

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

April 27, 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-11124

**Subject: MHI's Responses to US-APWR DCD RAI No. 725-5408 REVISION 2 (SRP 18)**

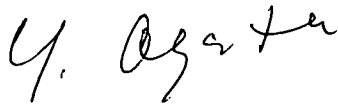
**Reference:** 1) "Request for Additional Information No. 725-5408 REVISION 2, SRP Section: 18 - Human Factors Engineering, Application Section: 18.5" dated March 28, 2011.

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. 725-5408 Revision 2."

Enclosed are the responses to the RAI 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,



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

Enclosure:

1. Responses to Request for Additional Information No. 725-5408 REVISION 2

DOB  
MRO

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

Contact Information

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Docket No. 52-021  
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Enclosure 1

UAP-HF-11124  
Docket No. 52-021

Responses to Request for Additional Information No. 725-5408  
REVISION 2

April 2011

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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**04/27/2011**

**US-APWR Design Certification  
Mitsubishi Heavy Industries  
Docket No. 52-021**

**RAI NO.:** NO. 725-5408 REVISION 2  
**SRP SECTION:** 18.5  
**APPLICATION SECTION:** 18.05 – HUMAN FACTORS ENGINEERING  
**DATE OF RAI ISSUE:** 03/28/2011

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**QUESTION NO. : 18-98**

NUREG-0711, Criterion 6.4 (2) states " The staffing analysis should determine the number and background of personnel for the full range of plant conditions and tasks ..."

DCD Tier 1 Section 2.9.1.2.4, Staffing & Qualification, states that, "...the space and layout of the MCR is designed to accommodate the foreseen maximum operating staff and temporary staff. " Provide the numbers and basis for the maximum staff. Also note that the addition of just one RO to the staff, in Phase 1a scenarios, and as mentioned in MUAP-07007, R3, Section 5.5, is not a maximum staff that would be expected in the MCR during a significant accident.

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**ANSWER:**

DCD Tier 1 Section 2.9.1.2.4, Staffing & Qualification has been deleted in Revision 3 of the DCD. DCD Tier 1, Revision 3, Section 2.9.1.2, item 6 states: "A staffing and qualifications analysis is performed in accordance with the requirements of the Staffing and Qualifications Implementation Plan."

The numbers for the maximum staff are determined based on the staffing and qualifications analysis, which is performed in accordance with the requirements of the Staffing and Qualifications Implementation Plan (MUAP-10008). As stated in that plan:

The staffing and qualifications analysis begins with ... typical staffing levels for Pressurized Water Reactor (PWR) plants in the U.S. and Japan. ... A systematic process is then used to evaluate ... significant differences between the US-APWR and predecessor plants .... The analysis approach utilizes multiple converging measures, including review of data from operational experience ....

To clarify this issue, the following changes will be made to MUAP-10008:

The following will be added to Section 4.1:

Sources of data from operational experience include the staffing defined in the EPRI "Advanced Light Water Reactor Utility Requirements Document" Volume II Chapter 10, Section 4.2.3, and current staffing at pressurized water reactor plants.

The title of Section 4.2.1.1 will be changed to "Minimum and Maximum Operating Staff Numbers" and the following will be added:

The initial starting point for the maximum staffing in the staffing and qualification analysis is based on providing HSI accommodations (i.e., space and layout) in the MCR for the following personnel:

- Two ROs, responsible for the operation of controls in MCR
- One MCR supervisor (Licensed senior reactor operator (SRO)), responsible for the direct supervision of the operators in MCR
- One shift supervisor (SRO), responsible for overall plant operation
- One shift technical advisor (STA), responsible for providing engineering support

The initial starting point for the maximum staffing in the staffing and qualification analysis is based on providing physical and habitability accommodations within the MCR envelope for the following active observer:

- One shift crew assistant, responsible for assisting the shift supervisor and handling communications
- One additional RO, responsible for assisting the above two ROs and interacting with other members of the plant staff
- One from the NRC
- One from the Plant Owner's management
- Two equipment operators

**Impact on DCD**

There is no impact on the DCD

**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**

There is no impact on the PRA

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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04/27/2011

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**APPLICATION SECTION:** 18.05 – HUMAN FACTORS ENGINEERING  
**DATE OF RAI ISSUE:** 03/28/2011

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**QUESTION NO. : 18-99**

NUREG-0711, Criterion 6.4 (2) states " The staffing analysis should determine the number and background of personnel for the full range of plant conditions and tasks ..."

DCD Tier 1 Section 2.9.1.2.4, page 2.9-3 needs clarification. This section states "Changes to staffing levels or personnel used in the HFE development are documented and analyzed for their potential impact on HSIs." Please clarify the meaning of this sentence and provide a revised sentence for Tier 1.

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**ANSWER:**

DCD, Tier 1 Section 2.9.1.2.4, Staffing & Qualification, has been deleted in Revision 3 of the DCD. DCD Tier 1, Revision 3, Section 2.9.1.2, item 6 states: "A staffing and qualifications analysis is performed in accordance with the requirements of the Staffing and Qualifications Implementation Plan."

The text in Section 2.9.1.2.4, which pertained to the staffing levels of the HFE development personnel, was inappropriate. The staffing for the HFE development team is described in Section 3 of Human Factors Engineering (HFE) Overall Implementation Procedure, which is Part 1 of MUAP-09019.

**Impact on DCD**

There is no impact on the DCD.

**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**

There is no impact on the PRA

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**QUESTION NO. : 18-100**

NUREG-0711, Criterion 6.4 (2) states " The staffing analysis should determine the number and background of personnel for the full range of plant conditions and tasks ..."

DCD Tier 2, Section 18.5.2, note 1, states:

*"Note 1: Staffing analysis of personnel in these positions is limited to those performing the following activities: on-line testing and maintenance required by technical specifications; radiological protection activities supporting technical specifications, required maintenance, and emergency and abnormal response; and required chemical monitoring supporting technical specifications, and abnormal and emergency response."*

This does not appear to agree with the scope of the S&Q IP (MUAP-10008) and is too limiting in its restriction to Tech Spec items. Also, it does not include normal at-power or shutdown operations. Please revise.

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**ANSWER:**

DCD Tier 2, Section 18.5.2 will be revised to be consistent with Section 2.0 of the Staffing and Qualifications Implementation Plan (MUAP-10008), as shown below.

**Impact on DCD**

DCD Tier 2, Section 18.5.2, note 1 will be replaced with the following.

Tasks directly related to plant safety are addressed in this analysis for the full range of plant operating modes, including the following:

- Startup / Shutdown
- Normal operations



- Abnormal and Emergency operations

- Transient conditions

The scope of tasks covered by the analysis includes operational tasks, plant maintenance tasks and plant surveillance and testing.

**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**

There is no impact on the PRA

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**QUESTION NO. : 18-101**

NUREG-0711, Criterion 6.4 (2) states " The staffing analysis should determine the number and background of personnel for the full range of plant conditions and tasks ..."

In the Staffing and Qualifications Implementation Plan (IP) (MUAP-10008), the last paragraph of Section 4.2.2, page 6, contains a discussion of the initial staff levels for non-licensed staff. Please provide these initial numbers.

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**ANSWER:**

The following revision will be made to the end of Section 4.2.2 of the Staffing and Qualifications Implementation Plan (IP), MUAP-10008:

The initial US-APWR staffing level for non-operating staff categories of personnel are based on staffing levels of predecessor PWR plants, as follows:

I&C technicians	33-45
Electrical maintenance personnel	33-40
Mechanical maintenance personnel	33-50
Radiological protection technicians	36
Chemistry technicians	13-16
Engineering support personnel	33-60

The ranges of numbers represents the variations in the operating plants to which the US-APWR will be compared.

Analyses described in Section 4.4 will then be used to evaluate the appropriateness of these initial staffing levels. The staffing numbers for these non-operations categories of personnel is also defined based on the analyses in Section 4.4 of the S&Q IP.

**Impact on DCD**

There is no impact on the DCD

**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**

There is no impact on the PRA

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**QUESTION NO. : 18-102**

NUREG-0711, Criterion 6.4 (2) states, "The staffing analysis should determine the number and background of personnel for the full range of plant conditions and tasks ..."

The Abstract of MUAP-10008 (R0), states that, "The staffing analysis covers both licensed operating staff and non-licensed positions (e.g., maintenance and testing staff) directly related to risk-important plant safety." This sentence is not completely clear, but the restriction to either RI or safety-related items is too restrictive. Also, it does not agree with other parts of the implementation plan (IP) that are broader, more appropriate in scope, and more in agreement with the guidance in NUREG-0711. Further, IP Section 4.4, page 12, 2<sup>nd</sup> sentence, and the Topical Report, MUAP-07007 (R3), Section 5.5, have similar restrictions. Please clarify.

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**ANSWER:**

The scope of the staffing and qualifications analysis is not limited to risk-important tasks. The personnel for tasks directly related to plant safety are included in the scope of the analysis. In addition, the analysis ensures that tasks not directly related to plant safety do not cause an adverse effect on tasks or personnel directly related to plant safety.

Therefore, the Abstract and Section 4.4 of MUAP-10008 (R0), as well as Topical Report, MUAP-07007 (R3), Section 5.5, will be corrected to be consistent with Section 2.0 of MUAP-10008, as described in the response to Question No. 18-100 (i.e. tasks directly related to plant safety are addressed in this analysis for the full range of plant operating modes).

The Abstract of MUAP-10008 will be revised as follows:

The staffing analysis covers tasks performed by both licensed operating staff and non-licensed positions (e.g., maintenance and testing staff) directly related to plant safety.

The following will be added to the end of Section 2.0 of MUAP-10008:

The personnel required for all tasks directly related to plant safety are included in the scope of the analysis. In addition, the analysis ensures that tasks not directly related to plant safety do not cause an adverse effect on tasks or personnel performing tasks directly related to plant safety.

Section 4.4 of MUAP-10008 will be revised as follows:

This includes staffing levels and qualifications assumptions for both operating staff as well as other categories of personnel (e.g., maintenance and test personnel) performing tasks directly related to plant safety.

Section 5.5 of MUAP-07007 will be revised as follows:

The plant specific report for the Staffing and Qualifications program element will define the staffing and qualifications for personnel that perform operations or maintenance tasks directly related to plant safety. Tasks directly related to plant safety are addressed in this analysis for the full range of plant operating modes, including the following:

- Startup / Shutdown
- Normal operations
- Abnormal and Emergency operations
- Transient conditions

The scope of tasks covered by the analysis includes operational tasks, plant maintenance tasks, and plant surveillance and testing. The report will define the basis for the staffing numbers and qualification requirements, with justification for changes from the reference plant. Staffing will be confirmed through Task Analysis and V&V program elements.

**Impact on DCD**

There is no impact on the DCD

**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**

There is no impact on the PRA

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**QUESTION NO. : 18-103**

NUREG-0711, Criterion 6.4 (4) states in part, " The basis for staffing and qualifications should be modified to address these issues: Operating Experience Review ..." DCD Tier 2 Section 18.5 does not reference the S&Q Implementation Plan (IP) (MUAP-10008), which addresses the issues identified in Criterion (4) nor any other MHI document. Please provide a commitment to follow the IP in Tier 2 and add the IP as a Tier 2\* reference.

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**ANSWER:**

DCD Tier 2 Section 18.5.1 will be revised to follow the Staffing and Qualifications Implementation Plan (MUAP-10008) and to add the implementation plan as a reference to Tier 2 Section 18.5.5, References.

**Impact on DCD**

The following description will be added in DCD Tier 2, Section 18.5.1, Staffing and Qualifications:

"The detailed staffing and qualification analysis process is described in the US-APWR Staffing & Qualifications Implementation Plan (MUAP-10008)."

MUAP-10008 will be added to DCD Tier 2 Section 18.5.5 References.

**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**

There is no impact on the PRA

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**QUESTION NO. : 18-104**

NUREG-0711, Criterion 6.4 (2) states, " The staffing analysis should determine the number and background of personnel for the full range of plant conditions and tasks ..."  
The minimum operator staffing levels in the control room are specified in Staffing and Qualifications Implementation Plan (IP), MUAP-10008 (R0), Section 4.2.1.1 as:

- 1 SRO located at the plant fulfilling the role of Shift Supervisor and STA
- 1 SRO located within the MCR fulfilling the role of MCR Supervisor
- 1 RO located at the controls of the plant in the MCR
- 1 RO located at the plant

This staffing is similar to that in current US NPPs and generally complies with the various subsections 50.54(i) through (m). However, there are two notable differences. First, the staffing numbers for licensed operators only address the single-unit column of the minimum staffing table for 50.54(m)(2). Please explain and provide a commitment (in the DCD and the IP) to the full table as applicable.

Secondly, one notable difference from current plants is the statement in Section 4.4.1 of the IP that there will only be one RO at the main control panels in the MCR and that the plant is designed to be operated by only one operator. However, the MHI documents do not address the responsibilities of the second RO that will be on-shift. Please provide those responsibilities.

Additionally, as a result of the recommendations following the TMI-2 accident (see NUREG-0585), the STA position was created. Further, it is noted that Appendix C of NUREG-0737, Clarification of TMI Action Plan Requirements, states that STA was expected to be an interim position which would be phased out when Shift Supervisor and SRO training and qualification requirements had been upgraded. As discussed in ANSI/ANS-3.1-1993, which has been endorsed by RG 1.8, the STA is the individual who provides advice and counsel to the operations shift. This implies that the Shift Supervisor and STA cannot be the same SRO. Please clarify how MHI intends to apply the lessons of TMI with a single SRO as Shift Supervisor and STA.



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**ANSWER:**

The reason why the staffing numbers for licensed operators only address the single-unit column of the minimum staffing table for 50.54(m)(2) is that the US-APWR applies only to a single-unit configuration. To clarify this point, the following will be added to the end of the Staffing and Qualifications Implementation Plan (IP), MUAP-10008 (R0), Section 4.2.1.1:

For plants with multiple US-APWR units, each US-APWR unit will fulfill these minimum staffing requirements.

The following will be added to Section 4.2.1.1 after the change identified above:

The second RO is required to be at the plant, but not in the MCR. The second RO will normally support maintenance and testing activities. During emergency conditions, the second RO may be used to restore success paths that may not have responded correctly to emergency actuation signals. The second RO may also be used for local control actions during degraded HSI conditions (i.e., for common cause failure of digital systems).

In the US-APWR, the MCR Supervisor leads activities directly related to plant operations; he is the leader of the control room operations shift. The Shift Supervisor performs a management oversight role for unit activities. This includes control room operations as well as maintenance and testing activities in the plant. During abnormal events, the Shift Supervisor can provide advice and counsel to the operations shift through his role as STA. To assume this role, the Shift Supervisor must have the required SRO and STA qualifications. Therefore, a shift supervisor in a combined Shift Supervisor-STA role establishes the minimum staffing for the US-APWR. The maximum staffing assumes separate roles.

**Impact on DCD**

There is no impact on the DCD

**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**

There is no impact on the PRA

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**QUESTION NO. : 18-105**

Please address the following typos in the S&Q IP, MUAP-10008 (R0):

- Page 3, Section 4.1, last sentence (7<sup>th</sup> line from bottom of page), 'describes' not 'descries.'
  - Page 4, 3<sup>rd</sup> line from bottom, 'Shift Supervisor' not 'Shift Manager' to agree with rest of document.
  - Page 6, 1<sup>st</sup> sentence under "Chemistry Technicians." This sentence is not understandable as written.
  - Page 6, 1<sup>st</sup> sentence under "Engineering Support Personnel" states "Engineering support personnel are responsible for the safe and reliable operation of a nuclear power generating plant depends, in part, on engineering personnel who understand the fundamentals of nuclear power plant technology." This sentence is not understandable as written.
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**ANSWER:**

MHI will revise the S&Q IP, MUAP-10008 as follows:

- Page 3, Section 4.1, last sentence (7<sup>th</sup> line from bottom of page), 'descries' will be replaced with 'describes.'
- Page 4, 3<sup>rd</sup> line from bottom, 'Shift Manager' will be replaced 'Shift Supervisor' to agree with the rest of the document.
- Page 6, 1<sup>st</sup> sentence under "Chemistry Technicians. This sentence will be replaced as follows;  
"Chemistry technicians monitor and maintain the chemistry of the station's fluid systems."
- Page 6, 1<sup>st</sup> sentence under "Engineering Support Personnel" will be replaced with the following;

“Engineering support personnel contribute to the safe and reliable operation of the nuclear power plant by maintaining and repairing nuclear plant equipment. They should understand the fundamentals of nuclear power plant technology.”

**Impact on DCD**

There is no impact on the DCD

**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**

There is no impact on the PRA

This completes MHI's responses to the NRC's questions.