

**REQUEST FOR ADDITIONAL INFORMATION NO. 102-1391 REVISION 0**

11/20/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 14.02 - Initial Plant Test Program - Design Certification and New License Applicants  
Application Section: 14.2 Initial Plant Test Program

QUESTIONS for Quality and Vendor Branch 1 (AP1000/EPR Projects) (CQVP)

14.02-91

RAI 1391 Question 4917 follows up MHI's response to RAI 7 Question 14.02-1.

MHI's response to RAI 7 Question 14.02-1 noted in part that Table 1.9.1-1 of the US-APWR DCD would be changed to status RG 1.37 as: "Conformance with no exceptions identified." Instead, Revision 1 to Table 1.9.1-1 of the DCD statuses RG 1.37 as: "Conformance with exception. Programmatic/operational aspect is not applicable to US-APWR design certification." The Revision 1 status of RG 1.37 in Table 1.9.1-1 of the DCD is not consistent with the status of other RGs to be used for the construction and preoperational phases of a US-APWR plant. MHI needs to revise Table 1.9.1-1 of the DCD to status RG 1.37 in accordance with MHI's initial response to RAI 7 Question 14.02-1.

(BNL 14.02-1, Sup. 1)

14.02-92

RAI 1391 Question 4918 follows up MHI's response to RAI 33 Question 14.02-28.

Section 14.2.10.2 of the US-APWR DCD includes general descriptions of the conditions required for plant initial criticality. RG 1.68, App. A.3, "Initial Criticality," cautions that: "all systems required for startup or protection of the plant should be operable and in a state of readiness." The RG 1.68 statement includes, but is not limited to, two specific examples: "the reactor protection system and emergency shutdown system." MHI is correct that the two specific examples from the more general RG 1.68 statement are addressed in DCD Section 14.2.10.2. However, DCD Section 14.2.10.2 does not include the RG 1.68 general prerequisite. MHI needs to include the RG 1.68, App. A.3, general prerequisite that: "all systems required for startup or protection of the plant should be operable and in a state of readiness" in Section 14.2.10.2 of the DCD.

(BNL 14.02-28, Sup. 1)

**REQUEST FOR ADDITIONAL INFORMATION NO. 102-1391 REVISION 0**

14.02-93

RAI 1391 Question 4921 follows up MHI's original response to RAI 33 Question 14.02-31.

MHI's response to of RAI 33 Question 14.02-31 is satisfactory (pending confirmation of the associated revision to the US-APWR DCD) with the exception of providing for an Accumulator Hot Flow Test per RG 1.79 Section C.1c.(3).

Please provide for an Accumulator Hot Flow Test in Section 14.2 of the DCD per RG 1.79 Section C.1c.(3).

(BNL 14.02-31, Sup. 1)

14.02-94

RAI 1391 Question 4922 follows up MHI's original response to RAI 33 Question 14.02-32.

Item (a) of MHI's response to RAI 33 Question 14.02-32 addresses verification of the reactor coolant pump (RCP) design flow rate. MHI refers to test 14.2.12.2.4.12, "RCS Flow Measurement Test," which states that: "*RCS flow rate is determined based on the correlation between data obtained by measuring RCP motor input power and the differential pressure across the reactor coolant line elbow tap, for the purpose of confirming reactor coolant flow is equal to or greater than the design flow specified in Section 5.1.*" It would appear that the full flow reference point should be established as part of the ITP. Please provide more information to explain how the actual value of RCS flow is determined. Is the elbow flow measurement device factory calibrated before installation? Is it calibrated after installation into the RCS using some certified reference standard?

Items (e) and (i) of MHI's response to the RAI relate to testing of component cooling water (CCW) cooling to the RCP. The MHI response refers to test 14.2.12.1.87 for the CCW System, but that test only seems to verify flow rates and not cooled component temperatures. MHI needs to add a step to the RCP test to verify temperatures and adequate cooling to the thermal barrier heat exchange (HX) and the motor air coolers or explain where that is verified.

(BNL 14.02-32, Sup. 1)

14.02-95

RAI 1391 Question 4923 follows up MHI's original response to RAI 33 Question 14.02-34.

MHI's response to RAI 33 Question 14.02-34 did not address part of the question. RG 1.68, App. A, Item 1.a(2)(d) calls for a check of the "pressure relief valves ... supports

## REQUEST FOR ADDITIONAL INFORMATION NO. 102-1391 REVISION 0

and restraints for discharge piping.” This check should be done after the valves have actuated and relieved. Please address this RG 1.68 guidance in the appropriate DCD test abstracts.

(BNL 14.02-34, Sup. 1)

### 14.02-96

RAI 1391 Question 4924 follows up MHI's original response to RAI 33 Question 14.02-40.

As noted in MHI's response to RAI 33 Question 14.02-40, MHI will revise Subsection 14.2.12.1.12 to include verification for the operability of heat tracing or area heating for portions of the Chemical and Volume Control System (CVCS) that normally contain 4 wt. % of boric acid solution. The purpose of the heat tracing is to assure that boric acid solution temperature does not go below 65 °F. The acceptance criteria states that the related portion of CVCS will operate as described in Subsection 9.3.4.3. However, Subsection 9.3.4.3 does not define the test criteria or methods. Please describe how MHI will test to show that the 65 °F limit is maintained for credible environmental conditions.

(BNL 14.02-40, Sup. 1)

### 14.02-97

RAI 1391 Question 4925 follows up MHI's original responses to RAI 33 Question 14.02-56 and Question 14.02-57.

MHI's original responses to RAI 33 Question 14.02-56 and Question 14.02-57 indicates several changes to DCD Section 14.2.12.1.50, “Dynamic State Vibration Monitoring of Safety Related and High-Energy Piping,” and Section 14.2.12.1.51, “Steady State Vibration Monitoring of Safety Related and High-Energy Piping.”

(a) In Section A, "Objective," of Subsection 14.2.12.1.50, MHI indicated that the word “specified” would be deleted from the phrase “specified transients.” If this subsection is intended to instrument and monitor piping during plant transients experienced during preoperational testing (and listed in the proposed changes to Subsection 14.2.12.1.1, “RCS Preoperational Hot Functional Test,”) then the word “specified” should be replaced with the phrase “preoperational test transients.” MHI should revise Subsection 14.2.12.1.50 to replace the word "specified" with the phrase “preoperational test transients.”

(b) In Section C, "Test Method," of Subsection 14.2.12.1.50, MHI indicated that the requirement to measure piping deflections during various plant transients would be replaced with three (3) specific action items. These specific items are acceptable. However, the dynamic response referred to in MHI's new item (1) and perceptible vibration by visual inspection referred to in MHI's new item (2) should be clearly defined. Deflection measurements may be considered as one of the vibration responses. However, the “Acceptance Criteria” should clearly state the response level at which

## REQUEST FOR ADDITIONAL INFORMATION NO. 102-1391 REVISION 0

the High Energy Piping components perform their intended functions. The current DCD Section 14.2.12.1.50 refers to DCD Section 3.9.2, which does not provide any such acceptance criteria for RVI components. MHI should revise Section 14.2.12.1.50 and Section 12.2.12.1.51 to specify or reference specific acceptance criteria.

(BNL 14.02-56/57, Sup. 1)

### 14.02-98

RAI 1391 Question 4926 follows up MHI's original response to RAI 58 Question 14.02-86.

MHI's response to RAI 58 Question 14.02-86 states that MHI will revise DCD Subsection 3.9.3.4.2.7 to delete the testing program of in-situ snubber dynamic lock-up testing. MHI needs to provide information in the DCD to indicate how the US-APWR will meet the ASME OM Code, Subsection ISTD, Article ISTD 5, "Preservice Operability Testing," for snubbers. This section calls for preservice testing of all snubbers that includes dynamic lockup testing.

(BNL 14.02-86, Sup. 1)

### 14.02-99

RAI 1391 Question 4927 follows up MHI's original response to RAI 33 Question 14.02-64.

As noted in MHI's response to RAI 33 Question 14.02-64, MHI will be revising Subsection 14.2.12.1.59, "Refueling Water Storage System Preoperational Test," of the US-APWR DCD to clarify the test acceptance criteria and include references to appropriate subsections of the DCD. However, the DCD subsections do not include the alarm setting for the high, below normal, and low levels in the refueling water storage pit (RWSP). These alarm levels should be included in DCD Subsection 14.2.12.1.59. Additionally, please reference DCD Section 6.3.2.2.3 in DCD Subsection 14.2.12.1.59.

(BNL 14.02-64, Sup. 1)

## REQUEST FOR ADDITIONAL INFORMATION NO. 102-1391 REVISION 0

14.02-100

RAI 1391 Question 4928 follows up MHI's original response to RAI 33 Question 14.02-66.

MHI did not respond to Item (2) of RAI 33 Question 14.02-66. Please add RGs 1.35 and 1.35.1 to Table 14.2-2 of the DCD or justify their exclusion.

(BNL 14.02-66, Sup. 1)

14.02-101

RAI 1391 Question 4929 follows up MHI's original response to RAI33 Question 14.02-69.

1. MHI's response to RAI 33 Question 14.02-69 is not complete and does not fully address the determination and correlation of leakage rates between leak detection sub-systems. RG 1.45 states (page 7) that: "Evaluating an alarm or indication of leakage is important, and the ability to compare indications of leakage to those of other monitoring methods is necessary." RG 1.45 additionally notes that "plants should formulate functional relationships converting signals from these other leakage monitoring systems to a leakage rate and provide them to the operators." MHI should revise the test procedure to provide for conversion of the various leak detection sub-system measures to RCS leakage rate and comparisons between the leak rates determined by the various sub-systems to ensure consistency within system capability and sensitivity.

2. DCD Subsection 14.2.12.1.71, "RCS leak Rate Preoperational Test," and the newly proposed test 14.2.12.1.xx, address RCS leakage rate systems at the preoperational phase. DCD Subsection 14.2.12.2.1.10, "RCS Final Leak Rate Test," addresses RCS leakage rate after fuel load, but apparently before power operation. Please add the changes that MHI committed to for Test 71 to Test 14.2.12.2.1.10, as well. Also, please perform Test 14.2.12.2.1.10 at full power to provide more appropriate testing of those several leakage detection sub-systems that utilize radiation measurements to detect RCS leakage rate.

(BNL 14.02-69, Sup. 1)

14.02-102

**RAI 1391 Question 4930 follows up MHI's original response to RAI 33 Question 14.02-78 and Question 14.02-79.**

RAI 33 Question 14.02-78 and Question 14.02-79 addressed the testing of the Instrument Air (IA) and the Service Air (SA) Systems as described in DCD Subsections 14.2.12.1.91 and 14.2.12.1.92 respectively. There is currently no test to address the compressed gas system. The RAI responses and the DCD commit to RG 1.68.3 but take

## REQUEST FOR ADDITIONAL INFORMATION NO. 102-1391 REVISION 0

exception to items C.7, C.8.b, and C.11. The NRC staff agrees that C.7 is not applicable to the US-APWR but maintains that the rest of the RG should be addressed.

MHI needs to:

(1) Provide a commitment to test the IA, SA, and compressed gas systems to RG 1.68.3 including all sections of the RG except for C.7.

(2) Revise DCD Subsections 14.2.12.1.91 and 14.2.12.1.92 to address all necessary aspects of RG 1.68.3.

(3) Provide a new preoperational test to test the compressed gas system, including the nitrogen, hydrogen, and oxygen sub-systems.

DCD Section 9.3.1.2.1.1, "Instrument Air System," states that: "Provisions are made to cross-connect the IAS and SSAS at the distribution header upstream of the dryers. In event that the instrument air compressors cannot meet the demand for instrument air, the station service air compressors will provide a backup supply of air." The SA System, therefore, falls within the scope of RG 1.68.3 and should be tested to this RG just as the IA System is tested. Further, this statement in the DCD seems to conflict with Acceptance Criterion D.5 of DCD Subsection 14.2.12.1.91, "Instrument Air System Preoperational Test" (refer to Section C.9 of RG 1.68.3).

MHI needs to:

(4) Reconcile the excerpt from DCD Section 9.3.1.2.1.1 with acceptance criterion D.5 of DCD Subsection 14.2.12.1.91.

Section C.8.a of RG 1.68.3 calls for a sudden loss of air pressure test and Section C.8.b calls for a gradual loss of air pressure test to verify that important to safety air-operated loads respond in accordance with their design on a loss of air pressure. The RAI response states that the: "US-APWR does not perform the gradual reduction pressure test because the sudden air pressure shutoff test verifies that the affected components respond properly." The purpose of C.8.b is to verify that the components do in fact operate as designed on a gradual loss of pressure. Just stating that they do operate that way by design does not meet the intent of the RG to verify that by testing.

MHI needs to:

(5) Revise DCD Subsection 14.2.12.1.91 to incorporate the gradual loss of air pressure test recommended in Section C.8.b of RG 1.68.3.

Section C.11 calls for functional testing of air systems important to safety to ensure that credible failures resulting in an increase in the supply system pressure will not cause loss of operability. MHI's response to RAI 33 Question 14.02-78 states that C.11 does not apply because the US-APWR does not have an important-to-safety instrument and control air system. The NRC staff does not agree with this interpretation. First, the set of safety-related components and systems is a subset of the larger set of important-to-safety systems and components. Second, Section A of footnote 1 of RG 1.68.3 describes that the RG applies to compressed air and other compressed gas systems that supply loads that could affect the overall safety and performance of the plant. This

## REQUEST FOR ADDITIONAL INFORMATION NO. 102-1391 REVISION 0

certainly applies to the US-APWR Instrument Air, which has safety-related loads listed in Table 9.3.1-1. The Service Air System can also supply these loads. And the Compressed Gas System supplies nitrogen and hydrogen to the safety injection accumulators, the pressurizer relief tank, the radwaste tanks, waste gas analyzer, and the volume control tank (VCT) for injection into the RCS. The staff does note that some testing at overpressure appears to be conducted in DCD Subsection 14.2.12.1.91, step C.5, despite the exception to Section C.11 of RG 1.68.3.

MHI needs to:

(6) Revise DCD Subsections 14.2.12.1.91 and 14.2.12.1.92 as required to document conformance to the guidance of Section C.11 of RG 1.68.3.

Further, MHI's response to RAI 33 Question 14.02-78 states that it is not necessary to reference RG 1.68.3 within the test abstracts because the recommendations of the RG are incorporated into the test abstracts. However, that is not completely the case. For example, most of the sections of the RG are addressed in Test 91 but most are not addressed in Test 92. Also, items C.8a and C.8b are not addressed in the test method section of Test 91. The staff notes that there is a statement in Test 91, "Verification of safety-related containment isolation valve position on loss of pressure is described in Subsection 14.2.12.1.62." However, Test 62 does not perform this test, rather lists it as a prerequisite. Also, the containment isolation valves are only a subset of all the safety-related air-operated valves of Table 9.3.1-1. There may be additional important-to-safety air-operated valves that need testing that are not listed in this Table.

MHI needs to:

(7) Reference RG 1.68.3 in DCD Subsections 14.2.12.1.91 and 14.2.12.1.92.

(8) Revise the reference to DCD Subsection 14.2.12.1.62 in DCD Subsection 14.2.12.1.91 to reconcile the statement that: "Verification of safety-related containment isolation valve position on loss of pressure is described in Subsection 14.2.12.1.62."

(9) Revise Tests 91 and 92 to include testing of RG 1.68.3 items C.8a and C.8b for all valves and other components within the scope of the RG; or reference where they are tested.

(BNL 14.02-78/79, Sup. 1)

### 14.02-103

RAI 1391 Question 4931 follows up MHI's original response to RAI 33 Question 14.02-83.

While DCD Table 1.1.1-1 commits to RG 1.140 with no exceptions, DCD Subsection 14.2.12.1.103 for the TSC HVAC System does not commit to fully testing per RG 1.140. There appear to be some areas where the RG is not implemented in the Initial Test Program. MHI needs to revise Subsection 14.2.12.1.103 to commit to full

## REQUEST FOR ADDITIONAL INFORMATION NO. 102-1391 REVISION 0

testing per RG 1.140 or explain the reason for areas not met or where alternative standards are used.

(BNL 14.02-83, Sup. 1)

### 14.02-104

(1) In DCD Section 14.2.12.2.3.8, Item D.2, the word “responses” should be “respond.”

(2) In DCD Section 14.2.12.2.4.9, the title of the test abstract is “Operational Alignment of Process Temperature Instrumentation at Power Test.” However, in Table 14A-1, items 5.y and 5.s, the test abstract is cited as “Operational Alignment of Process Temperature Instrumentation Test.” Please revise Table 14A-1, items 5.y and 5.s to document the proper title of the test abstract in DCD Section 14.2.12.2.4.9.

The test title should be consistent, particularly since there are two tests with similar titles.

(BNL 14.2-75)

### 14.02-105

The test described in DCD Subsection 14.2.12.2.1.14, “Operational Alignment of Process Temperature Instrumentation Test,” was added to the US-APWR DCD as part of Revision 1 to address the alignment of process instrumentation under isothermal conditions prior to criticality. This test is linked to a similar at-power test described in DCD Subsection 14.2.12.2.4.9. However, DCD Subsection 14.2.12.2.1.14 does not appear in Table 14A-1, which cross-references RG 1.68, Appendix A to the US-APWR test abstracts. Please reference DCD Subsection 14.2.12.2.1.14 in Table 14A-1 under items 5.y and 5.s.

(BNL 14.2-76)

### 14.02-106

RAI 1391 Question 5150 follows up MHI's original response to RAI 12 Question 14.02-3

DCD, Section 14.2.1, has a paragraph that provides the relevant requirements to which the test program conforms.

Bullet #4 refers to Section III.A.4 of 10CFR50, App. J, but that section does not exist. Please update by referring to App. J, Option B.

Bullet #5 refers to 10CFR52.79, but that section is for COL applications. Please correct to 52.47 for design certification applications.

(BNL 14.02-3, Sup. 1)