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TOKYO, JAPAN

May, 30, 2008

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jefrey A. Ciocco,

Docket No. 52-021
MHI Ref: UAP-HF-08094

Subject: MHI's Responses to US-APWR DCD RAI No.4

References: 1) "Request for Additional Information No. 4 Revision 0, SRP Section: 08-02 – Offsite Power System, Application Section: 08-02," dated April 30, 2008.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Response to Request for Additional Information No.4 Revision 0."

Enclosed are the responses to 9 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,

Y. Ogata

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

1. Responses to Request for Additional Information No.4 Revision 0

CC: L. J. Burkhart
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Docket No. 52-021
MHI Ref: UAP-HF-08094

Enclosure 1

UAP-HF-08094
Docket No. 52-021

Responses to Request for Additional Information No.4 Revision 0

May, 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

5/30/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.4 REVISION 0**
SRP SECTION:	**08.02 – Offsite Power System**
APPLICATION SECTION:	**08.02 – Offsite Power System**
DATE OF RAI ISSUE:	**4/30/2008**

QUESTION NO. : 08.02-1

In a letter dated February 8, 2008, you provided a response to question 3 on grid stability analysis that justifies the assumed 3-second time delay for loss of offsite power. The 3 second time delay for loss of offsite power is not described in Section 8.2,"Offsite Power" of your application. Revise your FSAR to include this discussion. In addition, provide the following information : 1) Provide a discussion how the energy stored in the rotational inertia of the main turbine-generator is maintained to power the medium voltage buses (including the RCPs) for 3 seconds or more. 2)Provide the minimum voltage and frequency that must be maintained by the COL applicant for the reactor coolant pumps to satisfy Chapter 15 analysis for a minimum of 3 seconds. 3) It is also stated in the letter that if a turbine trip occurs, the generator load break switch (GLBS) opens after a time delay of 15 seconds. Provide the signal that initiates opening of the GLBS in this scenario.

ANSWER:

The NRC requires that the discussion about the safety analysis condition of 3 seconds be incorporated into DCD Section 8.2. MHI will incorporate this discussion in the next revision of the DCD. The discussion will be general and include the information in Item 1 below.

Additionally, MHI also provides the following information in accordance with item 1) through 3) above.

1) When a turbine trip occurs, except for trips due to electrical system failure, offsite power system is expected to be kept stable. This is expected because the transmission network connected to nuclear plants is required high reliability and operability. In this condition, the breaker on the high voltage side of the main transformer is still closed. Therefore the onsite power is supplied and maintained by the offsite power system and performance of RCP also can be kept.
In addition, when offsite power is lost concurrent with turbine trip, onsite power system is not supplied from offsite power system. In this condition, the turbine-generator is still connected to the unit auxiliary transformers. Therefore onsite power system is supplied power from turbine-

generator. During this, turbine-generator rotates and supply power due to turbine-generator's large inertia. In this period, load on the unit auxiliary transformers is so small compared to the stored energy in the rotating mass of the turbine generator. Due to the very large inertia of the rotating mass of the turbine generator and the minimal load on the unit auxiliary transformers, the rotational speed changes very slowly. Therefore, following the turbine trip, the voltage and frequency at the generator terminals and at the unit auxiliary transformers will be kept within nominal turbulence of electrical system at least 3 seconds or more.

2) The performance of RCP will be evaluated and concluded in COLA based on grid stability analysis.
The Value of the voltage and frequency come from the specification of the motor which can operate successfully under running conditions at rated load (voltage : +/- 10%, frequency : +/- 5%)

3) In this scenario, GLBS is opened 15 seconds after a "Turbine Trip Signal".

Impact on DCD

MHI will add the description of the interface requirement for chapter 15 to Section 8.2 of the DCD.

Impact on COLA

Evaluation of grid stability analysis will be described in FSAR Section 8.2 of COLA.

Impact on PRA

There is no impact on PRA.

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QUESTION NO. : 08.02-2

In order to maintain reactor coolant pump operation for 3 seconds following a turbine trip, what should be the allowable voltage drop in the grid voltage on the high side of the main step-up transformer (MT), and reserve auxiliary transformer from the pre-trip steady-state voltage that the COL applicant must maintain in order to accomplish the 3 seconds requirement?

ANSWER:

The offsite power supply stability is expected to be maintained proper voltage and frequency, even if unit trip occurs. The adequacy of safety analysis under a very small variation of voltage will be addressed in COLA.

Impact on DCD

There is no impact on DCD.

Impact on COLA

Evaluation of grid stability analysis will be described in FSAR Section 8.2 of COLA.

Impact on PRA

There is no impact on PRA.

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QUESTION NO. : 08.02-3

Section 8.2.3 of the FSAR discusses design basis requirements for Combined License Information (COL).The staff believes that the applicant should also include the following interface requirement for the COL applicant:1) 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. 2) Revise the FSAR to include the above as an interface requirement.

ANSWER:

1) MHI will add the suggestion above to the revised DCD.
2) MHI will describe above interface requirement in FSAR.

Impact on DCD

MHI will add the description of the interface requirement for chapter 15 to Section 8.2 of the DCD.

Impact on COLA

Evaluation of grid stability analysis will be described in FSAR Section 8.2 of COLA.

Impact on PRA

There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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SRP SECTION:	**08.02 – Offsite Power System**
APPLICATION SECTION:	**08.02 – Offsite Power System**
DATE OF RAI ISSUE:	**4/30/2008**

QUESTION NO. : 08.02-4

Section 8.2.1.2 of the FSAR states that all plant medium voltage (MV) buses, both safety-related and non safety-related, are connected to UATs and RATs through bus incoming circuit breakers. If power to any MV bus is lost from the normal source, it is automatically transferred to the alternate source. In this regard, provide the following information: a) Describe the bus transfer scheme in detail (slow or fast) that will be used to transfer power from the normal source to the alternate source? b) Describe 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.

ANSWER:

Detail of the bus transfer scheme, which answer the above question, is already described in DCD Section 8.3.1.1.2.4 and Figure 8.3.1-2.
However, MHI will also add the description about the bus transfer scheme to Section 8.2.

Impact on DCD

MHI will add the description about the bus transfer to Section 8.2 of the DCD.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

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QUESTION NO. : 08.02-5

Figure 8.1-1 of the FSAR indicates that the safety-related buses and non-safety related buses are fed from the same reserve auxiliary transformer. The staff is concerned that in this configuration, the offsite power system design may not satisfy the criteria of SECY-91-078, "EPRI's Requirements Document and Additional Evolutionary LWR Certification Issues ," which requires that an 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 non-safety buses in such a manner that the offsite source can power the safety buses upon a failure of any non-safety bus. Describe how your design satisfies the criteria of SECY-91-078.

ANSWER:

The discussion point of this issue is that SECY-91-078 does not recommend the use of common transformers to feed safety-related buses and non safety-related buses.
US-APWR design is such that both the reserve auxiliary transformer (RAT) and the unit auxiliary transformer (UAT) connect to safety related and non safety-related buses.

The design is adequate because:

1) Safety-related buses are normally fed from RATs and non safety-related buses are normally fed from UATs.
2) Even if power from UATs is lost and a non safety-related MV bus fails concurrently, safety related MV buses are not affected and keep receiving stable power from RATs without any transient.
3) On the other hand, if the power of RATs is lost, safety-related MV buses are to be transferred to the power of UATs automatically.
4) Further more if the power of UATs is lost after a bus transfer, the plant is in a LOOP condition and the safety-related buses will be fed by the Class 1E EPS. Therefore, in this condition, no power comes from any offsite power.
5) Thus, capability of power feeding to safety-related buses under the normal condition is not influenced or affected from non-safety related onsite power system's failure since different

transformers normally supply power between safety-related buses and non safety-related buses respectively.

The SECY states that "*Therefore, it is the staff's position that at least one offsite circuit to each redundant safety division should be 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 failiure of any nonsafety bus.*"

US-APWR design satisfies with the concept of this SECY recommendation.

Impact on DCD

There is no impact on DCD.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

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QUESTION NO. : 08.02-6

Regulatory Guide 1.206, states that "if generator breakers/load break switches are used as a means of providing access to the offsite power system to the onsite ac distribution system by isolating the unit generator from the main step-up and unit auxiliary transformers and allowing back feeding of power through these circuits to the onsite ac distribution system." In this regard, provide information how you have followed the guidance found in SRP section 8.2 in Appendix A, "Guidelines for Generator Circuit Breakers/Load Break Switches." More specifically, describe how the design of the load break switch complies with the recommendations of Appendix A.

ANSWER:

MHI understands the SRP 8.2 Appendix A requirement. In this requirement, power feeding from UATs is not approved as immediately access. US-APWR designs that safety-related buses are fed from RATs as preferred power supply. Also design of GLBS is to be satisfied with any other detail requirements in this Appendix A.
MHI will add the statement that GLBS is designed in accordance with SRP 8.2 Appendix A to Section 8.2 of the DCD.

Impact on DCD

MHI will add the statement that the GLBS is designed in accordance with SRP 8.2 Appendix A to Section 8.2 of the DCD.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

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QUESTION NO. : 08.02-7

Section 8.2.1.2 of the FSAR indicates that UATs and RATs have been provided with protective devices for over current and differential current. The MT is provided with a differential current protection scheme. IEEE-Std-666, "IEEE Design guide for Electric Power Service Systems for Generating Systems," recommends sudden pressure and ground fault protection for transformers. Provide your justification for not including neutral over current, and sudden pressure protection for MT, RATs and UATs.

ANSWER:

MHI design has sudden pressure relays (SPRs) and ground fault protection relays (50/51N) for MT, UATs and RATs. MHI will revise the description of DCD to describe these protective design features.

Impact on DCD

MHI will revise the description of electrical protection schemes in Section 8.2 of the DCD.

Impact on COLA

The description about electrical protection scheme addressed site specific will be described in FSAR Section 8.2 of COLA.

Impact on PRA

There is no impact on PRA.

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QUESTION NO. : 08.02-8

Your discussion in Section 8.2.2.1 regarding compliance with GDC 2 is incomplete. Provide your acceptance criteria for the design of switchyard and offsite power systems to withstand the effects of natural phenomena such as high and low atmospheric temperatures, high wind, rain, lightning discharges, ice and snow conditions.

ANSWER:

MHI will describe the acceptance criteria for the switchyard and offsite power systems in the revised DCD. Switchyard and offsite power systems component are designed withstanding to the effects of natural phenomena such as atmospheric temperatures, high wind, rain, lightning discharges, ice and snow conditions.

Impact on DCD

MHI will add the acceptance criteria on revised DCD.

Impact on COLA

There is no impact on DCD.

Impact on PRA

There is no impact on PRA.

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QUESTION NO. : 08.02-9

Section 8.2.1.2 of the FSAR states that there are four three winding RATs, namely RAT1, RAT2, RAT3 and RAT4, however, Figure 8.1-1 indicates that RATs are two winding transformers. Clarify whether RATs have one secondary winding or two secondary windings.

ANSWER:

Each RAT has a total of 3 windings, one of which is a delta tertiary winding to prevent flow out of 3rd higher harmonic wave. Therefore, each RAT has one secondary winding. MHI has already described this specification in Table 8.3.1-1 on DCD.

Impact on DCD

There is no impact on DCD.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

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