

  
**MITSUBISHI HEAVY INDUSTRIES, LTD.**  
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TOKYO, JAPAN

June 28, 2011

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-11192

**Subject: MHI's Responses to US-APWR DCD RAI No.761-5804 Revision 3 (SRP 19)**


**References:** 1) "Request for Additional Information No. 761-5804 Revision 3, SRP Section: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation," dated May 25, 2011.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No. 761-5804 Revision 3".

Enclosed are the responses to all of the RAIs 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,



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

DOB  
MRO

Enclosure:

1. Responses to Request for Additional Information No. 761-5804 Revision 3

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

Contact Information

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Enclosure 1

UAP-HF-11192  
Docket Number 52-021

Responses to Request for Additional Information No.761-5804  
Revision 3

June, 2011

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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06/28/2011

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No.52-021**

**RAI NO.:** NO. 761-5804 REVISION 3  
**SRP SECTION:** 19 – Probabilistic Risk Assessment and Severe Accident Evaluation  
**APPLICATION SECTION:** 19.1.5.1  
**DATE OF RAI ISSUE:** 05/25/2011

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**QUESTION NO. : 19-524**

Structural failure or large deformation of the reactor internal structure (fuel assembly and control rod drive system) could prevent insertion of the control rods during or after an earthquake. In Table 19.1-54 of the DCD the HCLPF for the fuel assembly (reactor internals and core assembly) was assumed to be 0.5g without justification. To address this concern, staff requested the applicant to substantiate the HCLPF value of 0.5g for the fuel assembly.

In response, the applicant stated that the stress analysis for the fuel assembly is not complete. Further, the applicant stated that the HCLPF capacity of the fuel assembly and the combined reactor support arrangement will be at least 0.5g PGA since the system will be designed to meet the conservative requirements of the ASME code and tested to IEEE standard. The applicant also stated that updated fuel assembly fragility results will be included in an amendment to the PRA report MUAP-07030(R2) within one year after the issuance of the stress analysis report.

As the amendment to the PRA report has not been submitted, staff requests the applicant to provide the technical basis for estimating the HCLPF value of the fuel assembly and include this basis in DCD Section 19.1.5.

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**ANSWER:**

RAI No.454 19-399 requested justification of the HCLPF values using an acceptable approach (e.g., test, analyses or bounding analyses) to show that the HCLPF value of the fuel assembly and the combined reactor support arrangement will be at least 0.5g.

The answer to the RAI was that "MHI would like to demonstrate the HCLPF capacity of the fuel assembly is at least 0.5g using the results of stress analysis after the issuance of the stress analysis report for DCD Rev.2."

However, the PRA report has not yet been provided to the NRC because the seismic stress analysis report of the fuel assembly which reflects the change of structure analysis model has been postponed.

Therefore, MHI is postponing the schedule to provide the technical basis for estimating the HCLPF value of the fuel assembly using the revised stress analysis report of the fuel assembly until April 2012.

As a result of this delay, MHI is revising the schedule of issuance of technical basis for estimating the HCLPF value of the fuel assembly to be consistent with the revised schedule of stress analysis report of the fuel assembly. MHI will conduct the fragility analysis using the methodology of EPRI TR-1002988 in accordance with ISG-20.

The results of the fragility analysis will be issued by April 2012 before the date of ACRS review on PRA and NRC review phase 4.

Impact on DCD

Confirm the HCLPF value for fuel assembly in DCD Table 19.1-54 is equal or greater than 0.5g.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

PRA report MUAP-07030(R3) will be updated to address the results of the fragility analysis.

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**SRP SECTION:** 19 – Probabilistic Risk Assessment and Severe Accident Evaluation  
**APPLICATION SECTION:** 19.1.5.1  
**DATE OF RAI ISSUE:** 05/25/2011

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**QUESTION NO. : 19-525**

The standard design applicant is the supplier of some of the essential instrumentation and control equipment and should address this issue in the development of HCLPFs for use in the PRA based SMA. The COL applicant will be responsible for the qualification testing of most other electrical and I&C equipment and a COL action item should be added to the DCD that the COL applicant will address the application of a load factor in specifications for equipment to be qualified by testing to assure that the target HCLPF of 1.67 times the SSE is met.

Staff expects the applicant to address seismic qualification of Category I equipment to assure at least a 1.67 factor margin above the SSE (ref ISG-20). MHI has proposed developing load factors on SSE ISRS to arrive at the required response spectra (RRS). The October 9, 2009 letter response stated that these factors had not yet been defined but are being evaluated by component type and by method of qualification. As of yet, MHI has not submitted a response to the staff question. Staff notes that the test response spectra must be chosen so as to demonstrate that no more than one percent rate of failure would be expected when the plant is subjected to the applicable seismic margin ground motion. This is consistent with ISG-20, and clarifies how the COL licensee may confirm that prototype testing has demonstrated adequate seismic margin on a plant- and site- specific basis.

To address this issue, staff requests the applicant to include a COL action item in the DCD on how a COL licensee will seismically qualify equipment to assure at least a 1.67 factor margin above the SSE.

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**ANSWER:**

MHI performed an estimation of the load factors for instrumentation and electrical equipment qualified for seismic by testing and type testing. The results were reported as "The Additional Information on the Responses to US-APWR DCD RAI No.454-3000 Revision 0 (RAI 19-400)" on March 31, 2011. It is concluded that a load factor of 1.4 (of ASCE/SEI 43-05) or smaller value can meet the target HCLPF value with some margin. The results will be included in technical report, MUAP-07030(R3) Attachment 24E.

In ISG-20, for a COL application that incorporates a DC by reference, the COL applicant must address the COL action items included in the respective DC and update the DC's PRA-based seismic margin analysis to adequately incorporate site-specific and plant-specific information for the COL site. Also ISG-20 requires introducing an appropriate seismic margin factor to seismic qualification test by IEEE STD-344 in order to achieve a HCLPF of 1.67 times the SSE for equipment.

To address the ISG-20 requirement, a new COL action item will be added to DCD Chapter 19 Subsection 19.3 related to SMA.

Impact on DCD

COL 19.3(5) of DCD Revision 3 will be revised shown in Attachment 1.

Impact on R-COLA

Revise COL action item 19.3(5) in Table 1.8-201.

Impact on S-COLA

Revise COL action item 19.3(5) in Table 1.8-201.

Impact on PRA

There is no impact on the PRA.

**19.3 Open, Confirmatory, and COL Action Items Identified as Unresolved**

The following subsections identify the open, confirmatory and COL action items associated with this Chapter.

**19.3.1 Resolution of Open Items**

There are no open items associated with this Chapter.

**19.3.2 Resolution of Confirmatory Items**

There are no confirmatory items associated with this Chapter.

**19.3.3 Resolution of COL Action Items**

The following are the COL action items associated with this Chapter:

COL 19.3(1) The COL Applicant who intends to implement risk-managed technical specifications continues to update Probabilistic Risk Assessment and Severe Accident Evaluation to provide PRA input for risk-managed technical specifications. Peer reviews for the updated PRA will be performed prior to the use of PRA to risk-informed applications.

COL 19.3(2) Deleted

COL 19.3(3) Deleted

COL 19.3(4) The Probabilistic Risk Assessment and Severe Accident Evaluation is updated as necessary to assess specific site information and associated site-specific external events (high winds and tornadoes, external floods, transportation, and nearby facility accidents).

COL 19.3(5) ~~Deleted~~

COL 19.3(6) The COL Applicant develops an accident management program which includes severe accident management procedures that capture important operator actions. Training requirements are also included as part of the accident management program.

The COL Applicant will identify a milestone for completing a comparison of the as-built SSC HCLPFs to those assumed in DCD Subsection 19.1.5.1. Deviations from the HCLPF values or other assumptions in the seismic margins evaluation shall be analyzed to determine if any new vulnerability have been introduced.



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**QUESTION NO. : 19-526**

DCD, Chapter 19, should contain a COL action item requiring the COL applicant to identify plant-specific vulnerabilities and confirm the basis of the SMA. If the plant-level HCLPF is less than the target value, the applicant should perform a full convolution of sequence fragility for all sequences with a potential to lead to core damage to demonstrate that the seismic risk is acceptably low for the licensed plant. ISG-20 provides guidance on this process in Section 5.2, "Position on Updating DC PRA-Based Seismic Margin Analysis by COL Applicants."

DCD, Chapter 19, should also contain a COL action item requiring COL licensees to verify the plant SSC capacity to demonstrate the plant- and sequence-level HCLPF capacity is consistent with the FSAR. COL licensees should perform the verification based on the as-designed, as-built configuration of the plant. The plant walkdown process described in EPRI NP-6041 (Ref 13) can be used for the capacity verifications. COL licensees should complete the verification activities before initial loading of fuel to confirm that the as-designed and as-built plant level HCLPF capacity is at the level of 1.67 times the site GMRS PGA, or the values reviewed and approved for the licensee. The COL licensee should document the verification findings and make the documentation available for inspection. After completion of the as-built verification of seismic fragility target values for applicable seismic SSCs, the FSAR must be updated to reflect the as-built values. Further guidance is detailed in ISG-20, Section 5.3, "Verifications after Issuance of the COL."

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**ANSWER:**

Previous RAI No.454 19-401 requested inclusion of an ITAAC to conduct a plant walk down and verify that the as-built SSC HCLPF values are at least equal to the 1.67 times the certified seismic design peak ground acceleration value prior to fuel load. Therefore, added new ITAAC in the DCD Revision 2 Tire 1 Table 2.2-4 and Tier 2 Table 14.3-1d. Alternately deleted the COL action item COL 19.3(5) in the DCD Revision 2 because it required similar actions.

Due to ISG-20, COL holders should perform the verification based on the as-designed, as-built configuration of the plant.

To address these issues, a new COL action item will be added to DCD Chapter 19, Subsection 19.3, as shown in the response to RAI 19-525.

Impact on DCD

A new COL action item will be added to DCD Chapter 19, Subsection 19.3, as shown in the response to RAI 19-525.

Impact on R-COLA

Revise COL action item 19.3(5) in Table 1.8-201.

Impact on S-COLA

Revise COL action item 19.3(5) in Table 1.8-201.

Impact on PRA

There is no impact on the PRA.