

REQUEST FOR ADDITIONAL INFORMATION 386-2859 REVISION 0

6/11/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 08.03.01 - AC Power Systems (Onsite)

Application Section: 8.3.1

QUESTIONS for Electrical Engineering Branch (EEB)

08.03.01-23

Question #08.03.01-23

This is a follow up RAI to the original RAI #08.03.01-8 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

Part a:

In response to the RAI question #08.03.01-8, part a, MHI provided motor starting transient graphs in Attachment A showing that the starting of the large pump motors will not cause a substantial dip in the voltage at the safety buses. In a teleconference meeting with MHI on March 18, 2009, the staff asked MHI to provide assumptions used in the motor starting transient analysis (graphs). During the teleconference, MHI agreed to revise the ETAP motor transient analysis and the Attachment A. Also, MHI agreed to add a report with assumptions to support its analysis documented in Attachment A for staff review, and submit the revised Attachment A as part of the FSAR or Technical Report. The staff requests that MHI docket its response confirming the above actions to resolve this RAI question.

Part b:

MHI response to this RAI is not satisfactory because the applicant assumed a failure in a feeder breaker in the Non-Class 1E bus P1 or P2 which is not bounding or conservative. The staff original RAI highlighted the concern on the failure (stuck breaker) of the main breaker in the non-safety bus (P1 or P2) that fails to open which would then require opening of the primary side breaker of the RAT3 or RAT 4, thereby de-energizing the safety buses A and B (or C and D). Therefore a failure in the non-safety bus (main breaker failed) in P1 (or P2 bus) would cause a failure in the respective safety buses. The staff discussed this issue with MHI in the teleconference of March 18, 2009, indicating that the US-APWR electrical design did not adhere to the guidance provided by the NRC Commission on offsite power systems for evolutionary plants. During this teleconference MHI indicated that it understands the staff's concern. MHI agreed to change the electrical design for supplying the non-safety medium voltage buses P1 and P2 from the RAT to UAT transformers and the corresponding Schematics and FSAR description based on meeting discussion. The staff requests that MHI docket its response confirming the above actions to resolve the above RAI question.

Part c:

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

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the safety buses upon a failure of any non-safety bus. This issue is the same as discussed in above part b of the RAI Question 08.03.01-8. During the March 18, 2009, teleconference MHI agreed to supply power to the non-safety buses P1 and P2 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 non-safety buses. The staff requests that MHI docket its response confirming the above actions to resolve the above RAI question.

08.03.01-24

Question #08.03.01-24

This is a follow up RAI to the original RAI #08.03.01-9 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

By RAI #08.03.01-9, the staff asked MHI to describe protective relays that initiate the fast bus transfer from RAT to UAT transformers and the time to accomplish the transfer. In its response MHI described that the fast bus transfer is accomplished by the main and back-up differential relays in about 150 milli-seconds (9 cycles). MHI's answers to this RAI prompted the staff to ask the follow-up questions on the fast bus transfer during loss of voltage without involving a fault and the role of degraded and loss of voltage relays in the fast transfer scheme. The staff also asked MHI to explain why the 150 milli-seconds transfer time was appropriate in view of the experience in the USA of 100 milli-seconds used for fast bus transfers. The staff asked MHI to address if it had performed the required analysis to ensure that the motor voltages are not substantially out of phase with bus voltage during the 150 milli-seconds fast bus transfer.

During the March 18, 2009, teleconference MHI indicated that if the MV bus voltage goes down (due to loss or degraded voltage condition), bus transfer is only controlled as a slow transfer. MHI agreed during the March 18 teleconference to provide additional information to explain transfer on low/loss of voltage, and discuss why 150 ms versus 100 ms will not result in out-of-phase transfer of motor loads. Further, MHI agreed to add a description (narrative) on the protection relays which initiate the fast bus transfer in FSAR Section 8.3.1.1.2.4. The staff requests MHI to docket its response by providing the additional information discussed above and updating the FSAR (upcoming revisions) to resolve this RAI question.

08.03.01-25

Question #08.03.01-25

This is a follow up RAI to the original RAI #08.03.01-10 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

In the RAI Question #08.03.01-10, the staff asked MHI to explain the class 1 E bus transfer schemes (automatic fast transfer and slow transfer) and the use of the LOOP load sequencer when there is no turbine/reactor trip with Loss of power from the RAT. During the March 18, 2009, teleconference MHI explained that in the US-APWR design,

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the loads are restarted with LOOP sequencer as a standard design. MHI agreed during the March 18, 2009, teleconference to revise and explain better in the DCD the bus transfer schemes, the relays associated with the each scheme and the use of the LOOP sequencer. The staff requests MHI to docket its response by providing the additional information on the bus transfer schemes including the use of the LOOP sequencer in the FSAR (upcoming DCD revisions) to resolve this RAI question.

08.03.01-26

Question #08.03.01-26

This is a follow up RAI to the original RAI #08.03.01-13 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

The US-APWR FSAR description is not clear on the loads powered by the non-safety related buses P1 and P2 bus during an SBO. Therefore the staff asked MHI to clarify what are the required and not required loads on the non-safety related buses P1 and P2 bus during an SBO in RAI Question 08.03.01-13,. Also, the staff asked MHI to discuss what administrative controls and procedures MHI plans to be put in place to minimize the probability of overloading the AAC-GTG during an SBO event.

In its response to RAI Question 08.03.01-13, MHI stated that the only loads retained on the non-safety related buses P1 and P2 bus during an SBO are 200 kW respectively, and all other loads are manually locked open. MHI agreed during the March 18, 2009, teleconference to revise the description in the FSAR (upcoming DCD revisions) to show what P1 or P2 loads are not required during an SBO and discuss the administrative controls and procedures for shedding and locking these loads out. The staff requests MHI to docket its response by providing the additional information in the FSAR (upcoming DCD revisions) on this issue to resolve this RAI question.

08.03.01-27

Question #08.03.01-27

This is a follow up RAI to the original RAI #08.03.01-14 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

The applicant for the US-APWR FSAR does not address the degraded voltage protection for the onsite power distribution system in accordance with the Guidance given in BTP 8-6 as it relates to ac power system's capacity and capability to permit functioning of systems important to safety. The DCD states that the voltage levels at the class 1E buses are optimized for maximum and minimum load conditions and for the voltage variations of the offsite power system. MHI did not provide an analyses or data to support its conclusions.

The staff By RAI 08.03.01-14 asked MHI to provide additional information on how it met the requirements of given in BTP 8-6 as it relates to the onsite ac power system. The DCD applicant is responsible for the plant electrical distribution system therefore it is the responsibility of the DCD applicant to determine what voltage is needed at the safety

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buses for plant distribution loads. It is the responsibility of the DCD applicant to provide a description of the analytical techniques, methodology, and assumptions used in performing the analyses per BTP 8-6 position B.3., for the electrical distribution system that is within the scope of the DCD. Therefore the DCD applicant needs to provide the results of these analyses for each level of the electrical power distribution system that is within the scope of the DCD.

In the March 18, 2009, teleconference, the staff discussed the above RAI and informed MHI since the DCD applicant is responsible for the plant electrical distribution system it should be the responsibility of the applicant to determine what voltage is needed at the safety buses for plant distribution loads. Also, since the applicant is supplying the RAT and UAT transformers, therefore the applicant needs to perform the voltage drop, load flow and short circuit analyses of the electrical system within the scope of the DCD to determine the voltage required at the various distribution buses, and as well as the voltage required at the primary of the RAT and UAT transformers to support the said analysis.

During the March 18, 2009, teleconference MHI agreed to revise Attachment A to define the voltage boundary conditions for the onsite power distribution systems in accordance with the guidance given in BTP 8.6. Also, MHI agreed to include the onsite voltage boundary conditions in FSAR as the COL interface action items. MHI will clearly specify who will be responsible (DC or COL applicant) for Load flow, SC analysis, protective trip device coordination studies, etc. and this information will be incorporated in the revised DCD. The staff requests MHI to docket its response by providing the additional information in the FSAR (upcoming DCD revisions) on this issue to resolve this RAI question.

08.03.01-28

Question #08.03.01-28

This is a follow up RAI to the original RAI #08.03.01-16 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

The applicant did not describe in the DCD whether the class 1E GTGs can be started from the Remote Shutdown Panel (RSP) in case of evacuation of the main control room (MCR) due to a fire. In response to RAI Question #08.03.01-16, the applicant stated that the RSP is designed to allow the execution of the same safety functions as the MCR. The applicant stated that there was no impact on the DCD resulting from this RAI. The staff accepted the applicant response to the above RAI but took the position that description of such capability from the RSP should be included in the DCD to fully describe the functional capabilities of the RSP including the starting of the Class 1E GTGs. During the March 18, 2009, teleconference, the applicant agreed to revise the FSAR (upcoming DCD revisions) to include additional discussion on the functional capabilities of the RSP. The staff requests MHI to docket its response by providing the additional information in the FSAR (upcoming DCD revisions) on this issue to resolve the staff's RAI question.

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08.03.01-29

Question #08.03.01-29

This is a follow up RAI to the original RAI #08.03.01-17 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

In response to RAI 08.03.01-17 on testing of the Class-1E GTGs and maximum expected load carrying capability, MHI agreed to conduct the loading test for GTGs at 90-100% of the safety-related GTG's nameplate rating. In addition this test will be conducted at a Power Factor (PF) of 0.8 which is the nameplate value of GTG. Also, in its response MHI agreed to revise the description in the DCD Revision 2 to state that loading test will be carried at 90- 100% of the Class 1E GTG rating. During the March 18, 2009, teleconference, the staff requested that the loading test PF be included in the DCD Revision 2. MHI agreed that it will include the PF test values in the DCD Revision 2. The staff requests MHI to docket its response to indicate that the information discussed above will be incorporated in the FSAR (upcoming DCD revisions) to resolve this RAI question.

08.03.01-30

Question #08.03.01-30

This is a follow up RAI to the original RAI #08.03.01-18 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

In response to RAI Question #08.03.01-18, MHI stated that US-APWR design conforms to the guidance given in NEMA MG-1-20.45.A3 on variations from rated voltage and frequency. MHI also stated in their response that there is no impact on the DCD with which the staff disagreed because the description in the DCD is not clear how the design conforms to NEMA MG-1-20.45.A3 criteria of a combined variation in voltage and frequency of $\pm 10\%$. The staff informed MHI during the March 18, 2009, teleconference of its position that the description given in Table 8.3.1-2 in the DCD should be revised to clearly state that the US-APWR design conforms to the guidance of NEMA MG-1-20.45.A3 on combined variation in voltage and frequency of $\pm 10\%$. MHI agreed that it will revise the description in the upcoming DCD Rev 2. The staff requests MHI to docket its response that it will revise the information on combined variation in voltage and frequency in the FSAR (upcoming DCD revisions) to resolve this RAI question.

08.03.01-31

Question #08.03.01-31

This is a follow up RAI to the original RAI #08.03.01-19 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

In response to RAI 08.03.01-19, MHI provided to the staff the Attachment A which contains print outs (results) from the ETAP short circuit analysis of the Class-1E Onsite distribution system. During the March 18, 2009, teleconference the staff discussed the below listed issues on which the staff had concerns:

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- Safety-related Gas Turbine Generator are not running and therefore not included in the analysis;
- The voltage assumed is 1.0 of nominal which is not conservative;
- The interrupting rating of breakers in the each safety buses (A, B, C and D) are shown to be different for each breaker which is not correct;
- No analysis is provided on the steady-state load flow (distribution system voltage drop analysis) which is required by BTP 8.6 of the SRP.

MHI agreed that it will revise/recheck attachment A to address staff's concerns listed above. Also, MHI stated during the discussion that MHI will conduct the Load flow and voltage analysis. MHI believed that the GTGs are included in the analysis and will inform the staff this information is included in attachment A. The staff requests MHI to docket its response for addressing the issues listed above as agreed during the March 18 teleconference to resolve this RAI question.

08.03.01-32

Question #08.03.01-32

This is a follow up RAI to the original RAI #08.03.01-20 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

The RAI 08.03.01-20 requested MHI to provide additional information on circuit protective devices and their coordination in the form a coordination study to show that distribution equipment, including containment penetration assemblies are protected adequately. In its response to the above RAI, MHI stated that the detail protection and coordination of devices will not be done until the procurement of such equipment. The staff understands this position and therefore the staff asked MHI to clearly identify in the DCD whether MHI or the COL applicant will perform this analysis. MHI agreed to include this information in the DCD to specify who (DC or COL applicant) will perform the circuit protective devices coordination study. The staff requests MHI to docket its response for addressing the above issue as agreed during the March 18 teleconference to resolve this RAI question.

08.03.01-33

Question #08.03.01-33

This is a follow up RAI to the original RAI #08.03.01-22 based on discussions with the applicant (MHI) during the teleconference held on March 18, 2009.

By RAI 08.03.01-22, the staff informed MHI that the FSAR (DCD) did not include the results of the electrical power calculations and distribution system studies as listed in the Regulatory Guide 1.206, Section C.1.8.3.1.3, "Electrical Power System Calculations and Distribution system studies for AC System." Also, the FSAR did not include for the staff review information on the specific studies required for the AC power system in accordance with Section C.1.8.3.1.3 of RG 1.206. During the March 18 teleconference, MHI agreed to incorporate in attachment A the 6-studies needed to support the design and submit the appropriate documents for staff's review. Further, MHI will also state

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clearly in the DCD FSAR who will be responsible for the system studies that are listed in the Regulatory Guide 1.206, Section C.1.8.3.1.3. The staff requests MHI to docket its response for addressing the above issue as agreed during the March 18 teleconference to resolve this RAI question.