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

August 31, 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-11289

Subject: Revised MHI Plan for US-APWR Pipe Break Hazard Analysis

References:

(1) Technical report, MUAP-10017, Rev.1, December 2010, "US-APWR Methodology of Pipe Break Hazard Analysis"
(2) Technical report, MUAP-10022, Rev.0, February 2011, "Evaluation on Jet Impingement Issues Associated with Postulated Pipe Rupture"
(3) Revised RAI response, UAP-HF-10335, "MHI's Responses to US-APWR DCD RAI No. 636-4732 (SRP 03.06.02)"
(4) "Staff's preliminary Feedbacks on MHI's revised response to RAI No. 636-4732 regarding APWR DCD Section 3.6.2 jet loading evaluation"
(5) Presentation material, UAP-HF-11154, "Response to NRC's Draft Comment on Jet pressure Oscillation" dated June 22, 2011
(6) Presentation material, UAP-HF-11236, "MHI Plan for the Pipe Hazard Analysis" dated August 4, 2011

In reference (1), (2) and (3), Mitsubishi Heavy Industries, Ltd. ("MHI") provided the U.S. Nuclear Regulatory Commission ("NRC") staff a methodology of pipe break hazard analysis and RAI responses.

In reference (4), the NRC raised questions regarding the conservative methodology to assess oscillating jet impingement loads at all conditions throughout a jet blowdown process.

In reference (5), MHI provided the NRC staff assessed results for jet impingement loads at all conditions throughout the blowdown process. Then, mechanism and methodology for the Jet pressure oscillation analysis were presented to the NRC on June 22nd meeting.The following issues remained open for evaluation:

a) Jet pressure oscillation amplitude value
b) Damping ratio
c) Potential target

In reference (6), MHI explained the analysis methodology for the above issues a) ~ c) that will be documented in the revised technical reports (MUAP-10017 and MUAP-10022). The NRC did not identify any additional concerns regarding two of the three topics, "damping ratio" and "potential targets" at the August 4th meeting. With respect to "oscillation amplitude," NRC expressed concern on MHI proposal.

The purpose of this letter is to clarify the revised MHI plan for US-APWR Pipe Break Hazard

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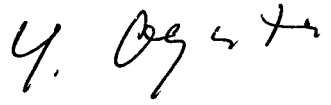
Analysis and to resolve the remaining issues a) Jet pressure oscillation amplitude value.

This letter includes a copy of the proprietary version (Enclosure 2), a copy of the non-proprietary version (Enclosure 3), 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 this letter. His contact information is provided below.

Sincerely,



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

Enclosures:

1. Affidavit of Yoshiki Ogata
2. "Revised MHI Plan for US-APWR Pipe Break Hazard Analysis (Proprietary)"
3. "Revised MHI Plan for US-APWR Pipe Break Hazard Analysis (Non-Proprietary)"

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

Contact Information
C. Keith Paulson, Senior Technical Manager
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Monroeville, PA 15146
E-mail: ckpaulson@mnes-us.com
Telephone: (412) 373-6466

Enclosure 1

Docket No. 52-021
MHI Ref: UAP-HF-11289

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

I, Yoshiki Ogata, state as follows:

1. I am General Manager, 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 documents entitled "Revised MHI Plan for US-APWR Pipe Break Hazard Analysis (Proprietary)", August, 2011 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 documents have 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 for performing the plant design of protection against postulated piping failures.

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.

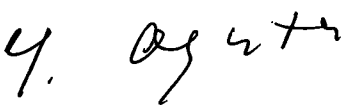
7. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without incurring the costs or risks associated with the design of the subject systems. Therefore, disclosure of the information contained in the referenced document would have 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 the methodology of the pipe break hazard analysis. 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 the methodology of the pipe break hazard analysis that maintains the desired level of conservatism.

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 31th day of August, 2011.



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

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Enclosure 3

UAP-HF-11289
Docket No. 52-021

Revised MHI Plan for US-APWR Pipe Break Hazard Analysis

(Non-Proprietary)

August, 2011

1. Revised MHI Plan for US-APWR Pipe Break Hazard Analysis

3) Revision of technical reports

MHI will add evaluation items of "blast wave" and "jet pressure oscillation" to the analysis procedure in Figure 1.1 of the technical report, MUAP-10017, Rev.2. (See Appendix-1)

MHI will add the analysis methodology of jet pressure oscillation to the technical report, MUAP-10022, Rev.1. (See Appendix-2)

The technical report, MUAP-10022, Rev.1 will include jet pressure oscillation amplitude ratio, the damping ratio and potential target in accordance with the NRC comments discussed on August 4th meeting as follows.

a) Jet pressure oscillation amplitude value

[ ]

b) Damping ratio

[ ]

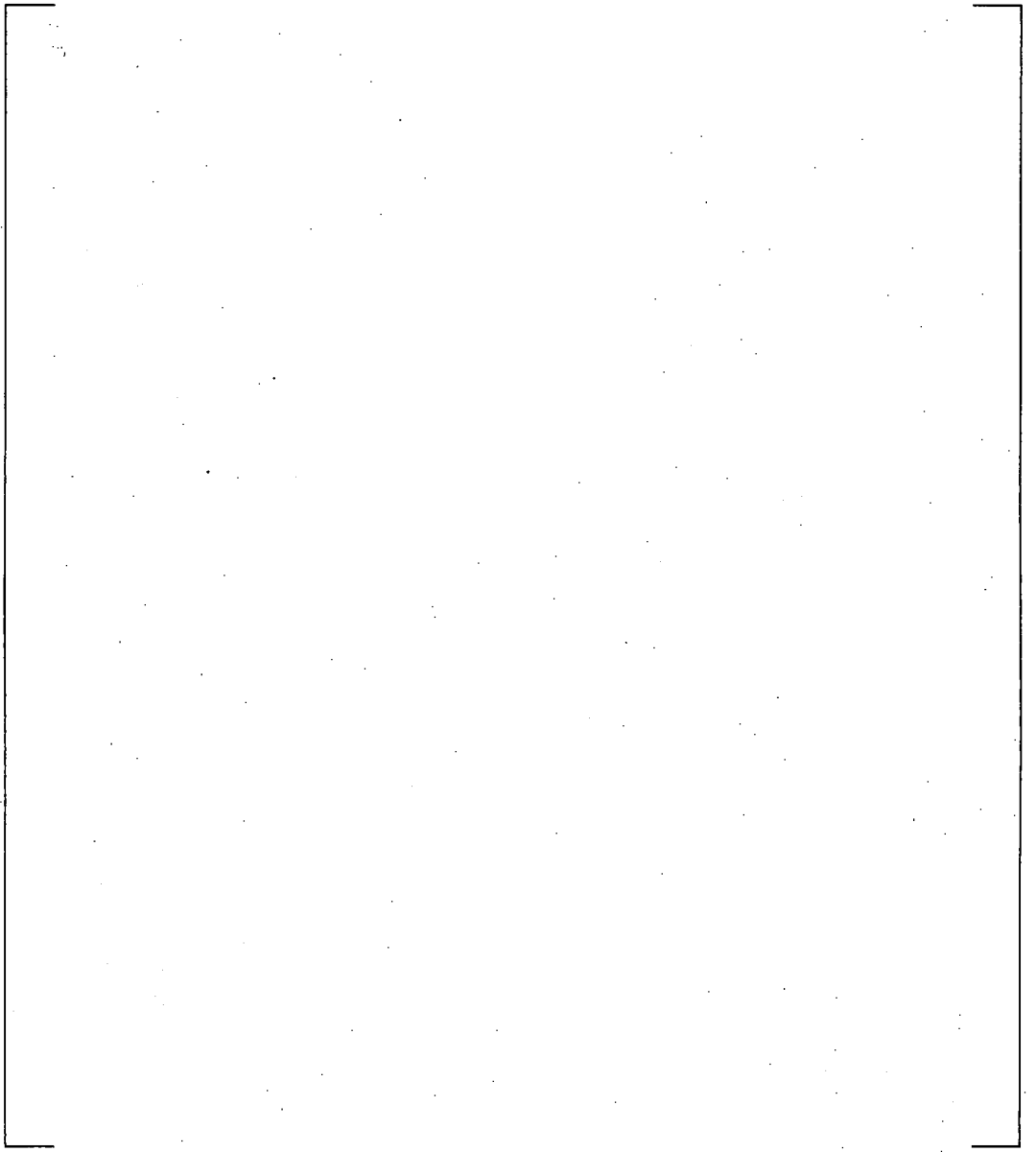
c) Potential target

[ ]

MHI will revise the both of technical reports by the end of September 2011.

4) Revision of DCD

MHI will revise subsection 3.6.2.4.1.2 "Jet Pressure Oscillation Assessing Procedure" according to the revision of the technical reports. (See Appendix-3)



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MHI will add a sentence "The calculation method of a static load is described in the technical report, MUAP-10017, Rev.2, December 2010, "US-APWR Methodology of Pipe Break Hazard Analysis" in Section 1.0 "OVERVIEW".

MHI will add the subsection 3.4 including Analysis methodology for jet pressure oscillation:
Evaluation flow diagram with explicit evaluation criteria will be added.
(4) Jet pressure oscillation amplitude: [ ]
(5) Damping ratio: [ ]
(6) Potential targets: Detailed methodology and calculation samples will be added.

3.6.2.4.1 Jet Impingement Loading on Safety-Related Components

Structural integrity of safety-related SSCs against jet impingement load caused by pipe break is evaluated based on steady state jet force from Subsection 3.6.2.3.

Jet impingement loading is a suddenly applied constant load which can have significant energy content. These loads are generally treated as statically applied loads. The Jet impingement pressure essentially has non-uniform distributions, which varies with distance from the pipe break as shown in References 3.6-26, 3.6-27, 3.6-28, 3.6-29, 3.6-30 and 3.6-31. However, the maximum pressure in the non-uniform distribution is conservatively used as a uniform pressure distribution.

The MHI original methodologies (Reference 3.6-25) used to evaluate the jet effects resulting from the postulated breaks in high energy piping are based on measurements cited in References 3.6-26, 3.6-27, 3.6-28, 3.6-29, 3.6-30 and 3.6-31. Figure 3.6-2 depicts jet characteristics for the three fluid states. The short term response evaluates the jet impingement load considering a dynamic load factor of 2 and snubber supports to be active. No dynamic load factor is used and the snubbers are considered inactive for the long-term response.

3.6.2.4.1.1 Blast Wave Assessing Procedure

Computational fluid dynamic analysis confirms the generation of a blast wave from a steam pipe break. Potential effects are assessed on equipment within the US-APWR pressurizer compartment. Distance between the postulated pipe break locations and components is long enough to attenuate the effects. However, if layout in the pressurizer compartment is changed in the future, reassessment of the blast wave will be conducted.

Blast wave is not considered to occur from a sub-cooled water pipe break. This is due to having a velocity of the two-phase flow at the break point that is slower than the speed of sound in atmospheric environments.

Therefore, the blast wave does n
32, Evaluation of Jet Impingemen
details on assessing a blast wave

MHI will modify all the sentences in subsection 3.6.2.4.1.2 regarding the jet pressure oscillation occurrence when the water flashing to steam in the later stage of a jet blowdown.

3.6.2.4.1.2 Jet Pressure Oscillation Assessing Procedure

Jet pressure oscillation from a steam pipe break is unlikely to occur in the US-APWR due to its high compression ratio. The jet flow expansion and Mach Disk is large. This leads to a stable flow downstream after the Mach Disk. The flow is so stable that disturbance at the impingement wall does not reach back to the Mach Disk.

When sub-cooled jet-flow impinges on the wall, pressure distributions on the wall are not of the concave type and a re-circulation vortex is not generated. This is due to having a flow velocity at the jet boundary that is lower than that of the core region.

Therefore, jet pressure oscillation does not have an impact on the design. Refer to Reference 3.6-32, Evaluation of Jet Impingement Issues Associated with Postulated Pipe Rupture, for details on assessing a jet pressure oscillation from a steam pipe break.