Docket No. 52-021
MHI Ref: UAP-HF-12064

Enclosure 3

UAP-HF-12064
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US-APWR Sump Strainer Test Plan for Head Loss Test

March 2012
(Non-Proprietary)

US-APWR

Sump Strainer Test Plan for Head Loss Test

NON-PROPRIETARY VERSION

March, 2012

MITSUBISHI HEAVY INDUSTRIES, LTD

Revision History

Revision	Page	Description
0	All	First Issue

Contents

1. Introduction

The US-APWR strainer test program is planned in order to obtain test data for strainer head loss. The head loss test plan shall be used to demonstrate acceptable head loss across the sump strainer subject to design basis post-LOCA debris loading. The test protocol shall be developed to reflect the discussions between the staff and MHI; extensive review and evaluation of NRC public meeting documents associated with GL-2004-02, GSI-191, and RG 1.82, Rev. 3; licensee RAI responses; and publicly available NRC trip reports that documented licensee strainer head loss testing. In addition, particular attention shall be paid to the 2008 March Guidance document (Reference 1). The test protocol and test plan also utilize guidance provided in NEI 04-07 Volume 1 and 2 (Reference 2, 3).

The following US-APWR test program shall be implemented:

Test-1 - Clean Test Strainer Head Loss (CTSHL) Test
Test-2 - Debris Laden Test Strainer Head Loss (DTSHL) Test

Each of the subject tests are described below. It should be noted that Test-2 is equivalent to Thin Bed Test due to the limited Design Basis quantity of fibrous debris associated with the US-APWR design.

Test-1 - Clean Test Strainer Head Loss (CTSHL)

The purpose of Test-1 is to establish the CTSHL for the US-APWR full-scale test strainer and to establish the system head loss prior to debris loading. For this test, non-chemical and chemical debris shall not be introduced. The test data results will be subtracted from Test-2 to determine the "debris loaded" head loss for the strainer.

Test-2 - Debris Laden Test Strainer Head Loss (DTSHL)

The purpose of Test-2 will be to measure the maximum head loss across the strainer with the design basis debris loading. This test will also be deemed as the Thin Bed Test to evaluate potential for the formation of a thin fiber bed that may trap additional particulate debris and increase head loss across the strainer. Floating debris which did not accumulate on the strainer was observed at the test conducted in June 2010. This issue was addressed by improving debris preparation and introduction procedure at previous test conducted in June 2011. Therefore, those improved procedures will be maintained.

CTSHL and DTSHL will be utilized to establish the total strainer head loss (TSHL). The measured CTSHL for Test-1 is subtracted from the DTSHL result for Test-2 and then, the prototype clean strainer head loss (CSHL, calculated separately) is added to determine the total strainer head loss (TSHL). Finally, design basis strainer head loss (DBSHL), with safety margin to TSHL, will be utilized for design basis NPSH calculation as discussed in Section 3.6 of MUAP-08001. (Reference 4)

The plant specific head loss test of the US-APWR will be implemented at Alden Research Laboratory (ARL) located at Holden, MA.

2. Test Facility

3. Test Debris

4. Test Scaling

5. Monitored Test Parameters

6. Test Termination Criteria

[redacted]

7. Repeatability

[redacted]

8. Schedule

See Table 2 for schedule for Strainer Head Loss Testing.

9. References

1 NRC Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Strainer Head Loss and Vortexing, March 2008, USNRC, NRR.

2 NEI 04-07 Volume 1, "Pressurized Water Reactor Sump Performance Evaluation Methodology," December 2004.

3 NEI 04-07 Volume 2, "Pressurized Water Reactor Sump Performance Evaluation Methodology," December 2004.

4 "US-APWR Sump Strainer Performance", MUAP-08001 Rev.5, Mitsubishi Heavy Industries, Ltd., August 2011. [ML11255A277]

5 Sure Flow Suction Strainer - Testing Debris Preparation & Surrogates Technical Document No. SFSS-TD-2007-004 Revision 4, January 2009. [ML092430056 & ML092580203]

6 NUREG/CR-6877 (LA-UR-04-3970), Characterization and Head Loss Testing of Latent Debris from Pressurized Water Reactor Containment Buildings, July 2005 USNRC.

7 Letter from Ho K. Nieh (NRR) to Gordon Bischoff (PWROG), dated December 21, 2007, Final Safety Evaluation for Pressurized Water Reactor Owners Group (PWROG) Topical Report (TR) WCAP-16530-NP, "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191" (TAC No. MD1119) (ADAMS Accession No. ML073521072), and Final Safety Evaluation by the Office of Nuclear Reactor Regulation Topical Report WCAP-16530-NP "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191" Pressurized Water Reactor Owners Group Project No. 694 (ADAMS Accession No. ML073520891)

8 NUREG/CR-6224, "Parametric Study of the Potential for BWR ECCS Strainer Blockage Due to LOCA Generated Debris", Appendix-B, "Transient ECCS Blockage Model", October 1995 USNRC

9 Letter from Ervin L Geiger (NRR) to Stuart N Bailey (SIRB), dated October 8, 2010, "Trip Report on Staff Observation of Generic Safety Issue 191 Related Fuel Blockage Testing of AREVA Fuel at Westinghouse Science and Technology Center" [ML102720058]

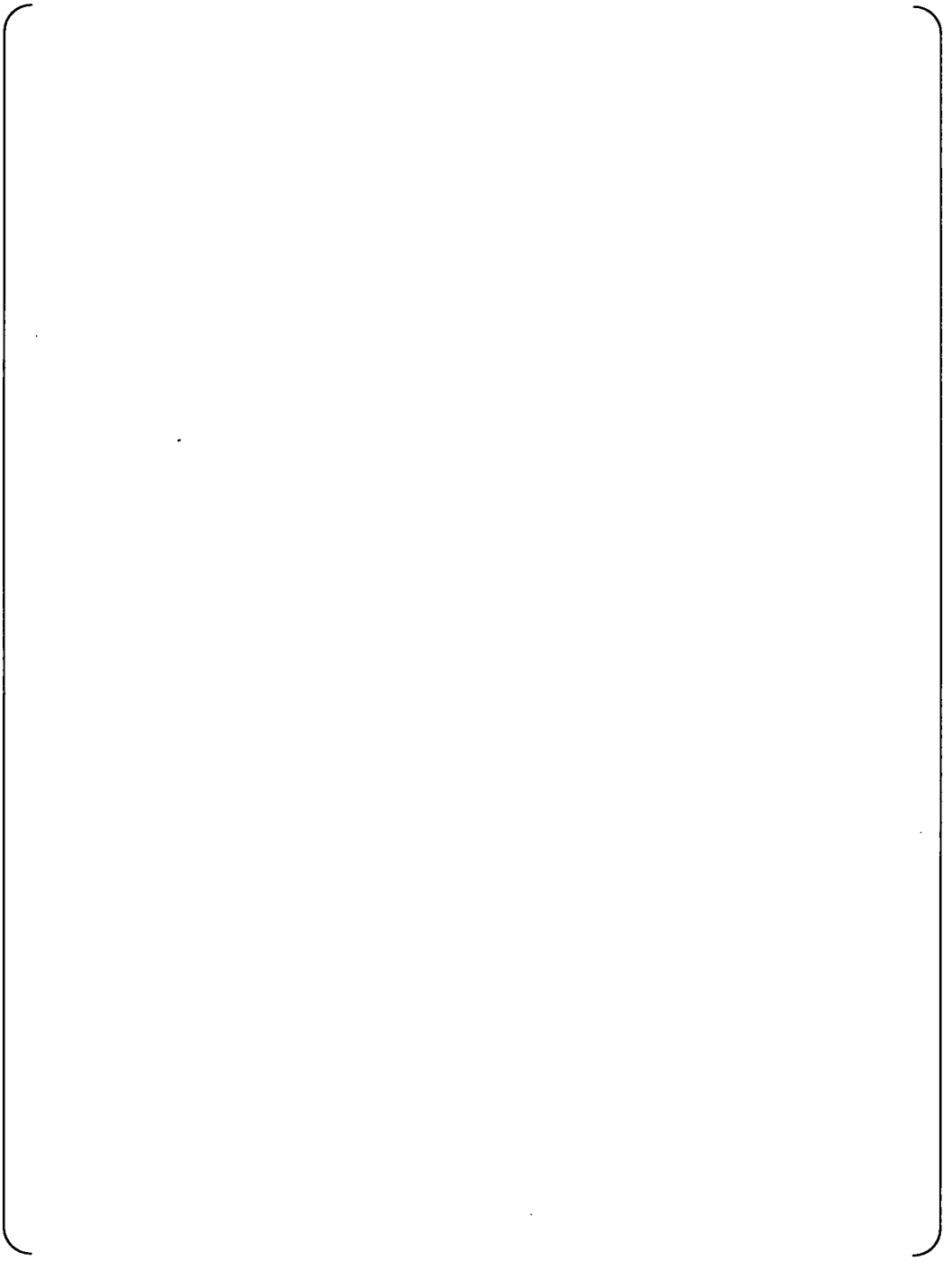

Figure 1 US-APWR Test Flume Configuration (Simplified)

Table 1 Principle Plant/Head Loss Test Parameters

Table 2 Head Loss Test Schedule