MITSUBISHI HEAVY INDUSTRIES, LTD.
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TOKYO, JAPAN

December 5, 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-12319

Subject: MHI's Supplemental Information in Response to US-APWR DCD RAI No. 662-5131 (SRP 03.08.03), Question 03.08.03-28

References: 1) "Request for Additional Information No. 662-5131 Revision 2, SRP Section: 03.08.03 - Concrete and Steel Internal Structures of Steel or Concrete Containments," dated November 15, 2010, ML103190226.

2) Letter (MHI Ref: UAP-HF-10358) from Y. Ogata (MHI) to U.S. NRC, "MHI's Response to US-APWR DCD RAI No. 662-5131 Revision 2 (SRP 03.08.03)," dated December 28, 2010, ML110100361.

In Reference 2, Mitsubishi Heavy Industries, Ltd. (MHI) provided its response to the U.S. Nuclear Regulatory Commission's (NRC) questions transmitted by the Request for Additional Information (RAI) identified in Reference 1.

The current status of RAI 662-5131, Question 03.08.03-28, is "Unresolved – Closed" with no follow-up questions from the NRC. MHI provided, informally, additional information in the form of a "white paper" document on April 25, 2011, to supplement the RAI response information to address the unresolved issues. The NRC determined the approach presented in the aforementioned document was acceptable in addressing the unresolved issues during a conference call held on May 23, 2011.

On October 23, 2012, the NRC communicated to MHI that the information in the white paper should be included on the docket in order to fully close out RAI 662-5131, Question 3.8.3-28 unresolved issues.

Therefore, with this letter, MHI transmits to the NRC a document entitled "Supplemental Information in Response to Request for Additional Information No. 662-5131, Question 03.08.03-28," that includes the white paper as part of the response for docketing within Enclosures 2 and 3.

As indicated in the enclosed materials, this document contains information that MHI considers proprietary, and therefore should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential. A non-proprietary version of the document is also being submitted with the information identified as proprietary redacted and replaced by the designation "[ ]."
This letter includes a copy of the proprietary version (Enclosure 2) of the response, a copy of the non-proprietary version (Enclosure 3) of the response, and the Affidavit of Yoshiki Ogata (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials

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designated as "Proprietary" in Enclosure 2 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittal. His contact information is below.

Sincerely,

Yoshiki Ogata,
Director, APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosures:

1. Affidavit of Yoshiki Ogata

2. Supplemental Information in Response to Request for Additional Information No. 662-5131, Question 03.08.03-28 (Proprietary)

3. Supplemental Information in Response to Request for Additional Information No. 662-5131, Question 03.08.03-28 (Non-Proprietary)

CC: J. A. Ciocco
J. Tapia

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Enclosure 1

Docket No. 52-021
MHI Ref: UAP-HF-12319

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

I, Yoshiki Ogata, state as follows:

1. I am Director, APWR Promoting Department, of Mitsubishi Heavy Industries, LTD ("MHI"), and have been delegated the function of reviewing MHI's US-APWR documentation to determine whether it contains information that should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

2. In accordance with my responsibilities, I have reviewed the enclosed document entitled "Supplemental Information in Response to Request for Additional Information No. 662-5131, Question 03.08.03-28," dated December 2012, and have determined that portions of the document contain proprietary information that should be withheld from public disclosure. Those pages containing proprietary information are identified with the label "Proprietary" on the top of the page and the proprietary information has been bracketed with an open and closed bracket as shown here "[ ]." The first page of the document indicates that all information identified as "Proprietary" should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

3. The information identified as proprietary in the enclosed document has in the past been, and will continue to be, held in confidence by MHI and its disclosure outside the company is limited to regulatory bodies, customers and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and is always subject to suitable measures to protect it from unauthorized use or disclosure.

4. The basis for holding the referenced information confidential is that it describes the unique design and methodology developed by MHI as it provides the analytical and testing basis for the qualification of steel concrete modules.

5. The referenced information is being furnished to the Nuclear Regulatory Commission (NRC) in confidence and solely for the purpose of information to the NRC staff.

6. The referenced information is not available in public sources and could not be gathered readily from other publicly available information. Other than through the provisions in paragraph 3 above, MHI knows of no way the information could be lawfully acquired by organizations or individuals outside of MHI.

7. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without incurring the costs or risks associated with the design of the subject systems. Therefore, disclosure of the information contained in the referenced document would have the following negative impacts on the competitive position of MHI in the U.S. nuclear plant market:

A. Loss of competitive advantage due to the costs associated with the development of the unique design parameters.

B. Loss of competitive advantage of the US-APWR created by the benefits of the steel concrete module design.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 5th day of December, 2012.

Yoshiki Ogata,
Director, APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

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Enclosure 3

UAP-HF-12319
Docket No. 52-021

Supplemental Information in
Response to Request for Additional Information No. 662-5131,
Question 03.08.03-28

December 2012
(Non-Proprietary)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

12/5/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 662-5131 REVISION 2**
SRP SECTION:	**03.08.03 – Concrete and Steel Internal Structures of Steel or Concrete Containments**
APPLICATION SECTION:	**3.8.3**
DATE OF RAI ISSUE:	**11/15/10**

QUESTION NO. RAI 03.08.03-28, SUPPLEMENT 1:

MHI's Amended Response to Question 03.08.03-05, (dated September 2009) is essentially unchanged from their initial response, dated 5/21/09. However, as stated in its evaluation of MHI's initial response to this question, the staff determined that the acceptability of the response to Question 3.8.3-5 was largely dependent on the acceptability of MHI's response to Question 3.8.3-9. This dependency also exists for the Amended Response. It is noted that MHI's Amended Response for this question includes English translations of several Japanese technical papers. The thrust of the initial Question 3.8.3-05 is for the applicant to demonstrate that the structural integrity of the SC module walls is assured when they are subjected to design loads at elevated temperatures caused by accidents or fire. The Amended Responses to Questions 3.8.3-05 and 3.8.3-09 have been reviewed by the staff, including a review of several technical papers that have been translated into English. As stated later in its evaluation of MHI's Amended Response to Question 3.8.3-09, the staff finds that, in general, these tests show that properly designed SC module walls (designed with adequate margins of safety) will retain adequate strength and ductility to resist the applied design loads when subjected to elevated temperatures due to accidents and/or fire. However, the staff continues to be concerned about the adequacy and completeness of the various tests conducted to show the structural soundness of the SC module walls when subjected to high temperatures in fires. The staff has therefore developed several questions that MHI is requested to address with regard to this aspect of the question.

Specifically, MHI is requested to furnish the following information:

1. Statements made in the Amended Response conclude that, in the aggregate, the results of all relevant tests conducted (in Japan) on fire resistance of the SC modules show that the fire resistance of the SC modules is equivalent to that of conventional reinforced concrete walls. This conclusion may not be entirely correct. Since the rebar in conventional reinforced concrete is enclosed within the concrete, it takes longer for the steel rebar to reach temperature at which loss of strength occurs then it does for the exposed steel faceplates. An important aspect of this issue is the fire resistance rating in terms of hours as per standard codes that are used to design buildings. The staff has found conflicting statements concerning the fire rating of the SC module type of structure. For example, in Reference 9, Part 2, it states that "We confirmed the structure studied in this work had a fire resistance time of over three

hours as well as adequate flame and heat blocking capabilities." Compare that with the statement in Reference 9, Part 6, which states: "We presented an experimental program and results for experiments on heating of under load. For SC bearing walls that have high H/T values, a fire resistance time of two hours or more can be obtained by controlling the loading axial force ratio." It is noted that for critical structural elements such as columns and bearing walls in important structures it is required to have at least a three-hour rating. MHI is requested to show clearly that these SC modules, when acting as bearing walls and subject to in-plane and out-of-plane shear loads and bending moments, exhibit a fire resistance time of three hours.

2. In addition to addressing the staff's concerns in (1) above, MHI is requested to describe the design parameters that need to be controlled to assure satisfactory structural behavior during a fire, such as the ratio of shear rib cross-sectional area to shear stress per cross-sectional area of the steel plate between ribs, and the ratio of design strength to ultimate strength of the SC module wall.

3. The staff is unable to find any extended discussion of fire resistance of the SC modules in the US-APWR DCD. MHI is requested to address this area in a subsequent revision to the DCD, including a specification of the required fire resistance ratings for the SC module walls.

The staff notices that a draft standard for the design of SC modules for fire conditions exists in Korea. Is there a similar code in use in Japan, and was it used on the design of the SC module walls for the US-APWR? If such a code was used for the US-APWR design, was it based on the results of tests cited in the technical reports sent to NRC in this Amended Response?

ANSWER:

Provided as supplementary information for NRC staff review, please see the "white paper" entitled "Postulated Fires Inside Containment" that is enclosed immediately following this response.

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 Technical/Topical Report

There is no impact on the technical Report.

Postulated Fires Inside Containment

The containment building is a very large single fire area with the exterior wall of the containment building as the only designated fire rated barrier. The interior rooms/areas of the containment building are separated into fire zones. Fire zones are identified as physical spaces separated by non-fire rated barriers within a fire area. Therefore, the interior containment walls which consist, in part, of SC modules are not listed as "fire-rated barriers." By not listing the interior walls as fire rated barriers means that there is no complete fire boundary that will prevent flame and hot gases from propagating throughout the fire area due to a postulated fire inside containment. There are also structural steel beams and columns within the containment structure which likewise do not comprise a fire barrier.

The FHA identifies the fire zones in the containment building fire area and the postulated fire loading for each zone. As part of the defense-in-depth approach to fire protection, combustibles within containment are minimized. Due to the limited combustibles in the containment, any postulated fire initiating will be of short duration. Any heat and smoke generated by the postulated fire will not be fully contained within a fire zone and will most likely disperse throughout the fire area. Therefore, elevated temperatures in the vicinity of SC modules or structural steel will be localized. Localized elevated temperatures on SC modules or structural steel members are not anticipated to cause global reductions in SC module section properties or any steel member instabilities.

The FHA identifies the fire zones within the containment which contain the reactor coolant pump (RCP) motors. These motors contain a substantial amount of lubricating oil. Per the US-APWR DCD Section 9.5.1.2.1, a seismically-designed oil leakage collection system for the RCPs is provided and collection tanks for accumulation of any oil leakage are provided in the lower levels of the primary containment. The tank for each RCP is sized to hold the total oil leakage volume from its RCP motor plus an additional 10%, and is provided with a flame arrestor on the vent. Other combustibles within the containment building are described in the FHA including electrical cables and administratively limited/controlled transient combustibles during plant operations.

The SC modules are very robust structures with a minimum thickness greater than 3 feet and ½-inch thick steel outer surfaces. The SC modules are in a fire area with a very large volume of space surrounded by very thick steel reinforced concrete fire barriers and a limited amount of combustible fuel. Therefore, considering the robust construction of the SC's, the surrounding containment structure, the limited combustible fuels, short duration and localized nature of any postulated fire, fires originating within the containment building are not anticipated to adversely affect the overall strength and load-carrying capability of the SC modules. Similarly, taking into account the limited combustible fuels, short duration and localized nature of any postulated fire, fires are not anticipated to adversely affect the overall stability/load-carrying capability of structural steel members contained within the containment structure.