



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

September 24, 2009

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-09458

**Subject: MHI's Response to US-APWR DCD RAI No. 432**

**References:** 1) "Request for Additional Information No. 432 Revision 0, SRP Section: 08.02 - Offsite Power System," dated July, 30, 2009

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.432 Revision 0."

Enclosed are the responses to 7 RAIs 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.

Enclosure:

1. Response to Request for Additional Information No.432 Revision 0

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-09458  
Docket No. 52-021

Responses to Request for Additional Information No.432 Revision 0.

September 2009

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**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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9/18/2009

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

**RAI NO.:** NO. 432-3206 REVISION 0  
**SRP SECTION:** 08.02 - OFFSITE POWER SYSTEM  
**APPLICATION SECTION:** 08.02  
**DATE OF RAI ISSUE:** 7/30/2009

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**QUESTION NO. : 08.02-10**

In RAI 4-205 Question 08.02-1 the staff requested MHI to revise Section 08.-02, Chapter 8 of the DCD to include a discussion on grid stability analysis justifying the assumed 3- second time delay for loss of offsite power as described in MHI's letter dated February 8, 2008 to the NRC. In the current version of the US-APWR FSAR, the 3 second time delay for loss of offsite power is not described in Section 8.2, "Offsite Power" of the DCD. In addition the staff asked MHI to provide the minimum voltage and frequency limits for the offsite power as an interface requirement that the COL applicant must maintain to ensure correct operation of the RCPs to satisfy Chapter 15 analysis for a minimum of 3 seconds.

During the March 23, 2009 teleconference, MHI agreed to add in future revisions of the DCD (Rev 2) a discussion on grid stability analysis justifying the assumed 3-second time delay for loss of offsite power. In addition, MHI agreed to add an interface requirement for the COL applicant in the upcoming DCD revision (Rev 2) for minimum voltage and frequency limits for offsite power to ensure correct operation of RCPs to satisfy Chapter 15 analysis.

The staff requests that MHI docket its response confirming the above actions to resolve this RAI question.

**ANSWER:**

DCD Subsection 8.2.3 describes the 3-second time delay assumed in Chapter 15 as follows:

Transmission system stability is consistent with the condition of the transient and accident analysis in Chapter 15. It is assumed that the power supply to RCPs following a reactor/turbine trip is maintained at least 3 seconds by the main generator (turbine generator coast down) or the offsite power in Chapter 15. Following a reactor/turbine trip, stability of the offsite power is expected to be maintained, including the power supply to the RCPs. In addition, when the offsite power is lost concurrent with a reactor/turbine trip, the turbine-generator is still connected to the UATs and RCPs are powered by turbine-generator. The large inertia of the turbine-generator will maintain voltage and frequency more than 3 seconds. In case of a unit trip due to an electrical fault, the main transformer circuit breaker opens and the non-Class 1E buses are powered continuously via RAT. The COL applicant is to perform grid stability analysis to conform the assumption in Chapter 15.

The minimum voltage and frequency limits of offsite power for proper operation of the RCPs will be added to DCD Subsection 8.2.3 as shown in the Impact on DCD section below.

**Impact on DCD**

Subsection 8.2.3 will be revised to add the following sentence.

**The interface requirement for offsite power is maintaining a transmission system operating voltage of  $\pm 10\%$  and a frequency of  $\pm 5\%$ .**

**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. : 08.02-11**

In RAI 4-205 Question 08.02-2 the staff requested MHI to specify the allowed grid voltage drop that the COL applicant must maintain on the high side of the main step-up transformer (MT), and reserve auxiliary transformer (RAT) from the pre-trip steady-state voltage in order to maintain reactor coolant pump operation for 3 seconds following a turbine trip. The staff believes that the DCD should contain minimum voltage and frequency requirements at the switchyard to ensure satisfactory operation of the RCPs for 3 seconds after a reactor trip to satisfy the Chapter 15 analysis. The COL applicant would then need to perform the needed analyses, such as grid stability analysis to meet these minimum voltage and frequency limits.

During the March 23, 2009 teleconference, MHI agreed to add in future revisions of the DCD (Rev 2) the operating characteristics of the RCPs and the minimum voltage and frequency requirements at the switchyard to ensure satisfactory operation of the RCP after a reactor trip for 3 seconds.

The staff requests that MHI docket its response confirming the above actions to resolve this RAI question.

**ANSWER:**

See response to Question No.08.02-10.

**Impact on DCD**

See response to Question No.08.02-10.

**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. : 08.02-12**

In RAI 4-205 Question 08.02-3 the staff requested MHI to include an interface requirement for the COL applicant to perform a grid stability analysis to show that, with no electrical system failures, the grid will remain stable and the reactor coolant pump bus voltage will remain above the voltage required to maintain the flow assumed in the Chapter 15 analyses for a minimum of 3 seconds following a turbine trip.

During the March 23, 2009 teleconference, MHI agreed to add in future revisions of the DCD (Rev 2) an interface requirement for the COL applicant to perform a grid stability analysis as discussed in the RAI 4-205 Question 08.02-3.

The staff requests that MHI docket its response confirming the above actions to resolve this RAI question.

**ANSWER:**

Subsection 8.2.3 of DCD Rev.1 indicates that the COL applicant is to provide the grid stability analysis.

COL Information 8.2(11) will be revised based on the response to RAI No. 424 Question No. 14.03.06-16.

**Impact on DCD**

COL Information 8.2(11) will be revised based on the response to RAI No. 424 Question No. 14.03.06-16 as follows:

The COL applicant is to address the stability and reliability study of the offsite power system. The Sstability study is to be addressed conducted in accordance with BTP 8-3 (Reference 8.2-17). The study should address the loss of the unit, loss of the largest unit, loss of the largest load, or loss of the most critical transmission line including the operating range for maintaining transient stability. A failure modes and effects analysis (FMEA) is to be provided.

**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. : 08.02-13**

In RAI 4-205 Question 08.02-4 the staff requested MHI to include a description of the design features provided to prevent connection of the alternate power on to a faulted bus when the buses are transferred from the reserve auxiliary transformers to the unit auxiliary transformer.

During the March 23, 2009 teleconference, MHI agreed to add in future revisions of the DCD (Rev 2) a description of the design features as requested in RAI 4-205 Question 08.02-4.

The staff requests that MHI docket its response confirming the above actions to resolve this RAI question.

**ANSWER:**

Transfer from normal offsite power to alternate offsite power is permitted when the bus faulted signal is not initiated.

**Impact on DCD**

The following sentence will be added after seventh sentence of fourth paragraph of DCD Subsection 8.2.1.2.

**Performance of these transfers is permitted when the bus faulted signal is not initiated.**

**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. : 08.02-14**

In RAI 4-205 Question 08.02-5 the staff expressed its concern that the proposed electrical design for the safety and non-safety buses as shown in Figure 8.1-1 of the USAPWR FSAR may not satisfy the criteria of SECY-91-078, "EPRI's Requirements Document and Additional Evolutionary LWR Certification Issues." The guidance given in the above documents state that the evolutionary plant design should include at least one offsite circuit to each redundant safety division supplied directly from one of the offsite power sources with no intervening nonsafety buses in such a manner that the offsite source can power the safety buses upon a failure of any non-safety bus. The staff asked MHI to discuss and provide rationale how the proposed electrical design meets the guidance given in SECY-91-078 which states that offsite source can power the safety buses upon a failure of any non-safety bus. This issue is the same as was discussed in part b of the RAI 10-453 Question 08.03.01-8.

During the March 18, 2009, and March 23, 2009 teleconferences, MHI agreed to revise the design of the supply power to the non-safety buses P1 and P2 such that these nonsafety buses will be supplied from UATs normally. MHI agreed that it will revise the electrical design, appropriate drawings and FSAR to ensure that the power to the safety buses is supplied directly from the offsite (RAT transformers) with no intervening nonsafety buses.

The staff requests that MHI docket its response confirming the above actions to resolve the above RAI question.

**ANSWER:**

See response to RAI No.386 Question No.08.03.01-23.

**Impact on DCD**

See response to RAI No.386 Question No.08.03.01-23

**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. : 08.02-15**

In RAI 4-205 Question 08.02-6 the staff asked MHI to provide information on the design of the generator load break switch (GLBS) and how it complies with the criteria and guidelines of SRP Section 8.2, Appendix A, "Guidelines for Generator Circuit Breakers/Load Break Switches."

During the March 23, 2009, teleconference, MHI agreed to add in future revisions of the Section 8.2 of the DCD (Rev 2) a discussion on the GLBS to indicate that it is designed in accordance with SRP Section 8.2, Appendix A criteria and guidelines.

The staff requests that MHI docket its response confirming the above actions to resolve the above RAI question.

**ANSWER:**

Subsection 8.2.2.1 of US-APWR DCD Rev.1 states compliance with SRP Section 8.2 Appendix A as follows:

Standard Review Plan (SRP) Section 8.2 Appendix A

The US-APWR has GLBS which is designed and tested in accordance with SRP Section 8.2 Appendix A. In addition, the Class 1E MV buses are normally supplied from RAT as normal PPS. Therefore, immediate access circuit is assured without isolating the main generator from MT and UAT in case of electrical fault in the power supply circuit affecting the UATs.

In addition, this description is based on response to RAI 4-205 Question 08.02-6 and material prepared by NRC for the teleconference stated "Response OK".

**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. : 08.02-16**

In RAI 4-205 Question 08.02-7 the staff asked MHI to provide justification for not including neutral overcurrent and sudden pressure protection for Main Transformer (MT), RATs and UATs in accordance with the recommendations of IEEE-Std-666, "IEEE Design guide for Electric Power Service Systems for Generating Systems." In their response to the staff RAI, MHI stated that the MT, UATs and RATs have sudden pressure relays (SPRs) and ground fault protection relays (50/51N).

During the March 23, 2009, teleconference, MHI agreed to revise the description of electrical protection schemes in the future revisions of the Section 8.2 of the DCD (Rev 2) to indicate that MT, UATs and RATs have these protective design features. MHI stated that it will include an interface requirement in the DCD for COL applicant to describe any site specific electrical protection scheme in FSAR Section 8.2 of COL application.

The staff requests that MHI docket its response confirming the above actions to resolve the above RAI question.

**ANSWER:**

Subsection 8.2.1.2 states to include the sudden pressure and ground over current protection scheme as follows:

The MTs, UATs and RATs have differential, over-current, sudden pressure and ground over-current protection schemes per IEEE Std 666 (Reference 8.2-9). The COL applicant is to provide site-specific protection scheme.

In addition, this description is based on response to RAI 4-205 Question 08.02-7 and material prepared by NRC for the teleconference stated "Response OK".

**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.