

  
**MITSUBISHI HEAVY INDUSTRIES, LTD.**  
16-5, KONAN 2-CHOME, MINATO-KU  
TOKYO, JAPAN

May 26, 2011

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-11151

**Subject: MHI's Response to US-APWR DCD RAI No. 738-5663 REVISION 2 (SRP 05.04.01.01)**

**Reference:** 1) "Request for Additional Information No. 738-5663 Revision 2, SRP Section: 05.04.01.01 – Pump Flywheel Integrity, Application Section: DCD Tier 2, Section 5.4.1.1" dated April 25, 2011.

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. 738-5663 Revision 2."

Enclosed is the response to the RAI contained within Reference 1.

In the responses to Question No. 05.04.01.01-8 are provided in Enclosure 2 and 3. As indicated in Enclosure 2, this submittal 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. The proprietary information is bracketed by the designation "[ ]".

This letter includes a copy of the proprietary answers (Enclosure 2) and the Affidavit of Yoshiki Ogata (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials designated as "Proprietary" in Enclosure 2 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

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,

*Yoshiki Ogata* for

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

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MHI

Enclosures:

1. Affidavit of Atsushi Kumaki
2. Response to Request for Additional Information No. 738-5663 Revision 2  
(Proprietary Version)
3. Response to Request for Additional Information No. 738-5663 Revision 2  
(Non Proprietary Version)

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

Contact Information

C. Keith Paulson, Senior Technical Manager  
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## ENCLOSURE 1

Docket No.52-021  
MHI Ref: UAP-HF-11151

### MITSUBISHI HEAVY INDUSTRIES, LTD.

#### AFFIDAVIT

I, Atsushi Kumaki, state as follows:

1. I am Group Manager, Licensing Promoting Group in 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 "Response to Request for Additional Information No. 738-5663 Revision 2", 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 inspection availability developed by MHI for the Reactor Coolant Pressure Boundary of the US-APWR, and test results conducted by MHI and are not issued publicly.
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 development of

inspection methodology for the Reactor Coolant Pressure Boundary of the US-APWR. Providing public access to such information permits competitors to duplicate or mimic the methodology without incurring the associated costs.

- B. Loss of competitive advantage of the US-APWR created by benefits of enhanced plant safety, and reduced operation and maintenance costs associated with the Reactor Coolant Pressure Boundary.

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 26<sup>th</sup> day of May, 2011.



Atsushi Kumaki,  
Group-Manager-Licensing Promoting Group in APWR Promoting Department  
Mitsubishi Heavy Industries, LTD.

Docket No. 52-021  
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**Enclosure 3**

**UAP-HF-11151  
Docket Number 52-021**

**Response to Request for Additional Information  
No. 738-5663 Revision 2**

**May 2011  
(Non Proprietary)**

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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**05/26/2011**

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

**RAI NO.:** NO. 738-5663  
**SRP Section:** 05.04.01.01 – Pump Flywheel Integrity (PWR)  
**DATE OF RAI ISSUE:** 04/25/2011

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**QUESTION NO.: 05.04.01.01-8**

The response to RAI No. 274-2126, Question 05.04.01.01-05 states that the analysis (MUAP-09017) incorporates justification for the initial flaw size distribution and flaw acceptance criteria. However, this does not resolve the RAI, since it cannot be determined from this information that the critical crack size can be detected during an inspection. Therefore, the response should include:

- At design speed of 1500 rpm (125% of normal operating speed), what is the critical crack size where the flywheel would rupture due to a non-ductile failure?
    - For example, Table 4-1 of the Mitsubishi Heavy Industries Report MUAP- 07035 provides information that at a speed of 2596 rpm, a crack size of 0.25 inches would rupture the flywheel. This table also says that at a speed of 2489 rpm, a crack size of 0.50 inches would rupture the flywheel. Therefore, provide the crack size at a speed of 1500 rpm that would rupture the flywheel for the period of time between inspection of the flywheel. This should include a 10 year inspection interval and a 20 year inspection interval.
  - What crack length size is the ultrasonic inspection technique for the flywheel capable of reliably detecting? Mitsubishi Heavy Industries Report MUAP-09017, Section 8.0 implies that a crack length of 0.040 inches can be detected 50% of the time. This however, does not provide what size can be reliably detected. Provide a reliable capability of the inspection technique; for instance, MHI response to RAI No. 199-2073, Question 10.02.03-5 stated that ultrasonic inspection procedures for the integral rotor forgings can reliably detect flaws of [ ] inches.
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**ANSWER:**

In non-ductile failure analysis for the Reactor Coolant Pump Flywheel, the crack size at which the flywheel would fail at a speed of 1,500 rpm is over 3.0 inches in length. The relation between crack size(up to 3.0 inches in length) and speed is shown in Table 1 below, for reference. These analysis results show that the critical crack size for design speed of 1,500 rpm (125% of normal operating speed) is large enough to be detected during an

inspection (including visual inspection), and this situation is the same for both a 10 year inspection interval and a 20 year inspection interval.

Table 1 Nonductile Failure Limiting Speed

Crack Length	Speed
0.25 inches	2,596 rpm *
0.50 inches	2,489 rpm *
1.00 inches	2,335 rpm
2.00 inches	2,144 rpm
3.00 inches	2,022 rpm

\* These values are provided in MUAP-07035 Rev.0

Depending on the shape of cracks, the ultrasonic inspection technique used for examining the RCP flywheel is capable of reliably detecting crack sizes of [ ] inches in length.

**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.

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