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March 26, 2009

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

NRC Docket No. 52-021
MHI Ref: UAP-HF-09126

Subject: **MHI's Responses to US-APWR DCD RAI No. 201-2199 Revision 1**

Reference: 1) "Request for Additional Information No. 201-2199 Revision 1, SRP Section: 09.01.03 Spent Fuel Pool Cooling and Cleanup System, Application Section: 9.1.3, dated February 24, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. (MHI) transmits to the U.S. Nuclear Regulatory Commission (NRC) the document entitled, "Response to Request for Additional Information No. 201-2199 Revision 1."

Enclosed are the responses to 2 RAIs contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. for questions concerning any aspect of the submittals. His contact information is found at the end of this letter.

Sincerely,

Y. Ogata

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

Enclosure:

1. Responses to Request for Additional Information No. 201-2199 Revision 1

CC: J. A. Ciocco
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NRO

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Docket No. 52-021
MHI Ref: UAP-HF-09126

Enclosure 1

UAP-HF-09126
Docket No. 52-021

Responses to Request for Additional Information
No. 201-2199 Revision 1

March 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

3/26/2009

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 201-2199 REVISION 1

SRP SECTION: 09.01.03 – Spent Fuel Pool Cooling and Cleanup System

APPLICATION SECTION: 9.1.3

DATE OF RAI ISSUE: 2/24/2009

Requested Information No. 09.01.03-04:

What process does the applicant have to clean the top surface of the SFP water in order to maintain clarity and clean impurities that might rise above the SFPCS inlet?

Background:

GDC 61 requires that impurities be eliminated and SRP Section 9.1.2 states that the criteria in ANSI/ANS-57.2 are adequate to meet this requirement. GDC 14 requires the integrity of the RCPB be maintained by controlling impurities that may cause degradation in the RCS. The EPRI guidelines are mentioned in SRP 9.3.4 as a means of satisfying this requirement. ANSI/ANS-57.2 recommends that water clarity be maintained so that fuel assembly identification can be read underwater. The EPRI guidelines also suggest turbidity limits, and indicate (p. B-16) that skimmers are an important part of the SFP purification to maintain optical clarity. The DCD mentions that inlet to the SFPCS is 4 ft below the minimum water level, but makes no mention of skimmers or any other equipment to clean the top layer of SFP water.

ANSWER:

The US-APWR relies on normal operation of the Spent Fuel Pit Cooling and Purification System (SFPCS) and adherence to adopted water chemistry limits and monitoring practices to cleanup impurities and maintain water clarity at the surface of the spent fuel pit (SFP). Normal configurations of SFPCS pump strainers, mixed bed demineralizers and filters are capable of removing floating contaminants and material debris from SFP water, including water surface layers.

The water chemistry limits and the SFP clean-up system adopted for the US-APWR design are adequate to satisfy GDC 61, SRP 9.1.3, the EPRI Primary Water Chemistry Guidelines, and Regulatory Guide 1.13, including the clarifications and exceptions to ANSI Standard N210-1976/ANS-57.2-1983. These aforementioned regulations, however, do not mention relevance of SFP water cleanliness and clarity to maintenance of RCPB integrity.
The use of SFP surface skimmers to remove floating contaminants and material debris that could potentially cause turbidity or cloudiness from the surface of the water has been found by the Japanese to be ineffective, unnecessary, and costly. Although older generations of Japanese

plants use skimmers installed in the SFP, newer plants consider such systems to be ineffective in maintaining cleanliness and optical clarity of the SFP water due to the following:

- Japanese operating experience has shown that the absence of skimmers has created no SFP clarity issues.
- The difficulty in establishing and maintaining proper skimmer operating depth results in unnecessary suctioning of water from below the normal water level, i.e., beneath the surface, hence rendering surface cleanup ineffective.
- One skimmer is limited to a one- to two-square meter suction area requiring multiple skimmers to adequately clean the entire pool surface.
- Surface debris will eventually be adequately eliminated by the demineralizers and filters of the purification loop.

Four plants operating at different periods since 1991 do not employ skimmers in the SFPCS. One plant under construction and two plants under licensing stage also removed the spent fuel pit water skimmers from their designs.

Regarding RCPB integrity, although it is possible that SFP water may enter the refueling cavity during refueling operations due to the opened refueling cavity gate, ingress of surface contaminants that may challenge RCPB integrity, if any, would be negligible. Furthermore, only a slight disturbance is expected at the point where the SFP water and the injected water in the refueling cavity meet in the refueling canal due the similar water height between them. In other words, there is no surface water disturbance significant enough to introduce surface contaminants into the RCS that might affect RCPB integrity.

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.

This completes MHI's response to NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

3/26/2009

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 201-2199 REVISION 1

SRP SECTION: 09.01.03 – Spent Fuel Pool Cooling and Cleanup System

APPLICATION SECTION: 9.1.3

DATE OF RAI ISSUE: 2/24/2009

Requested Information No. 09.01.03-05:

What water purity evaluation and processing would be undertaken prior to refueling operations?

Background:

GDC 14 requires the integrity of the RCPB be maintained by controlling impurities that may cause degradation in the RCS. The EPRI guidelines are mentioned in SRP 9.3.4 as a means of satisfying this requirement. The EPRI guidelines suggest monitoring of additional impurities (Ca, Mg, Al, Fe, as listed on p. B-12) in preparation for refueling operations. However, the DCD makes no mention of such sampling or limits for these quantities.

ANSWER:

The US-APWR Spent Fuel Pit Cooling and Purification System (SFPCS) purifies the spent fuel pit water according to the recommendations of EPRI PWR Primary Water Chemistry Guidelines. The chemistry parameters and limits are tabulated in Table 1 below. Weekly water sampling of the spent fuel pit will be performed to monitor the concentrations of boron, halogens, sulfate ions, and dissolved solids that account for turbidity. Silica will be monitored monthly. There is no set value for gamma isotopic concentration. However, the radioactivity of the SFP water will be monitored on an ongoing basis by a process sampling. The design value of the decontamination factor of 100 for the SFP demineralizers is verified by samples taken to ensure that the design decontamination factor is maintained, as per ANSI/ANS 57.2-1983. As a result, the atmospheric dose at the SFP water surface will be controlled within the limit of ≤ 2.5 mrem/hr. Radiation levels in the SFP area will be constantly monitored by the SFP area radiation monitor. Furthermore, the effects from trace amounts of radioactive materials not removed by the demineralizer or filter are being mitigated by containment of the materials within the SFP water.

Before refueling operations commence, a confirmatory evaluation of the SFP water chemistry will be carried out to determine that water chemistry limits are being maintained prior to refueling cavity-SFP alignment. Water samples at the demineralizer inlet and filter discharge will be extracted to determine the water chemistry, as well as the performance of both demineralizers and filters determining the decontamination factor. If the values are found to be unsatisfactory, appropriate

resin and/or filter replacement operations will be performed. Once the limits are satisfied, the sampling process is repeated, and the alignment of the refueling cavity-SFP configuration is resumed.

Table 1 US-APWR Spent Fuel Pit Water Chemistry Parameters and Limits

Parameter	Monitoring Frequency	US-APWR Standard (ppm)	US-APWR Limit (ppb)	EPRI Limit (ppb)
Boron	1/W	–	$\geqq 4\times10^6$	–
Chloride, fluoride	1/W	≦50	≦150	≦ 150
Sulfate	1/W	≦50	≦150	–
Silica	1/M	≦1000	≦150	–
Turbidity	1/W	≦500	–	–
Gamma isotopics	continuous	–	–	–

Impact on DCD

Table 9.1.3-1 of DCD Section 9.1.3 will be corrected as follows:

	Analysis	Unit	Standard value	Limited value
1	Boron	ppm	–	≧4000
2	Chloride ion	ppm	≦0.05	≦0.15
3	Fluoride ion	ppm	≦0.05	≦0.15
4	**Sulfate**	**ppm**	**≦0.05**	**≦0.15**
5	**Silica**	**ppm**	**≦1.00**	**≦1.00**
6	Turbidity	ppm	≦0.50	–
7	**Gamma isotopics**	**μCi/ml**	–	–

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to NRC's question.