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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-13155

Subject: MHI's Revised Response to US-APWR DCD RAI No. 488-3745 Revision 1 (SRP 14.03.11)

- References:**
- 1) "Request for Additional Information No. 488-3745 Revision 1, SRP Section 14.03.11 – Containment Systems and Severe Accidents – Inspections, Tests, Analyses, and Acceptance Criteria - Application Section: 14.3.4.11", dated November 23, 2009 (ML093340594).
 - 2) MHI Letter: UAP-HF-10005 from Y. Ogata to U.S. NRC, "MHI's Amended Response to US-APWR DCD RAI No. 488-3745 Revision 0," dated January 10, 2010 (ML100141733).
 - 3) MHI Letter: UAP-HF-13103 from Y. Ogata to U.S. NRC, "MHI's Revised Response to US-APWR DCD RAI No. 871-6121 Revision 0 (SRP 19)", dated April 25, 2013 (ML13119A168).

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Revised Response to Request for Additional Information No. 488-3745 Revision 1." MHI submitted their original response to the RAI in Reference 2.

Enclosed is the revised response to Question 14.03.11-41. This response is revised to align the response with the design change described in Reference 3 and supersedes the prior response for this question in Reference 2 in its entirety. The responses to the other questions transmitted by Reference 2 are not changed by this transmittal.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,



Yoshiki Ogata,
Executive Vice President
Mitsubishi Nuclear Energy Systems, Inc.
On behalf of Mitsubishi Heavy Industries, Ltd.

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MRO

Enclosure:

1. Revised Response to Request for Additional Information No. 488-3745 Revision 1

CC: J. A. Ciocco
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Docket No. 52-021
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Enclosure 1

UAP-HF-13155
Docket No. 52-021

Revised Response to Request for Additional Information No.
488-3745 Revision 1

June 2013

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/21/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 488-3745 REVISION 0

SRP SECTION: 14.03.11- CONTAINMENT SYSTEM AND SEVERE
ACCIDENTS - Inspections, Tests, Analyses, and Acceptance
Criteria

APPLICATION SECTION: 14.3.4.11

DATE OF RAI ISSUE: 11/23/2009

QUESTION NO.: 14.03.11-41

RAI 14.3.4.11-29:

The staff requested, in RAI 51-916, Question 14.3.11-3 (14.3.4.11-3), that the applicant provide cross-references or roadmaps from severe accident analyses that are used to define specific ITAAC addressing severe accident prevention and mitigation features. Also, for each ITAAC item identified, the staff requested a discussion on how the ITAAC acceptance criteria provide verification of the critical assumptions/requirements in severe accident analyses.

In a letter dated September 18, 2008, Mitsubishi responded to RAI 51-916, Question 14.3.11-3 (14.3.4.11-3) that:

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.

In the RAI response, the applicant provided a comparison table of the US-APWR design features for mitigating severe accidents, with the location of Tier 1 information and Tier 2 information.

The applicant pointed out that 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.

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.

The applicant indicated that 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. The applicant stated that 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.

The staff has reviewed the response and has identified that the following needs to be addressed by the applicant:

1) Table 14.3-1 provided in the Tier 2 DCD and the modification planned in response to RAI 51-916, Question 14.3.11-3 (14.3.4.11-3) does not provide a roadmap or show how key insights and assumptions from PRA and severe accident analyses are addressed in the design information in the DCD. Table 14.3-1 lists (or will list) the key design features/PRA insights/severe accident mitigation features along with references to the applicable sections in Tier 1 and Tier 2 DCD. The table or the accompanying discussion should also identify the specific design feature(s) that should be verified for each of the item and the ITAAC defined to address them.

Essentially, the steps or the analyses conducted to develop Table 14.3-1 should be included in accompanying discussion or should be apparent from the information provided in the table. Some of the discussions provided in response to RAI 51-916, Question 14.3.11-3 (14.3.4.11-3) presents the analysis being conducted and such analyses, as completed to address all relevant issues, should be included in Section 14.3.4.11.

In a letter dated April 23, 2009, Mitsubishi responded to RAI 222-1933, Question 14.3.11-20 (14.3.4.11-20) with revised DCD Tier 2 Table 14.3-1 which identifies which particular analysis (DBA, Severe Accident, Flooding, etc) was used to create each assumption. In addition, several assumptions were added.

The NRC staff has reviewed the response and has identified that the following need to be addressed by the applicant.

Although the proposed change to Tier 2 Table 14.3.-1 now clearly indicates which particular analysis is used to create each assumption, the NRC staff has noted that how the critical assumptions from transient and accident analyses are identified are not clearly delineated.

MHI does not provide a roadmap of how the key design features are delineated and accordingly, it is not clear that all the key design features have been identified. A roadmap should (a) identify the key design features and assumptions delineated in an analysis, (b) include in Table 14.3-1 and relate to the key design feature and assumptions in the analysis (c) cross-reference the ITAAC defined to address the design feature and/or the assumption. A review of the roadmap will assure that all the key design features and assumptions are included for development of ITAAC and that for each, ITAAC are developed or it is judged that ITAAC are not necessary.

One key design feature related to Section 2.11 and 14.3.11 identified in the PRA and Severe Accident Analysis was not included in Table 14.3-1.

- hydrogen igniter power supply is provided from two non-Class 1E buses with alternate AC generation.

Please provide a roadmap as discussed above, that directly addresses all the key design features and assumptions for which ITAAC should be developed. Justify if any of the key design features and assumptions is not addressed in the ITAAC.

Follow-up RAI based on 8/6/2009 Conference call.

ANSWER:

“Roadmaps,” as used in NUREG-0800 Standard Review Plan (SRP) Section 14.3 (e.g., SRP Section 14.3 Appendix C, §§ II.B.ii and II.B.iii, p. 14.3-30) consist of the cross references between Tier 1 and Tier 2 information that show how the key physical parameters from the Tier 2 analyses are captured in Tier 1. For the US-APWR, these roadmaps consist of DCD Revision 2 Tables 14.3-1a through 14.3-1f (also referenced as “Table 14.3-1”).

Tier 1 information is developed per the NRC-endorsed principle (e.g., as stated in SRP Section 14.3 and NRC Regulatory Guide 1.206 Subsection C.II.1.1) that Tier 1 design descriptions include top-level design features and performance characteristics that are the most significant to safety. The level of detail in Tier 1 is governed by a graded approach to the SSCs of the design, based on the safety significance of the functions they perform.

The system design descriptions should be accompanied by the appropriate ITAAC. The graded approach to selection of top-level design features and parameters applies to ITAAC development as part of the overall development of Tier 1. US-APWR ITAAC are developed by using an approach similar to developing the Tier 1 design descriptions as described in DCD Subsection 14.3.3.2 (pp. 14.3-6-14.3-8). The following considerations discussed in Subsection 14.3.4 (p. 14.3-12) are applied when determining if ITAAC are needed:

- ITAAC address the most safety-significant aspects of each of the systems of the design, describing the top-level design features and performance characteristics most significant to safety;
- Numeric performance values are included for in the ITAAC acceptance criteria for selected performance characteristics consistent with safety analysis assumptions;
- ITAAC level of detail is governed by a graded approach related to the SSCs of the design, based on the safety significance of the functions they perform;
- Non safety related aspects of SSCs may not be subject to ITAAC.

ITAAC for non-safety related SSCs may be limited to inspections to verify conformance to their functional arrangement as described in Tier 1. Non safety related SSCs that are risk-significant, or that prevent or mitigate severe accidents, are verified to exist via specific ITAAC or the functional arrangement ITAAC.

To determine the key design features listed in Table 14.3-1, MHI conducted engineering reviews of the applicable DCD chapters (e.g., Chapters 2 through 10, 15 and 16), to identify key design features used in deterministic safety analyses on case by case basis per Subsection 14.3.3.5 (pp. 14.3-9-14.3-10).

A risk-based approach was also applied to support the deterministic approach, using DCD Chapter 19 to identify features determined to be important by PRA and evaluations of severe accident scenarios. Particular emphasis is placed on DCD Table 19.1-119, which summarizes the key insights and design features with risk-significance. DCD Table 17.4-1 lists risk-significant SSCs as identified in the design phase of the Design – Reliability Assurance Program (D-RAP). Table 17.4-1 was used to cross-check design features for risk-significance, and is also referenced in Table 14.3-1d (Sheet 7 of 7) because D-RAP provides reasonable assurance that the US-APWR is designed, constructed, and operated consistent with risk insights and assumptions for the SSCs.

Table 14.3-1 was updated in DCD Revision 2 to reflect the combination of the deterministic and risk based approaches. Many design features are important to both the deterministic and risk-based analyses. In order to present the roadmaps in a concise manner, such features are presented in the table that addresses its role in the more deterministic analysis (Table 14.3-1a for design basis accidents, Table 14.3-1b for internal and external hazard analysis, and so on), with cross-references to information in DCD Chapter 19 that describe their importance to PRA, severe accident prevention or severe accident mitigation. Design features that are included in the road map principally due to their risk-significance or role in severe accidents, are listed in Table 14.3-1d, "PRA and Severe Accident Analysis Key Design Features." This approach is summarized in DCD Subsection 14.3.3.5 (pp. 14.3-9 and 14.3-10).

During the roadmap development, the following features were generally omitted from the key design features:

Programmatic and operational aspects such as operations and maintenance activities

These aspects include control of valve position, equipment operating status and so on. They are administratively controlled by procedures and programs and are not addressed in Tier 1.

Specific characteristics not considered in each DBA analysis such as hardware information

This information depends on the detailed design of specific equipment and is beyond the level-of-detail threshold of Tier 1 selection criteria. Examples in this category include specific materials of construction for specific equipment, or the detailed environmental parameters specified for equipment design such as radiation dose to equipment during its qualified life.

Less significant features of non-safety related SSCs

The roadmaps and Tier 1 address non-safety related features with a focus on certain design features that are significant to hazard analysis, fire protection, ATWS, severe accident prevention or mitigation, and contribution to risk.

The Tier 1 selection criteria and roadmap development have been addressed in the general discussion of Tier 1 and ITAAC development via revision to Subsection 14.3.3.5 on page 14.3-10 and Subsection 14.3.4 on page 14.3-12 in DCD Revision 2. This RAI question identifies DCD Subsection 14.3.4.11 as requiring revision to include some of the discussion provided in response to RAI 51-916, Question 14.3.11-3 (14.3.4.11-3), MHI ref.: UAP-HF-08183 dated September 18, 2008, regarding reviews to ensure that severe accident prevention and mitigation features are adequately addressed. Subsection 14.3.4.11 specifically addresses ITAAC for containment systems. Severe accident prevention and mitigation design features apply to containment as well as other SSCs, and MHI therefore considers that such features are more appropriately discussed in that Subsections 14.3.3.5 and 14.3.4.

The hydrogen igniter power supplies which are provided by two non-Class 1E buses, dedicated nonsafety-related batteries and alternate ac gas turbine generators have been added to DCD, Table 14.3-1d and to Tier 1 Table 2.11.4-1, as ITAAC Items 6.a and 6.b.

Additional design features were added to DCD Table 14.3-1, consistent with the addition of key PRA insights and assumptions to DCD Table 19.1-119. Identification of ITAAC for these features is addressed in response to Question # 14.03.11-40 of this RAI.

Impact on DCD

See the response to RAI 871-6121 (UAP-HF-13103) for changes to DCD Tier 1 Table 2.11.4-1 and the response to RAI 1022-7082, question 19-590 (UAP-HF-13143) for changes to DCD Tier 2 Table 14.3-1d.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical/Topical Report

There is no impact on Technical/Topical Report.