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September 21, 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-12264

Subject: **MHI's Response to US-APWR DCD RAI No. 957-6388 Revision 3 (SRP 03.11)**

Reference: 1) "Request for Additional Information No. 957-6388, Review Section 03.11 – Environmental Qualification of Mechanical and Electrical Equipment - Application Section: 3.11", dated August 22, 2012.

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. 957-6388 Revision 3."

Enclosed is the response to a question contained within Reference 1.

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.

Enclosure:

1. Response to Request for Additional Information No. 957-6388 Revision 3

DO81
NRO

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-12264
Docket No. 52-021

Response to Request for Additional Information No. 957-6388
Revision 3

September 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

9/21/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: **NO. 957-6388 REVISION 3**

SRP SECTION: **03.11 – ENVIRONMENTAL QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT**

APPLICATION SECTION: 3.11

DATE OF RAI ISSUE: **8/22/2012**

QUESTION NO.: 03.11-61:

For the 10 CFR 50.49, "Environmental qualification of electrical equipment important to safety for nuclear power plants," review, the US-APWR DCD addressed qualification of electrical and mechanical equipment in Section 3.11 of FSAR Chapter 3. Specifically, Section 3.11 addressed equipment that will be performing its safety functions for the anticipated environmental conditions during and following a design basis event (DBE). 10 CFR 50.49 lists those environmental conditions as pressure, temperature, humidity, aging, radiation, and chemical effects. US-APWR Section 4.2.6, "Indoor Chemical Environment-pH for Fluids," discusses MUAP-08015(R1), "US-APWR Equipment Qualification Program," and states that "The most severe chemical environment results from a single failure of the spray system." MUAP-08015 further states that no other chemical effects were identified for their equipment qualification. However, the staff has learned that nitric acid by radiolysis of nitrogen and water in the containment or in the sump can be generated in the post-DBE environment and should be considered under the chemical effects. Explain whether nitric acid generation should or should not be considered under the chemical effects of 10 CFR 50.49. If so, provide the appropriate electrical and mechanical equipment qualification evaluation.

ANSWER:

The primary parameter of interest with respect to chemical effects qualification is solution pH. As described in Technical Report (TR) MUAP-08015, Revision 1, the integrated Equipment Qualification (EQ) Program for the US-APWR includes an environmental qualification program required by 10 CFR 50.49. As described in the TR, Subsections 4.2.6 and 5.5.1.5, chemical effects inside containment (including post accident pH control), as well as other locations inside the containment building where chemical exposure of equipment can occur, are considered in determining EQ requirements. The concentration of the chemicals (and the corresponding mixture pH) used for qualification testing is required to bound the chemical environment expected to result from plant operation during a loss-of-coolant accident (LOCA).

There are a variety of acids and bases produced in containment during a LOCA. Boric acid is a weak acid inside containment after a LOCA, coming from the reactor coolant system (RCS), refueling water storage pool (RWSP), accumulators, and containment spray. Hydrochloric acid (HCl) is a strong acid produced by the radiolysis of chlorine containing materials, such as chloride-bearing cable jacketing, inside containment. Carbon dioxide

(CO_2) can be absorbed from the air into the water to create carbonic acid. However, carbonic acid is considered a weak acid whose effects are considered insignificant relative to the other acids produced during a LOCA, and is thus ignored in the determination of the pH of the RWSP fluid used as the source of the containment spray water. Nitric acid (HNO_3) can also be produced by the radiolysis of nitrogen in air and water.

In order to maintain the RWSP pH greater than 7, a buffering agent is used to offset the various types of acids produced by the environmental conditions associated with a LOCA inside containment. In the US-APWR design, sodium tetraborate is introduced into containment as a buffering agent by the actuation of containment spray.

The response to RAI 460-3484 (MHI letter UAP-HF-09519, dated November 13, 2009) provides MHI's calculation of the minimum RWSP pH based on the transient balance between these acids and sodium tetraborate used to determine the chemical effects requirements for environmental qualification. As demonstrated in this calculation, even If the effects of additional acids such as hydrochloric and nitric acid are taken into account, the RWSP fluid pH has been shown to be greater than 7 under the postulated post-LOCA condition. Therefore, MHI concludes that nitric acid generation is already adequately considered under the chemical effects of 10 CFR 50.49.

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 Topical Report / Technical Report

There is no impact on the Topical Report / Technical Report.

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