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

September 18, 2008

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-08183

Subject: MHI's Responses to US-APWR DCD RAI No. 51

Reference: 1) "Request for Additional Information No. 51 Revision 0, SRP Section: 14.03.11 – Containment Systems and Severe Accidents – Inspections, Tests, Analyses, and Acceptance Criteria: 14.3.4.11," dated August 19, 2008.

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. 51 Revision 0 .

Enclosure 1 provides the response to the 17 questions that are contained within Reference 1.

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,

Y. Ogata

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

Enclosure:

1. Responses to Request for Additional Information No. 51 Revision 0

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

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NRO

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

Docket No. 52-021
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Enclosure 1

UAP-HF-08183
Docket No. 52-021

Responses to Request for Additional Information No. 51 Revision 0

September 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

9/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 51 REVISION 0**
SRP SECTION:	**14.03.11 – Containment Systems and Severe Accidents – Inspections, Tests, Analyses, and Acceptance Criteria**
APPLICATION SECTION:	**14.3.4.11**
DATE OF RAI ISSUE:	**8/19/2008**

QUESTION NO.: 14.03.11-1

(14.3.4.11-1)
Clarify the key design features of the CHS system that are to be verified via ITAAC

The Design description for the Containment Hydrogen Monitoring and Control System (CHS) should include more details of the key design features of the hydrogen igniter system and the hydrogen igniters in the system. A figure should be included in the CHS Tier 1 section, noting the location and arrangement of these igniters in the containment.

SRP Chapter 14 appendix C provides guidance for the development of ITAAC used to verify severe accident features.

The Tier 1 design description for the CHS does not provide the specific locations for the hydrogen igniters and the key design features for the igniters. It does not specify a need for a minimum quantity of functional igniters. The operating principle of these igniters is not described. The severe accident function of the igniters is not discussed and the qualification of the igniters to withstand severe accident environment is not stated.
No figure is provided in Section 2.11.4 of the Tier 1 US-APWR DCD identifying the locations of the igniters.

Include these descriptions and a figure identifying the locations of the igniters that were assumed in the severe accident analysis as part of Section 2.11.4 of the Tier 1 USAPWR DCD, to include specific ITAAC to verify each key design feature or provide a justification as to why the above information need not be verified via ITAAC. Include a discussion of the roadmaps used to develop the key design features of the CHS system Tier 1 information from the severe accident analysis.

ANSWER:

Section I.A.(3), Appendix C.II.1-A of RG 1.206 discusses the ITAAC for the severe accident features, as follows.

"The design description should describe these features, and the functional arrangement ITAAC should verify that they exist. In general, the ITAAC need not include the capabilities of these features."
Thus, ITAAC for the non-safety systems with severe accident features should focus on verification of the existence (not capabilities) of the systems, components, or equipment, and the ITAAC for the severe accident features which are linked to the capabilities are not proposed in Tier 1.
Based on the above consideration, MHI responds to each question as follows:

Location of the igniters, minimum quantity of functional igniters required
There are 20 igniters strategically located in containment areas and subcompartments where hydrogen may be produced, transit or collect. MHI will add the above information as "key design features" and "location and functional arrangement" in Section 2.11.4 of Tier 1.
The location and figure are sufficiently shown in Tier 2 Subsection 6.2.5.2 and Figure 6.2.5-1, and MHI believes that this revision provides sufficient detail in Tier 1.

Key design features for the igniters
Current Tier 1 description states as follows.

> The CHS consists of the hydrogen monitoring system and the hydrogen ignition system. The hydrogen monitoring system consists of a single hydrogen detector. The hydrogen ignition system consists of a set of igniters designed to burn hydrogen continuously at a low concentration. The hydrogen igniters burn off hydrogen starting at the low flammability limit (approximately 10% hydrogen in air), thereby preventing further hydrogen accumulation that could become a threat to containment integrity.

MHI believes that the information is sufficient information for Tier 1 purposes.

Operating principle
The igniters are considered non-safety related components, and the descriptions of non-safety related components in Tier 1 are allowed to contain less detail. The detailed information on the igniter operating principle is provided in Section 6.2.5, Table 6.2.5-1 and Section 19.1.3.2 of Tier 2 as a glow plug type.

Severe accident function and qualification
Tier 1 information currently states the function for the system under the heading "System Purpose and Function" as being for severe accidents.
As discussed above, MHI considers that ITAAC need not address the capabilities such as an environmental qualification under a severe accident condition.

Roadmap to Tier 2
MHI will expand Table 14.3-1 to incorporate the added key design features of the CHS.

Impact on DCD

The first sentence of "Location and Functional Arrangement" in Section 2.11.4 of Tier 1 will be revised as follows in DCD rev.2:

~~The igniters are located within the containment.~~ **There are 20 igniters strategically located in containment areas and subcompartments where hydrogen may be produced, transit or collect.**

Key design features in Section 2.11.4 of Tier 1 will be revised as follows in DCD rev.2:

The hydrogen ignition system consists of ~~a set of~~ **20 igniters installed inside the containment**, designed to burn hydrogen continuously at a low concentration.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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APPLICATION SECTION:	**14.3.4.11**
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QUESTION NO.: 14.03.11-2

(14.3.4.11-2)
Indicate and include ITAAC items that provide verification of critical assumptions from Containment Transient and Accident Analyses.

The NRC staff could not identify what Containment System Tier 1 Section 2.11 ITAAC items provide verification of critical assumptions from Containment Transient and Accident Analyses.

SRP Chapter 14.3 Appendix C provides guidance that states that the critical assumptions from transient and accident analyses should be verified by ITAAC. Cross references ("Roadmaps") should be provided in Tier 2 Section 14.3, showing how the key physical parameters from these Tier 2 analyses are captured in Tier 1.

RG 1.206 Section C.II.1.2.11 provides guidance that key parameters and insights from containment safety analyses, such as LOCA, main steamline break, main feedline break, and subcompartment analysis should be verified by ITAAC.

Section 14.3.4.11 of the DCD states that ITAAC provide for verification of key parameters and insights from containment safety analyses, such as LOCA, main steam line break, main feed line break, and sub compartment analyses. However, there were no cross references or detailed discussion provided in Tier 2 Section 14.3, showing how the key physical parameters from these Tier 2 analyses are captured in Tier 1.

Provide, or indicate where within DCD Tier 2 Chapter 14 the cross references from containment safety analyses that are used to define specific ITAAC are provided.
Discuss how the cross references have been used in developing the ITAAC. Also, for each ITAAC item identified, discuss how the ITAAC acceptance criteria will provide verification of the critical assumption from containment safety analyses.

ANSWER:

Current Table 14.3-1 addresses the cross-reference with Tier 1 and Tier 2, and also includes key parameters (specifications) in the containment transient and accident analyses. This table

especially focuses on the numerical performance parameters of the safety function, flood protection, fire protection, severe accident function and so on per SRP 14.3.
These key parameters are directly incorporated in the corresponding design description of the referenced Tier 1 section, and are verified in the ITAAC.
MHI will expand Table 14.3-1 and directly extract the design commitments from Section 6.2.1 of Tier 2 regarding the containment transient and accident analyses.

Comparison of ITAAC acceptance criteria with the analysis assumptions
The comparison with the assumptions in the containment transient and accident analyses will be resolved with the enhancement of Table 14.3-1 described the above.
Tier 2 Section 14.3 (especially Tier 2 Section 14.3.4.11) is used to develop this ITAAC.

Impact on DCD

This revision will impact Revision 2 of the DCD. MHI will enhance Table 14.3-1 of Tier 2 to include any information not already specified in this table and to clarify the key assumptions in the containment transient and accident analyses, which will be extracted from Section 6.2.1 of Tier 2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 14.03.11-3

(14.3.4.11-3)
Discuss how the ITAAC were developed to verify the existence of severe accident prevention and mitigation features.

Section 14.3.4.11, ITAAC for Containment Systems, of the Tier 2 DCD states that ITAAC provide for verification of the existence of severe accident prevention and mitigation features, but does not provide any additional discussion.

RG 1.206, Section C.II.1.2.11, ITAAC for Containment Systems, states that the applicant should develop ITAAC to verify the existence of severe accident prevention and mitigation design features. Section 14.3.4.11 of the DCD is consistent with RG 1.206 but does provide a discussion or cross-reference of ITAAC items with the severe accident prevention and mitigation features. Section 14.3 of NUREG-0800, Appendix A. IV. 6, states that, at a minimum, the section should include a discussion of the treatment of severe accident design features (item v in the paragraph).

Provide or indicate where within DCD Tier 2 the cross-references or roadmap from severe accident analyses that are used to define specific ITAAC addressing severe accident prevention and mitigation features are provided. Also, for each ITAAC item identified, discuss how the ITAAC acceptance criteria provide verification of the critical assumptions/requirements in severe accident analyses.

ANSWER:

The severe accident prevention and mitigation design features are mainly addressed in Section 19.2 of Tier 2 and the cross-references with Tier 1 are provided in Table 14.3-1.
This cross reference table addresses the key design features relied upon by the safety analysis as well as design features for severe accidents. To avoid this confusion, MHI will revise the title of Table 14.3-1 to "Tier 1 and Tier 2 Cross-References". Also, the Title of the middle column will be changed to "Key Design Features/PRA Insights/Severe Accident Mitigation Features.

For example, the key design features of diverse actuation systems has been addressed in Table 14.3-1 (Sheet 3 of 6) of Tier 2 and Subsection 2.5.3.1 of Tier 1 as an ATWS feature specified in Subsection 19.2.2.1. And, two independent alternative ac power sources have been also addressed in Table 14.3-1 (Sheet 3 of 6) of Tier 2 and Subsection 2.6.5.1 of Tier 1 as a station blackout feature specified in Subsection 19.2.2.3. These design features are verified in the individual ITAAC in the corresponding Tier 1 sections and tables.

The following provides a comparison of the US-APWR design features for mitigating severe accidents with the location of Tier 1 information and cross-references in Tier 2. As shown on this table, some of the severe accident mitigation features are not specified in Table 14.3-1, but the existence of these features is verified in the ITAAC as mostly inspections of the functional arrangement and/or design description.

Severe Accident Mitigation Features	Tier 1 Location	Existence of Cross-reference
Depressurization valve	2.4.2.1, Figure 2.4.2-2, Table 2.4.2-2	Not specified in Table 14.3-1
Hydrogen igniter	2.11.4.1	Table 14.3-1 (Sheet 6 of 6)
Large volume containment	2.11.1.1	Table 14.3-1 (Sheet 5 of 6)
Hydrogen monitor	2.11.4.1	Table 14.3-1 (Sheet 6 of 6)
Alternative containment cooling	Not specified	Not specified in Table 14.3-1
Firewater injection to spray header	2.7.6.9.1	Table 14.3-1 (Sheet 5 of 6)
Drain line to reactor cavity	2.11.1.1	Not specified in Table 14.3-1
Core debris trap	2.11.1.1	Table 14.3-1 (Sheet 6 of 6)
Debris spreading area	2.11.1.1	Table 14.3-1 (Sheet 5 of 6)
Reactor cavity floor concrete	2.11.1.1	Table 14.3-1 (Sheet 6 of 6)
Reactor cavity depth	2.11.1.1	Table 14.3-1 (Sheet 5 of 6)
Firewater injection to reactor cavity	2.7.6.9.1	Table 14.3-1 (Sheet 5 of 6)

Thus, the verification of the existence of design features for severe accident prevention and mitigation is accomplished in the simple ITAAC as the inspection of the functional arrangement and/or design description in general, but some of the specific design features are verified in a separate ITAAC per the specific requirement of RG 1.206 and SRP 14.3 (e.g., SRPs 14.3.5 and 14.3.6).

As part of its RAI response process, MHI found that some of the design features were not specified in Table 14.3-1 and the existence of the SSCs used as the severe accident prevention and mitigation features were not clearly described in Tier 1.
MHI will add these unspecified design features in each design description in Tier 1 and provide the corresponding cross-reference in Table 14.3-1 of Tier 2, respectively.

Impact on DCD

This revision will impact Revision 2 of the DCD. MHI will enhance Table 14.3-1 of Tier 2 to clarify the design features for severe accident prevention and mitigation, which will be extracted from Section 19.2 of Tier 2, not specified in this table.
In addition, MHI will clarify the existence of design features in the SSCs for severe accident prevention and mitigation in the design descriptions of Tier 1.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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APPLICATION SECTION:	**14.3.4.11**
DATE OF RAI ISSUE:	**8/19/2008**

QUESTION NO.: 14.03.11-4

(14.3.4.11-4)
Explain and specify the severe accident analysis requirements to be satisfied in the Design Commitment and Acceptance Criteria of ITAAC # 4, 5, 6, and 7 in Table 2.11.1-2, Containment Vessel ITAAC.

The design commitment and acceptance criteria in the above mentioned ITAAC are written in terms of meeting severe accident analysis requirements. For example, the acceptance criteria of ITAAC #4 in Table 2.11.1-2 state that "the as-built drain piping to the reactor cavity exists that meets severe accident analysis requirements." Since it does not refer to or specify the severe accident analysis requirements to be met, these ITAAC are not clear. Severe accident analysis requirements should be specified.

ANSWER:

Severe accident analysis requirements of ITAAC #4, 5, 6 and 7 in Table 2.1.1-2 of Tier 1 correspond to items shown in Table 19.1-115, Key Assumptions (Sheet 3 of 4), as follows:

g. Reactor cavity has a core debris trap area to prevent entrainment of the molten core to the upper part of the containment.
h. The other cavity flooding system is a set of drain lines from SG compartment to the reactor cavity. Spray water which flows into the SG compartment drains to the cavity and cools down the molten core after reactor vessel breach.
i. Reactor cavity is designed to ensure thinly spreading debris by providing sufficient floor area and appropriate depth.
j. Reactor cavity floor concrete is provided to protect against challenge to liner plate melt through.

As stated in the response to Question No. 14.03.11-1, ITAAC for the non-safety systems with severe accident features should focus on verification of the existence (not capabilities) of the systems, components, or equipment, and the ITAAC for the severe accident features, which are linked to the capabilities but are not proposed in Tier 1.

Based on the above consideration, ITAAC need not address additional requirements, functions or capabilities for the severe accident.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 14.03.11-5

(14.3.4.11-5)
Indicate ITAAC items that provide an analysis or demonstration to show that safety related containment system instrumentation has been qualified for a harsh environment.

The NRC staff could not identify ITAAC that provide verification of the environmental qualification of safety related instrumentation in the Containment Isolation System.

SRP Chapter 14.3 Appendix C provides guidance that states that the system ITAAC should include analysis of demonstration to show that the safety system equipment has been qualified by type test, previous operating experience, or analysis or any combination of these three methods to substantiate that it should be capable of meeting, on a continuing basis, the design-basis performance requirements.

ITAAC item #6.a in Table 2.11.2-1 provides for verification of harsh environment qualification for those items listed in table 2.11.2-1. The NRC staff noted that the instrumentation associated with the Containment Isolation System, and shown on Figure 2.11.2-1, are not listed in Table 2.11.2-1.

Provide (or indicate where in Tier 1 of the DCD it is provided) ITAAC that verify the environmental qualification of safety related instrumentation in the Containment Isolation System.

ANSWER:

Some safety-related instrumentation in the Containment Isolation System is listed in Table 2.11.3-2. These instruments are listed as components of CSS, and ITAAC that verify the environmental qualification is described in ITAAC item #6.a in Table 2.11.3-3.

The other instrument (PT-2390 and PT-2391) shown in Figure 2.11.2-1are not listed in Table 2.11.2-1. Therefore, MHI will add these instruments in Table 2.11.2-1 of the DCD Revision 2.

Impact on DCD

Tier 1 of the DCD Revision 2 document will be revised to add the instruments (PT-2390 and 2391) in Table 2.11.2-1 as shown in the following:

System Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	Safety-Related Display	Control PSMS	Active Safety Function	Loss of Motive Power Position
CVVS	VCS-PT-2390, 2391	-	Yes	-	Yes/Yes	No	No	-	-

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 14.03.11-6

(14.3.4.11-6)
Revise applicable system ITAAC and associated tables to assure verification of the containment isolation functions of different systems.

Table 2.11.2-1, Containment Isolation System Equipment Characteristics, of Section 2.11.2 provides a listing of many isolation valves and their characteristics. Many other isolation valves and the corresponding ITAAC are addressed in the respective systems. These systems/components are noted with dotted lines in Figure 2.11.2-1. For example, the isolation valves in RHRS, SIS, FWS, MSS are addressed in the respective system description and ITAAC. In some systems (e.g., CVCS, CCWS, PSS, and SGBDS), a check of the system equipment table reveals that some of the isolation valves have not been addressed. For example, CVCS seal water return line check valve CVCS-VLV-202 is not included in Table 2.4.6-2 and therefore not addressed by the ITAAC, RCP CCW supply line inside containment isolation valves VLV-403A and B are not listed in CCWS Table 2.7.3.3-2 and are not addressed by ITAAC. Also, for some systems, a check of the system ITAAC table reveals that an ITAAC item addressing the containment isolation function of the valves is not included. For example, SGBDS valves SGS-AOV-031A and others are listed in CCWS ITAAC Table 2.7.1.10-1, but there is no containment isolation function ITAAC for these valves in Table 2.7.1.10-3. Similarly, CCWS Valves 402A and B and 445 A and B are listed in CCWS Table 2.7.3.3-2, but there is no Containment Isolation Function ITAAC for those valves in Table 2.7.3.3-3.

Revise the associated Tables to assure verification of containment isolation function of different systems. Provide a list of the revisions made or a list of ITAAC addressing containment isolation functions of valves.

ANSWER:

MHI will perform a confirmatory review to ensure containment isolation system components that require verification of function have an ITAAC. MHI will revise the associated tables to assure verification of containment isolation function for the different systems.

Impact on DCD

Tier 1 of the DCD will be revised to include the following, and any other missing ITAAC for containment isolation functions that turn-up from the results of our confirmatory review:

- CVS-VLV-202 will be added in Table 2.4.6-2.
- NCS-VLV-403A and B will be added in Table 2.7.3.3-2.
- ITAAC for containment isolation function will be added in Table 2.7.1.10-3 and Table 2.7.3.3-5.

These revisions will be reflected to the DCD Revision 2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 14.03.11-7

(14.3.4.11-7)
Provide verification through ITAAC that the location of the outermost isolation valve is such that the length of the pipe from containment to the valve is not greater than the specified value.

Containment isolation valves are designed to be located within certain distance from the containment. Table 6.2.4-3, List of Containment Penetrations and System Isolation Provisions, (Column 10), in Tier 2 provides the length of the pipe and the CIV distances should not be greater than the value defined. This is a key design feature and should be included in Tier 1 design description. An ITAAC verifying that the valve positions do not violate this maximum distance is considered applicable.

ANSWER:

MHI believes that the length of the pipe does not reach the safety significance threshold for an ITAAC. The shorter the length of pipe run between the CIV and containment the likelihood of a pipe break is only incrementally less, but the consequences remain unchanged. GDC 55, 56 and 57 state that isolation valves outside containment shall be located as close to containment as practical. MHI understands the basis of this requirement but this requirement is not directly related to safety because it does not adversely affect the safety if the as-built length of the pipe does not meet the value of Tier 2 Table 6.2.4-3. This is consistent with the assumptions for US-APWR ITAAC as described in DCD Chapter 14, Section 14.3 and consistent with the NRC staff position on ITAAC for the containment isolation system. As-built pipe length will be demonstrated as described in COL item 6.2(6).

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 14.03.11-8

(14.3.4.11-8)
Indicate ITAAC items that provide verification of the minimum inventory of alarms, displays and controls for the CHS and CIS systems.

The NRC staff could not identify ITAAC that provide verification of generation of minimum inventory of alarms, displays and controls for the CHS, some instrumentation on the CIS system, and containment isolation function of some systems.

The US-APWR DCD Section 14.3.4.11 ITAAC for Containment Systems states that ITAAC provide for verification of the minimum inventory of alarms, displays, and controls.

In accordance with SRP chapter 14.3 Appendix C, the design description of the containment vessel, containment spray system, containment isolation system, and containment hydrogen monitoring system in Section 2.11 of the Tier 1 DCD identifies the alarms, displays, and controls in the MCR. ITAAC to verify that these alarms, controls, and displays can be retrieved in the MCR are defined for the containment spray system and the containment isolation system.
Discuss if any ITAAC is required to verify that alarms, displays, and controls can be retrieved for the containment vessel.

For the Containment Isolation System, provide (or indicate where in Tier 1 it is provided) ITAAC required to verify the minimum inventory of alarms, displays and controls associated with the containment instrumentation shown on Figure 2.11.2-1, that is not listed in Table 2.11.2-1. Amend Table 2.11.2-1 as required.

For systems with containment isolation functions (e.g., CVCS, SGBDS, PSS), provide ITAAC to verify the display of position indication of the containment isolation valves in the MCR. Include the displays of the CIV positions in the respective system table (e.g., Table 2.4.6-4 for CVCS) for their verification by the ITAAC (e.g., ITAAC item #12 in Table 2.4.6-5). For example, CVCS letdown isolation valves CVCS-AOV-005 and 006 position indication are not listed in Table 2.4.6-4.
Provide (or indicate where in Tier 1 it is provided) ITAAC required to verify the minimum inventory of alarms, displays and controls are provided for the CHS system, as described in the design description paragraph 2.11.4.1.

ANSWER:

CIS System
As for the Containment Isolation System, instruments from the Containment Spray System are described in Table 2.11.3-4. The other instruments related to CVVS are not listed in Table 2.11.2-1. Therefore, MHI will add these instruments to Table 2.11.2-1 of the DCD Revision 2.

ITAAC to verify the display of position indication of the containment isolation valves in the MCR will be added in the respective system tables.

CHS System
The ITAAC #1 of Table 2.11.4-1 covers the verification of the existence of the inventory of displays because the design commitment and acceptance criteria of the ITAAC table refer to the Design Description of Subsection 2.11.4 directly. Therefore, the current ITAAC meets the guidance of SRP 14.3 for this system.

Impact on DCD

Tier 1 of the DCD Revision 2 document will be revised to add the instruments (PT-2390 and 2391) in Table 2.11.2-1 as shown in the response of 14.03.11-5.

ITAAC to verify the display of position indication of the containment isolation valves in the MCR will be added in the respective system tables. Containment isolation valves in CVCS will be added in Tier 1 Table 2.4.6-4. As for SGBDS and PSS, tables of equipment, alarm, displays, and control functions for containment isolation valves will be added and containment isolation valves will be listed in these tables. ITAAC for containment isolation function will be added in Table 2.7.1.10-3 (SGBDS).

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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QUESTION NO.: 14.03.11-9

(14.3.4.11-9)
Define ITAAC to verify the automatic activation of the hydrogen igniters when required.

RG 1.206, Appendix C.II.1-A, General ITAAC Development Guidance, II.G. Initiation Logic, states that if a system/component has a direct safety function, it typically receives automatic signals to perform some action (e.g., start, isolation). The system ITAAC should capture these aspects related to system's direct safety function. The hydrogen igniters are activated automatically in response to an ECCS actuation signal and are considered to have a safety function even though the CHS is a non safety-related system. Because of this safety function of the igniters, ITAAC should be developed to verify automatic activation/alignment of the igniters.

Define an ITAAC for automatic activation of the hydrogen igniters.

ANSWER:

The igniters are activated automatically upon the receipt on an ECCS actuation signal. For severe accident events, actuation of the igniters before the onset of core damage is necessary. However, the igniter requirement is for a severe accident event, so that activation of the igniter by an ECCS actuation signal is not safety-related function, and an ECCS actuation signal for the igniter is required to be appropriately isolated from the safety divisions.

All safety signals, including an ECCS actuation signal, are isolated between safety and non-safety divisions in the communication systems as described in Section 2.5.1 of Tier 1, and this isolation feature is verified in ITAAC #10.i.3 of Table 2.5.1-5.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

9/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 51 REVISION 0**
SRP SECTION:	**14.03.11 – Containment Systems and Severe Accidents – Inspections, Tests, Analyses, and Acceptance Criteria**
APPLICATION SECTION:	**14.3.4.11**
DATE OF RAI ISSUE:	**8/19/2008**

QUESTION NO.: 14.03.11-10

(14.3.4.11-10)
Clarify the seismic design feature of the CHS that are to be verified via ITAAC

RG 1.206, Appendix C.II.1-A, General ITAAC Development Guidance, Special Cases for Seismic Qualification, states that some nonsafety equipment may require special treatment because of its importance to safety. Hydrogen igniters can be considered a special case for seismic qualification because of the role they play in severe accident conditions and their location near safety related equipment.

Please discuss the assumptions used as to the equipment survivability expectations of the CHS components in the event of credible seismic severe accident initiating event, such that they perform their severe accident function. Also include a discussion on the assumed effects the igniter components would have on nearby safety related equipment in the event of a design basis seismic event.

Justify why the assumed hydrogen igniter design features need not be verified via ITAAC. If necessary, define applicable ITAAC to address the verification of the design features for these assumptions.

ANSWER:

The igniter is considered a non-seismic category component as described in Table 3.2-2 (item 47) of Tier 2. In addition, ITAAC need not address the additional functions and capabilities in the severe accident case as discussed in the response to RAI No.14.03.11-1.Therefore, the seismic qualification should not be addressed in Tier 1.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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APPLICATION SECTION:	**14.3.4.11**
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QUESTION NO.: 14.03.11-11

(14.3.4.11-11)
Define the ITAAC to verify embedment depth.

The US-APWR DCD Table 2.11.1-2 Containment Vessel Inspection, Tests, Analyses, and Acceptance Criteria does not contain any ITAAC item related to the verification of the embedment depth.
RG 1.206, Section C.II.1 Inspections, Tests, Analyses, and Acceptance Criteria, Appendix A, Building Structures, provides guidance and the related rationale for what an applicant should include in the ITAAC for building structures. It states that the building description should specify – and the ITAAC should verify – the embedment depth (from the top of the foundation to the finished grade). Discuss why verification of the embedment depth is not identified as an ITAAC item in Table 2.11.1-2 or indicate where the item is addressed within the supplied ITAAC

ANSWER:

MHI will revise the associated tables to assure verification of embedment depth.

Impact on DCD

Table 2.11.2-2 of Tier 1 of the DCD Revision 1 will be revised as follows:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3. The PCCV structural configuration is as shown in Table2.2-2, Figures 2.2-3 through 2.2-11 and Figure 2.11.1-1.	3. Inspections of the as built PCCV will be performed.	3. The as-built PCCV configuration is reconciled with descriptions in Table2.2-2, Figures 2.2-3 through 2.2-11 and Figure 2.11.1-1.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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APPLICATION SECTION:	**14.3.4.11**
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QUESTION NO.: 14.03.11-12

(14.3.11-12)
Clarify Acceptance Criteria for Containment Vessel ITACC item #3 in Table 2.11.1-2

Table 2.11.1-2 of the US-APWR DCD item #3 defines acceptance criteria for ITAAC for the PCCV structural configuration as shown in Figure 2.11.1-1. However, Table 2.2-2, 'Definition of wall thicknesses for safety related structures: PCCV, Containment internal structure, Reactor Building, and Power Source Building', defines the wall thicknesses.
RG 1.206, Section C.II.1 Inspections, Tests, Analyses, and Acceptance Criteria, Appendix A for Building Structures provides guidance that states that building structure design description should provide sufficient dimensions for the COL applicant or licensee to verify by ITAAC and develop dynamic models for the seismic analysis. Examples of these dimensions include overall building dimensions as well as thicknesses of walls, floor slabs, and foundation mat.
The ITAAC defined for the inspections of the as built PCCV should also refer to Table 2.2-2, which contains additional relevant parameters for verification.

ANSWER:

MHI will revise the associated tables to assure verification of dimensions of wall thicknesses, floor slabs and foundation mat as they were defined for the building structure design for safety related structures.

Impact on DCD

Table 2.11.2-2 of Tier 1 of the DCD Revision 1 will be revised as follows:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3. The PCCV structural configuration is as shown in Table2.2-2, Figures 2.2-3 through 2.2-11 and Figure 2.11.1-1.	3. Inspections of the as built PCCV will be performed.	3. The as-built PCCV configuration is reconciled with descriptions in Table2.2-2, Figures 2.2-3 through 2.2-11 and Figure 2.11.1-1.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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APPLICATION SECTION:	**14.3.4.11**
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QUESTION NO.: 14.03.11-13

(14.3.4.11-13)
Indicate ITAAC items that provide verification of overcurrent protection of electrical penetrations.

For containment electrical penetration, RG 1.206 section C.II.1.2.6 provides guidance that states that the applicant should develop ITAAC to verify that all electrical penetrations are protected against postulated currents greater than their continuous current rating. Such an ITAAC was not noted in the ITAAC presented for the containment systems.

Justify why such an ITAAC item is not required or define applicable ITAAC for the containment electrical penetrations.

ANSWER:

The design description for containment electrical penetrations is addressed in Section 2.6.8 of Tier 1. The ITAAC to ensure the electrical integrity of the circuits for postulated overload and short-circuit conditions for the containment electrical penetrations are contained in Table 2.6.8-1(Items 5 and 6).

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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APPLICATION SECTION:	**14.3.4.11**
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QUESTION NO.: 14.03.11-14

(14.3.4.11-14)
Provide ITAAC to verify containment isolation valve position on loss of motive power for selected systems.

The design description of the containment isolation system and the containment spray system identifies the loss of motive power position for the remotely operated valves. A table is provided (Table 2.11.2-1 for Containment Isolation System and Table 2.11.3-2 for Containment Spray System) identifying the loss of motive power position for the remotely operated valves. Containment spray system has identified an ITAAC for verifying that each as-built remotely operated valve assumes the indicated loss of motive power position (item #9.b). However, a similar ITAAC was not defined for the containment isolation system.

Justify the lack of a similar ITAAC for the containment isolation system or provide applicable ITAAC for the system.

ANSWER:

ITAAC for verifying that each as-built remotely operated valve assumes the indicated loss of motive power position will be added in Table 2.11.2-2.

Impact on DCD

ITAAC for verifying that each as-built remotely operated valve assumes the indicated loss of motive power position will be added in Table 2.11.2-2 of the DCD Revision 2 as following.

	Design Commitment		Inspections, Tests, Analyses		Acceptance Criteria
13	After loss of motive power, the remotely operated valves, identified in Table 2.11.2-1, assume the indicated loss of motive power position.	13	Tests of the as-built valves will be performed under the conditions of loss of motive power.	13	Upon loss of motive power, each as-built remotely operated valve identified in Table 2.11.2-1 assumes the indicated loss of motive power position.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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APPLICATION SECTION:	**14.3.4.11**
DATE OF RAI ISSUE:	**8/19/2008**

QUESTION NO.: 14.03.11-15

(14.3.4.11-15)
Clarify ITAAC to verify containment isolation valve electrical redundancy.

In the US-APWR Tier 1 Containment Isolation system design description paragraph 2.11.2.1, the containment isolation system key design features state that where actuation of two power-operated isolation valves on the same penetration (in series) is required, electrical redundancy is provided by independent power sources. The NRC staff noted that there are no ITAAC defined to verify the electrical independence of the containment isolation valves. SRP 14.3 Appendix C provides guidance for the development of ITAAC to verify independence. The ITAAC should include analysis or demonstration to show that there is physical, electrical and communications independence between redundant portions of a safety system.

Justify the lack of ITAAC to verify this key design feature of the CIS or provide appropriate ITAAC in the CIS sections or other system sections.

ANSWER:

MHI believes that electrical redundancy is verified by the current ITAAC. ITAAC #6.b states that the Class 1E components, identified in Table 2.11.2-1, are powered from their respective Class 1E division. ITAAC #6.c also states that separation is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E cable. These ITAAC are to verify electrical redundancy and independence. So, these ITAAC cover the corresponding this key design feature, which states where actuation of two power-operated isolation valves on the same penetration (in series) is required, electrical redundancy is provided by independent power sources.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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DATE OF RAI ISSUE:	**8/19/2008**

QUESTION NO.: 14.03.11-16

(14.3.4.11-16)
Indicate ITAAC items and include additional ITAAC items, as necessary that address PRA and severe accident insights.

RG 1.206 and SRP Section 14.3 state that PRA and severe accident insights should be addressed in ITAAC. RG 1.206 states that if the PRA results indicate that a particular system component or function is risk-significant, ITAAC should verify that component or function. It further states that Section 14.3 of the application should include roadmaps for PRA, including shutdown safety analyses and severe accidents with specific references to the system ITAAC where the key parameters from those analyses are verified. Chapter 19 of the application should identify PRA insights.

Section 19.1.3.2 of the Tier 2 DCD discusses the design/operational features for mitigating the consequences of core damage and preventing releases from containment and Section 19.1.3.3 discusses the design/operational features for mitigating the consequences of releases from containment. The design/operational features addressed in these sections include RCS depressurization through severe accident depressurization valves, alternative containment cooling, fire water injection into the reactor cavity and to the spray header. No ITAAC items were noted addressing these design/operational features.

Present an analysis (e.g., a roadmap) of the PRA and severe accident results/insights with specific reference to the system ITAAC where the key parameters from those analyses are verified. Identify existing ITAAC or develop additional ITAAC to assure that PRA and severe accident insights are addressed.

ANSWER:

PRA insights
As stated in the answer to the question No.14.03.11-4, key assumptions and insights on PRA are described in Subsections 19.1.4 through 19.1.6 and summarized in Table 19.1-115. The ITAAC items related to PRA assumptions and insights can be extracted from Subsections 19.1.4 through 19.1.6 and Table 19.1-115. MHI will identify ITAAC items and revise Table 14.3-1 to clarify these

PRA assumptions and insights and to cross-reference with Tier 1 based on the further review of Subsections 19.1.4 through 19.1.6 and Table 19.1-115. These key assumptions and insights identified in a further review are to be verified in the simple ITAAC as the inspection of the functional arrangement and/or design description in general.

Severe accident insights
Refer to the response to RAI No. 14.03.11-3.

Impact on DCD

PRA insights
MHI will revise Table 14.3-1 in the DCD Revision 2 to clarify PRA insights and the cross-reference with Tier 1 design description based on the further review of Subsections 19.1.3 through 19.1.6. MHI will revise the design description of Tier 1 as applicable to add any missing non-safety feature per the identification of the PRA insights.

Severe accident insights
Refer to the response to RAI No. 14.03.11-3.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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APPLICATION SECTION:	**14.3.4.11**
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QUESTION NO.: 14.03.11-17

14.3.4.11-17
Revise the DCD or address the editorial comments.

In Table 2.11.2-2, CIS ITAAC, item 6b is same as item12. It appears that one is a repeat of the other. Make the necessary correction.

In Table 2.11.3-5, pg. 2.11-29, item 9b, replace "Table 2.9.3-2 by "Table 2.11.3-2 both in Design Commitment and Acceptance Criteria column.

In Table 2.11.3-5, pg. 2.11-27, item 5b, Acceptance Criteria, replace "Table 2.3.11-3 by "Table 2.11.3-3."

ANSWER:

Table 2.11.2-2
This typographical error has been corrected in Revision 1 of the DCD.

Table 2.11.3-5
MHI will correct the typographical errors per the comments in Revision 2 of the DCD.

Impact on DCD

MHI will revise Table 2.11.3-5 in Revision 2 of the DCD Tier 1 as follow.

- Replace "Table 2.9.3-2 by "Table 2.11.3-2 both in Design Commitment and Acceptance Criteria column of ITAAC item 9b.
- Replace "Table 2.3.11-3 by "Table 2.11.3-3." In Acceptance Criteria column of ITAAC item 5b.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.