



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

April 24, 2009

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-09204

Subject: Additional Information for Sump Strainer Performance

- Reference:** [1] Letter MHI Ref: UAP-HF-08080 from Y. Ogata (MHI) to U.S. NRC, "Additional Information for NRC Review Schedule for US-APWR Design Certification Application" dated April 16, 2008.
- [2] Letter MHI Ref: UAP-HF-08228 from Y. Ogata (MHI) to U.S. NRC, "Transmittal of the meeting materials for the NRC's visit to Sump Chemical Effect Test", dated October 7, 2008.
- [3] Letter MHI Ref: UAP-HF-08306 from Y. Ogata (MHI) to U.S. NRC, "Transmittal of the Technical Report entitled "US-APWR Sump Strainer Performance" (MUAP-08001 Rev.2)", dated December 26, 2008.

On April 15, 2008, Mitsubishi Heavy Industries, Ltd. ("MHI") presented to the Nuclear Regulatory Commission ("NRC") the enhanced schedule and plan for the US-APWR sump strainer design. MHI also submitted the subsequent letter (Reference 1) to the NRC and committed that all reports required for the NRC review would be provided by the end of 2008. With this letter, MHI stated that a technical report MUAP-08001 would be updated incorporating a "bounding evaluation" for the evaluation of sump strainer debris head loss, using existing tests data of debris head loss measured at plant specific test for a U.S. operating plant.

At the NRC' visit to MHI Kobe Shipyard on September 17, 2008, the NRC asked MHI about the contents of the bounding evaluation, and asked about the content of the plan for the US-APWR head loss test. MHI replied that this bounding evaluation is a comparative evaluation with operating plant testing which would be applied for the US-APWR. MHI committed to the NRC that the aforementioned report would be revised incorporating the bounding evaluation in September, 2008, and further revised by the end of 2008, incorporating ongoing chemical effects tests results. However, MHI stated to the NRC that MHI had a plan to do head loss tests in early 2009, apart from the technical report, in order to further confirm that the design would perform as well as or better than that of the bounding evaluation. (Reference 2)

With the letter (Reference 3) dated December 26, 2008, MHI submitted the updated technical report incorporating a bounding evaluation which was based on the operating plant test data.

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After the report submission, the NRC reviewed the report and discussed the results in a conference call with MHI on April 10, 2009. In the call, the NRC expressed their concerns about the comparative evaluation based on operating experience. The NRC pointed out a concern regarding the head loss impact due to the strainer hole size. The different debris characteristics and/or strainer layout was also a concern affecting the validity of the comparative evaluation. The NRC eventually expressed that there might be many uncertainties in the evaluation, therefore, plant specific head loss testing to measure postulated debris head loss would be required to prove the design basis of the US-APWR.

MHI believes that the bounding evaluation is still valid since the US-APWR sump strainer has robust design features and has substantial conservatism in the evaluation areas of sump performance compared with operating plants as presented in the technical report (Reference 3), as well as in the past presentations to the NRC (Reference 1 and 2). The bounding evaluation should preclude the necessity for a head loss test specific to for the US-APWR.

However, in order to revalidate the bounding evaluation and provide additional empirical proof of the strainer head loss validation, MHI will complete the following actions to resolve the above NRC's concerns:

- 1) MHI has already initiated a program to measure the plant specific head loss for the US-APWR and is developing a test plan and test conditions for discussion with the NRC, prior to the test. A summary for the test plan is provided in Enclosure 2 of this letter. The test information and results will become an attachment to the report, MUAP-08001.
- 2) MHI will keep the bounding evaluation, as an independent validation to ensure the robustness of the US-APWR strainer design. MHI will revise the report to provide further additional information to justify the comparative evaluation using existing knowledge, experience at an operating plant, and/or using the above head loss test results.

Enclosure 2 of this letter describes a summary of the head loss test plan for the US-APWR.

The head loss testing for the US-APWR is currently planned for June, 2009.

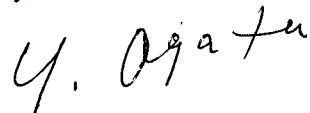
MHI is initiating these activities during the NRC phase 1 review, and is targeted for completion by June 2009. Therefore, MHI will update the Technical Report (Reference 3) by incorporating test results well in advance to the DCD phase-2 review period, to be completed by March 2010.

As indicated in the enclosed materials, this transmittal 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), a copy of the non-proprietary version (Enclosure 3), and the Affidavit of Yoshiaki 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,

A handwritten signature in black ink, appearing to read "Y. Ogata". The signature is written in a cursive style with a long horizontal stroke at the end.

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

Enclosures:

1. Affidavit of Yoshiki Ogata
2. Sump Strainer Head Loss Test Plan (Proprietary Version)
3. Sump Strainer Head Loss Test Plan (Non-proprietary Version)

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

Contact Information

C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373-6466

ENCLOSURE 1

Docket No. 52-021
MHI Ref: UAP-HF-09204

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

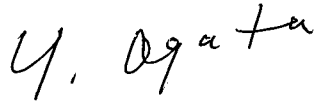
I, Yoshiki Ogata, state as follows:

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 document entitled "Additional Information for Sump Strainer Performance" dated April 2009, 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 test plan of the sump strainer system related to the US-APWR specific design, developed by MHI and involved vendors and not used in the exact form by any of MHI's competitors. This information was developed at significant cost to MHI, since it required the performance of research and development and the performance of detailed hardware design and software development extending over several years.
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 unique design and test plan of the sump strainer system. 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.

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 24th day of April, 2009.

A handwritten signature in black ink that reads "Y. Ogata". The signature is written in a cursive style with a long horizontal stroke at the end.

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

ENCLOSURE 3

US-APWR

Sump Strainer Head Loss Test Plan

(NON-PROPRIETARY VERSION)



Purpose

The purpose of this summary is to provide a brief description of the Test Plan to be implemented by PCI for the MHI US-APWR. The Test Plan will provide test results for the US-APWR plant specific strainer, plant configuration and design basis to compare and confirm the PCI calculation for bounding the US-APWR head loss performance using operating plant data conservatively bounds and qualifies the head loss performance of the standard Sure-Flow[®] Strainer (SFS) design for the US-APWR. In short, the testing is expected to resolve any and all RAIs regarding the head loss performance of the US-APWR standard design for the ECCS.

US-APWR Test Scaling Basis

The US-APWR licensing basis and the design specification have specified that debris will collect non-uniformly on any two (2) of four (4) operating sumps on the basis of a 70 / 30 ratio (Reference 1). This means that one (1) of the two (2) sumps will collect 70% of the debris and the other sump would only collect 30% of the debris.

This is a very conservative licensing basis compared to US industry methodologies discussed in NEI 04-07. This means the US-APWR licensing basis assumes debris will load on one (1) of the two (2) strainers with 40% more debris on one (1) sump (i.e., sump at 70%; not 50%) than a U.S. Licensee Design Basis utilizing the guidance provided in NEI 04-07.

The US-APWR design document (Reference 2) further specifies that 100% of the non-chemical debris (i.e., fibrous and particulate) quantity will be scaled for testing and it is further assumed that all 100% of the non-chemical debris reaches only one of the two operating strainers. In addition, the US-APWR design document specifies that 200% of the chemical precipitate debris shall be scaled to reach one of two operating strainers. All of this yields a very conservative testing basis for qualification.

For the test, a full scale SFS module of identical construction as planned for supply to US-APWR plants will be tested (Reference 3). The testing scale is therefore 1/18 (1 of 18 SFS modules) and a pump flow; of 5.56%; except for adjustments made to increase conservatism for non-uniform debris loading and for sacrificial screen areas for miscellaneous tags, labels, etc.. Debris allocations stated above are based on 9 SFS modules; less the sacrificial area for tags, labels, etc..

Tests and Test Protocol

The test protocol to be implemented by PCI through its subcontractors; AREVA NP, Inc. and Alden Research Laboratory, Inc. is consistent with the testing protocol developed with the NRC staff beginning in April 2007 and includes refinements caused through witness and comment by the NRC staff for debris tests implemented for nine(9) other PCI clients; U.S. licensees.

In general, this protocol is the most comprehensive and robust test protocol applied in the industry since it includes a bounding flow stream to allow settling of debris in the near field; which is defined herein as the flow stream(s) within 30 feet of the plant strainer modules.

The bounding flow stream is defined by modeling the recirculation pool with a CFD computer program. The model includes all sources of flow into the recirculation pool. The flow streams created when any two of four sumps are operating are then documented in 30 one foot increments from the modules to define the strainer approach flow stream velocities. To fully evaluate the US-APWR; six different combinations of sump pairs were evaluated to determine



which combination would create the bounding (highest velocity) "near field" approach flow stream to the SFS test module.

The results from the CFD approach flow stream analysis only evaluates flow stream velocities along streamlines from the strainer modules and thus does not take into account areas of flow recirculation. Approach velocities thus calculated are therefore higher and more conservative than what would be obtained with simple cross-sectional averaging. Conservatism is further applied by using a weighted average by applying the fastest approach flow stream velocity at each 1 foot increment twice to further bound the post LOCA conditions to the test conditions.

For the US-APWR, the two north sumps were confirmed to have the highest approach velocity combination of operating sump pairs; *predominantly because each is affected in this process by the location of two downcomers in the near field of each sump; (within 30 feet of the strainer modules)*. This defining case is significantly more severe compared to the other 5 cases evaluated.

Six changes in the flume's flow stream width are planned to bound the controlling worse case flow velocities defined by the CFD modeling and analysis.

Test Protocol

In general, the test protocol for debris testing will introduce debris 30 feet from the strainer; except for a small portion of latent fiber which is introduced along the 30 foot flow stream at the surface of the water prior to test recirculation start up. Water is pre-heated to ~ 120 °F and kept at this temperature to the extent possible.

Particulates are introduced first; from most transportable to least transportable; then fibers; beginning with "fines"; and then "smalls" fiber classes. Debris not expected to transport is then introduced such as large pieces of fibers, chunks of materials, etc..

Once all non-chemical debris is introduced, PCI normally allows the debris bed to continue to form overnight. In the morning of the second test day, ALOOH chemical precipitate debris; manufactured within 24 hours of introduction and meeting the settling criteria required by the NRC is introduced in controlled batches so as not to over concentrate the recirculation pool.

Based on the test scaling and configuration; PCI anticipates it will use the second day to introduce 100% of the chemical debris; and the third test day to introduce the "second" 100% chemical debris before going to test termination.

The total number and types of tests planned are as follows;

- **Clean Strainer Head Loss Test**
This test will determine the head loss of the clean strainer which will be subtracted the latter tests to determined the debris-bed head loss.
- **Miscellaneous Debris Transport Test**
The debris transport characteristics of miscellaneous debris (tags, labels, tape, Reflective Metallic Insulation (RMI), etc.) will be tested.
- **Design Basis Test**



Enclosure 3
US-APWR - Sump Strainer Head Loss Test Plan

This test will determine the debris-bed head loss which envelops the design basis accident for the US-APWR. This bed test will be a contingency test, and will be performed if fiber bed is observed sufficiently formed on whole strainer surface without clean surface portion at the design basis test.

In summary, the US-APWR Test Plan will test the standard SFS design for the US-APWR using the testing protocol developed and evolved with US NRC oversight. The Test Plan exceeds the design basis requirements proposed for US-APWR licensing; therefore, this test plan is bounding. If the test confirms the debris head loss is less than that calculated using industry bounding methodologies, the test result(s) will provide an alternate and independent methodology to validate the US-APWR has met the licensing requirements for head loss performance.

References:

1. Mitsubishi Heavy Industries, Ltd. "US-APWR Sump Strainer Performance", MUAP-08001 Rev.2, December, 2008
2. Mitsubishi Heavy Industries, Ltd. "US-APWR Technical Information and Requirements for ECC/CS Strainer Rev.2, Mar, 2009.
3. PCI/AREVA, US-APWR Test Plan (Draft), April 2009.

Best regards,

James M. Bleigh

Engineered Systems Manager

Performance Contracting, Inc.

16047 West 110th Street

Lenexa, KS 66219

Phone: 913-928-2801 / Fax 913 928-2901

Cell: 913-707-5407



Enclosure 3
US-APWR - Sump Strainer Head Loss Test Plan





Enclosure 3
US-APWR - Sump Strainer Head Loss Test Plan

