1 RAI (including 2 questions) 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,

Y. Ogata

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

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NRO

Enclosures:

1. Responses to Request for Additional Information No. 278-2250 Revision 1

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-09162
Docket No. 52-021

Responses to Request for Additional Information
No. 278-2250 Revision 1

April 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

04/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 278-2250 REVISION 1

SRP SECTION: 6.2.2 – Containment Heat Removal System

APPLICATION SECTION: 6.2.2

DATE OF RAI ISSUE: 03/13/2009

QUESTION NO.: 06.02.02-16

Background

As part of its review of the US-APWR design aspects that address GSI-191, the staff reviewed the applicant's coatings debris-generation evaluation to the applicable regulatory criteria (GDC 38 and 10 CFR 50.46(b)(5)) using the guidance of SRP Section 6.2.2. SRP Section 6.2.2 provides no specific guidance for debris-generation evaluations, but, rather, references RG 1.82 Rev. 3, the Nuclear Energy Institute (NEI) Guidance Report NEI 04-07 (Reference 1) and the associated NRC safety evaluation report (Reference 2) of the NEI guidance report as providing acceptable guidance for PWR sump debris evaluations.

NEI 04-07, as modified by the staff safety evaluation provides guidance acceptable to the NRC staff relative to generation of protective-coatings debris. RG 1.82 does not provide any detailed guidance on estimation of coatings debris generation.

On page 9 of the Sump Strainer Performance Report, MUAP-08001-P (Reference 3), the applicant states the following:

> "As for the coating debris of the US-APWR, the ZOI for qualified coatings is a sphere with a radius 10 times the MCP inner diameter, which generates largest amount of coating debris. In the evaluation, the volume of coating debris was calculated by multiplying the surface area of the ZOI sphere by the thickness of the coating film. The thickness of the coating film was defined based on the past experience, and was conservatively assumed to be 650 (μm). As a result, the maximum volume of coating debris was established as 0.51 (m3)."

Use of a 10D ZOI (zone of influence) meets the guidance of the staff safety evaluation to NEI 04-07. However, the staff safety evaluation states that:

> "The analysis should also seek to accurately estimate the amount of coating on a plant specific basis within the ZOI. If a realistically conservative approach is taken, the basis and justification for why the method is realistically conservative should be provided."

In contrast, the applicant simply used the surface area of a sphere of diameter 10D as the coated surface area of components inside the ZOI. It is unclear why the applicant could not provide an estimate of surface area based on the actual coated components, which may include pipe, vessel,

and support surfaces, that are within the postulated ZOI of the most limiting break.

Additional staff guidance with respect to addressing coatings related to GSI-191 is provided in "NRC Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Coatings Evaluation (Reference 4)," which recommends that as part of the description of the coatings systems used in containment, licensees should provide dry-film thickness (DFT) for each coating system, and that DFT may come from plant records, manufacturer recommendations, or actual sample measurements on the existing coatings.

Requested Information

1. Provide the basis and justification for the use of the surface area of a 10D sphere as a conservative estimate of the coated surface area inside the zone of influence (ZOI), or provide an estimate of the coated surface area in the ZOI based on the actual coated systems, structures, and components located in the ZOI.

2. Describe in detail the past experience used to justify the assumed coatings thickness of 650 μm, such as actual measurements on similar coatings systems. Does the assumed thickness account for recoating during the life of the plant?

References

1. NEI 04-07 Pressurized Water Reactor Sump Performance Evaluation Methodology Revision 0 December 2004; ADAMS Accession No. ML050550138
2. Safety Evaluation By The Office Of Nuclear Reactor Regulation Related To NRC Generic Letter 2004-02, Nuclear Energy Institute Guidance Report (Proposed Document Number NEI 04-07), "Pressurized Water Reactor Sump Performance Evaluation Methodology", Dated December 6, 2004, ADAMS Accession No. ML051460182
3. US -APWR Sump Strainer Performance, MUAP-080001-P (R2), December 2008; ADAMS Accession No. ML090050043
4. NRC Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Coatings Evaluation, ADAMS Accession No. ML080230462, Enclosure 2 to letter from William H. Ruland, NRC, to Anthony Pietrangelo, NEI, dated March 28, 2008, Subject "Revised Guidance For Review Of Final Licensee Responses To Generic Letter 2004-02, "Potential Impact Of Debris Blockage on Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors"," ADAMS Accession No. ML080230112

ANSWER:

The calculation methodology used to estimate the amount of coating within ZOI for the US-APWR is a realistically conservative approach compared with the estimation of surface area based on the actual coated components within the postulated ZOI. This methodology is based on past experience of Mitsubishi PWR plant construction, and it can be used for estimation of coating debris for new MHI plant, as a bounding value for as-built coatings.

The dry-film thicknesses for coatings in containment experienced for recent Mitsubishi PWR plants are shown in Table A-1. Table A-2 provides an estimation of surface areas based on the actual coated components within a sphere with a radius 10 times the main coolant pipe inner diameter (i.e. 31 inches) of the Mitsubishi PWR plant constructed in the past, which has a similar layout feature to the US-APWR, and resulted that the maximum coating debris of the plant was 0.466 (m3). The worst case location for this break causing the most coating generation was taken at a location in the RCL cold leg between the SG and the RCP.

Therefore, it is concluded that the use of 0.51 (m3) of coating debris for Mitsubishi PWR plants, as well as for the US-APWR, is reasonably conservative.

Since the amount of coating debris (i.e., 0.51 (m3)) is one of key assumptions associated with strainer performance evaluation, this characteristic will be assured in a programmatic ITAAC.

The use of 0.51 m3 of debris rather than an actual worst case 0.466 m3 is sufficiently conservative to accommodate an expected amount of recoating during plant life. Surfaces in need of recoating will be refurbished before recoating to remove deteriorated or damaged coatings.

Table A-1 Dry-film thickness of coating in containment (MHI PWR plant)

Item		Dry-film thickness
Civil portion (Concrete surface)	Floor	650μm
	Wall [Note]	650μm (up to flood level) 450μm
Mechanical portion	Steel Structure, Support beam, column, etc.	200μm
	Equipment, Component, Piping, etc	200μm

Note: 200μm of DFT is applied when concrete wall is constructed with steel plate formwork.

Table A-2 Breakdown of coating debris within 10D of ZOI (MHI PWR plant)

Item		Dry-film Thickness [μm]	Surface area within ZOI(10D) [m2]	Volume [m3]
Civil portion	Concrete floor	650	85.7	0.056
	Concrete wall (up to flood level)	650	79.8	0.052
	Concrete wall	450	400.0	0.18
Mechanical portion	Supports for steam generator	200	110.6	0.022
	Supports for reactor coolant pump	200	46.0	0.09
	Steam generator	40	70.3	0.014
	Reactor coolant pump	200	89.1	0.004
	Restraints	200	72.7	0.015
	Steel structures	200	521.2	0.104
	Pipe and miscellaneous	200	56.0	0.011
TOTAL (coating debris within 10D of ZOI)				**0.466**

Note: 10D means 10 times the main coolant pipe inner diameter (31 inches).

Impact on DCD

Tier 1 Table 2.4.4-5 Emergency Core Cooing System Inspections, Tests, Analyses, and Acceptance Criteria, will be revised as follows:

Design Commitment		Inspections, Tests, Analyses		Acceptance Criteria	
7.b	The ECCS provides RCS makeup, boration, and safety injection during design basis events.	7.b.i	Injection test with low tank pressure condition and analysis for each as-built accumulator will be conducted. The test will be initiated by opening isolation valve(s) in the piping being tested. Each as-built accumulator will be partially filled with water and pressurized with nitrogen. All valves in these lines will be open during the test.	7.b.i	The water volume injected from each as-built accumulator into reactor vessel is ≥2126 ft^3. The water volume injected from each accumulator into reactor vessel during large flow is ≥1326.8 ft^3. The calculated resistance coefficient of the as-built accumulator system (based on a cross-section area of 0.6827 ft^2) meets the requirements shown in Table 2.4.4-6.
		7.b.ii	The as-built safety injection pump injection test will be performed. Analysis will be performed to convert the test results from the test conditions to the design condition.	7.b.ii	Each as-built safety injection pump has a pump differential head of no less than 3937 ft and no more 4527 ft at the minimum flow, and injects no less than 1259 gpm and no more than 1462 gpm of RWSP water into the reactor vessel at atmospheric pressure.
		7.b.iii	Inspections of each as-built accumulator and the RWSP will be conducted.	7.b.iii	The volume of each is as follows: Each as-built accumulator: at least 3,180 ft^3 As-built RWSP: at least 81,230 ft^3
		7.b.iv	Inspections of the as-built ECC/CS suction strainers will be conducted.	7.b.iv	Four stainless steel strainers are located at the lowest part of containment.
		7.b.v	Inspections will be conducted of the as-built coatings used in containment.	7.b.v	A report exists and concludes that, for the as-built coatings used in containment, the volume of coating debris that may be created within a postulated RCL line break ZOI is equal or less than 0.51 (m3).

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA.