16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

July 18, 2008

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

Attention: Mr. Jeffery A. Ciocco,

Docket No. 52-021
MHI Ref: UAP-HF-08127

Subject: MHI's Responses to US-APWR DCD RAI No.10

References: 1) "Request for Additional Information No. 10 Revision 4, SRP Section: 08.03.01 – AC Power Systems (Onsite), Application Section: 8.3.1," dated June 18, 2008

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.10 Revision 4."

Enclosed are the responses to 16 RAI's contained within Reference 1.

As indicated in the enclosed materials, this document contains information that MHI considers proprietary, and therefore should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) and 10 C.F.R § 9.17 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

This letter includes a copy of "Responses to Request for Additional Information No.10 Revision 4." (Enclosure 2), a copy of "Responses to Request for Additional Information No.10 Revision 4 Attachment A." (Enclosure 3) which includes proprietary information, and the Affidavit of Yoshiki Ogata (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials designated as "Proprietary" in Enclosure 2 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) and 10 C.F.R.§ 9.17 (a)(4).

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.

D081
NRO

Enclosures:

1. Affidavit of Yoshiki Ogata

2. Responses to Request for Additional Information No.10 Revision 4
- Version not containing proprietary information

3. Responses to Request for Additional Information No.10 Revision 4 Attachment A
- Version containing proprietary information

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

Contact Information
C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373-6466

Enclosure 1

Docket No. 52-021
MHI Ref: UAP-HF-08127

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

I, Yoshiki Ogata, state as follows:

1. I am General Manager, APWR Promoting Department, of Mitsubishi Heavy Industries, LTD ("MHI"), and have been delegated the function of reviewing MHI's US-APWR documentation to determine whether it contains information that should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) and 10 C.F.R.§ 9.17(a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

2. In accordance with my responsibilities, I have reviewed the enclosed document entitled "Response to Request for Additional Information No.10 Revision 4" and "Response to Request for Additional Information No.10 Revision 4 Attachment A" dated July 2008, and have determined that portions of the document contain proprietary information that should be withheld from public disclosure. "Response to Request for Additional Information No.10 Revision 4 Attachment A" is proprietary and proprietary information are identified with the label "Proprietary" on the top of the page. The first page of the document indicates that all information identified as "Proprietary" should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

3. The information identified as proprietary in the enclosed document has in the past been, and will continue to be, held in confidence by MHI and its disclosure outside the company is limited to regulatory bodies, customers and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and is always subject to suitable measures to protect it from unauthorized use or disclosure.

4. The basis for holding the referenced information confidential is that it describes the unique design of the AC Power System, developed by MHI and not used in the exact form by any of MHI's competitors. This information was developed at significant cost to MHI, since it required the performance of Research and Development, detailed design for its software and hardware extending over several years.

5. The referenced information is being furnished to the Nuclear Regulatory Commission ("NRC") in confidence and solely for the purpose of information to the NRC staff.

6. The referenced information is not available in public sources and could not be gathered readily from other publicly available information. Other than through the provisions in paragraph 3 above, MHI knows of no way the information could be lawfully acquired by organizations or individuals outside of MHI.

7. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without incurring the costs or risks associated with the design of the subject systems. Therefore, disclosure of the information contained in

the referenced document would have the following negative impacts on the competitive position of MHI in the U.S. nuclear plant market:

A. Loss of competitive advantage due to the costs associated with development of the AC Power System. Providing public access to such information permits competitors to duplicate or mimic the technology without incurring the associated costs.

B. Loss of competitive advantage of the US-APWR created by benefits of enhanced plant safety, and reduced operation and maintenance costs associated with the AC Power System.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 18th day of July, 2008.

Y. Ogata

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

Docket No. 52-021
MHI Ref: UAP-HF-08127

Enclosure 2

UAP-HF-08127
Docket No. 52-021

Responses to Request for Additional Information No.10 Revision 4

July 2008
(Non-Proprietary)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-7

1. Section 8.3.1.1.1 of the US-APWR Design Control Document (DCD) states the station service transformers (SSTs) are protected with differential relays for internal faults. An examination of the Figure 8.3.1-1, "Onsite Ac electrical distribution system (sheet 1of 7)," does not show the differential protection for station service transformers (SSTs) as stated in Section 8.3.1.1.1. The applicant is requested to address this discrepancy between the narrative in the DCD and the accompanying drawings.

ANSWER:

MHI will revise the Figure 8.3.1-1 including SST's protection relay equipment.

Impact on DCD

MHI will revise the Figure 8.3.1-1 including SST's protection relay equipment in the DCD Revision 2.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-8

1. The Drawing 8.3.1.1.1 (sheet 1 of 7) shows (also as described in Section 8.3.1.1.1) that non-safety buses N3, N4 and P1 and N5, N6 and P2 are connected to UAT3 or RAT3 and UAT4 or RAT4 respectively. As described in Section 8.3.1.1.2, safety buses A and B are supplied from UAT3 or RAT3, and safety buses C and D from UAT4 or RAT4. The normal feed for the buses N3 and N4 is from UAT3 and Buses N5 and N6 is from UAT4 respectively. The Normal feed for bus P1 is from RAT3 and bus P2 is from RAT4. Because of the normal and alternate offsite power configurations possibilities, it is plausible that RAT3 would supply the non-safety buses N3, N4, P1 and safety buses A and B. Similarly, RAT4 would supply non safety buses N5, N6, P2 and safety buses C and D at any given time. Discuss and answer the following:

    a. Since the non safety buses N3, N4, N5 and N6 supply reactor coolant pumps (RCP), discuss the impact on the safety bus voltage due to (1) starting of one large RCP pump motor (7431 KVA) and (2) with one RCP pump motor running and second RCP pump motor starting. If a voltage drop and load flow analysis were performed for this limiting condition, then provide and discuss the results and assumptions of such an analysis and the impact on the safety bus voltage regulation.

    b. Discuss the impact on the safety buses by assuming a stuck breaker in the non-safety system that fails to clear a fault in the non-safety system.

    c. Discuss and provide rationale how the proposed 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.

ANSWER:

For normal conditions, Class 1E MV buses A, B, C, D and permanent buses P1, P2 are supplied power from RATs as preferred power source. Where as the non Class 1E MV buses N1 to N6 are supplied power from UATs under normal conditions.
The function and availability of Class 1E power systems are not affected with any failure of non Class 1E power systems under normal condition.

a. MHI evaluates the availability of Class 1E system under the condition that all Class 1E and non Class 1E MV buses are supplied power from same transformer system as conservative evaluation. The detail of analysis is provided in Attachment A. Class 1E power systems are not affected, even if the large non-Class 1E load which are RCP, FWP and CWP start under highly base load condition.

b. It should be prevented that the failure of non-Class 1E loads or active electrical components of non-Class 1E power systems such as circuit breaker affects to function and availability of Class 1E power systems. Based on this, if a non-Class 1E MV load fails, a feeder breaker of failed load is opened and Class 1E power systems can be prevented to sustain any influence. Even if a feeder breaker can not be opened because it is stuck, incoming breaker of non-Class 1E MV bus is opened and Class 1E power systems can be prevented to sustain any influence.
Thus, Class 1E power systems can be maintained under any condition, even if "double" failure of non Class 1E power system components is considered.
Further more, Class 1E power systems and non-Class 1E power systems are supplied power from different transformer systems normally as mentioned above. MHI believes US-APWR satisfies with SECY requirement completely.

c. MHI has already answered to NRC in the answer for RAI No.4 (answer No.08.02-5) submitted in 5/30/2008. Please see it.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	NO.10 REVISION 4
SRP SECTION:	08.03.01 – AC Power Systems (Onsite)
APPLICATION SECTION:	8.3.1
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.03.01-9

1. The automatic fast class 1E bus transfer scheme is described in Section 8.3.1.1.2.4.A and it states that the fast bus transfer scheme is initiated by RAT protective relays. However the RAT protective relays are not described. Describe the RAT protective relays and what is the approximate time to accomplish the fast transfer from RAT to UAT.

ANSWER:

The protection scheme of MT, UAT and RAT is described in Section 8.3.1.2.
And the Figure 8.3.1-1 (sheet 1 of 7) shows the protection scheme of onsite power system.
Protective devices for each RAT are applied through the use of main differential and back-up differential relay.
However, detail of protection scheme is not described in Section 8.3.1.1.2.4.
MHI will add the description about kinds of protection relays of transformers in Section 8.3.1.1.2.4.
MHI will perform the above in the DCD Revision 2.

The RAT side incoming breaker of each MV bus is opened immediately, when protection relays of RAT are actuated. The UAT side incoming breaker is closed after completion of RAT incoming breaker opened. This fast transfer will take approximate 150 msec. including mechanical open/close time (each 3 cycle) of circuit breakers and relay circuit actuation time (approximate 50 msec. as maximum).

Impact on DCD

MHI will add the description about kinds of protection relays of transformers in Section 8.3.1.1.2.4.
MHI will perform the above in the DCD Revision 2.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-10

1. In the case where the automatic fast transfer of class 1E bus scheme is not successful, the DCD states that slow transfer is initiated by bus undervoltage relays. The DCD further states that the breaker from the UAT is closed after 1 second and loads on the affected buses are started by the LOOP load sequencer. Answer the following questions:

    a. Since RAT and UAT are both offsite power sources, a transfer of feed via the slow transfer from RAT to UAT implies that there is no LOOP. (1) Discuss why the LOOP load sequencer is used in loading the affected buses when there is no LOOP. (2) What happens to the loads that were already running before the transfer took place.

    b. Describe the slow transfer scheme with respect to voltage decay (residual voltage) of the large motor loads that were tripped and their reconnection to the restored bus. Describe any safety features (permissive) installed in the motor load breakers that will prevent the motor load being connected out-of-phase with the bus voltage?

    c. In describing the transfer scheme, it is stated that the slow transfer is initiated by the bus undervoltage signal. Describe whether it is the loss of voltage or degraded voltage signal that initiates the trip of the incoming circuit breaker from the RAT. What is the impact of the low or degraded voltage on the motor loads for the duration until the motor loads are tripped?

ANSWER:

The fast transfer is caused by any electrical component failure of RAT related system. The fast transfer is carried before undervoltage signal is initiated. On the other hand, the slow transfer is caused by loss of power. The slow transfer is carried after undervoltage signal initiated.

The following is one of typical scenario where the fast transfer is not successful.

- Though RAT incoming breaker is opened immediately by RAT protection signal initiated, UAT incoming breaker can not be closed for random failure.
- After this, undervoltage signal initiated, feeder breakers of bus are opened. After 1 second, UAT incoming breaker is closed. This condition is not "completely" LOOP. And feeder breakers are closed in accordance with LOOP load sequencer.
- If UAT incoming breaker is not successful to close again, undervoltage condition of bus is kept. Class 1E GTG breaker is closed within 100 seconds later, and loads are started in accordance with LOOP sequence.

a. If power supply from RAT is lost, the bus is in undervoltage condition and load feeder breakers and RAT incoming breaker are opened. Preparation of "slow transfer" is completed. Next, the UAT incoming breaker is closed after 1 second, even if the UAT power supply is available or not. Thus slow transfer is caused after bus has lost power once.
This design is standard practice that all loads are tripped once and restart sequentially at slow transfer scheme. It is preferable that voltage drop can be controlled and limited even if onsite power system is supplied power from transformer system. And also it is preferable from view point of easy operation.

b. As mentioned above, slow transfer is caused after bus has lost power once. All loads are tripped once, and UAT incoming breaker is closed with time delay. Further more, loads are restarted with LOOP sequence. Based on this, loads which are started by late sequence timing are not affected with an out-of-phase condition. Even loads which are started by early sequence timing are also not affected with an out-of-phase condition, because these loads ensure sufficient duration until restart.

c. The Figure 8.3.1-2 shows the logic diagram of onsite power system. Sheet 6 of 24 shows that RAT incoming breaker of train A is tripped by "bus voltage protection (UVA-3)". And Sheet 12 of 24 shows that UVA-3 voltage protection signal consists of "loss of voltage" or "degraded voltage" signal of A train MV bus.
"Loss of voltage" protection acts at 70% voltage, 0.8 seconds (typical value) later. The integrity loads can be kept because of protected quickly. "Degraded voltage" protection acts at 90% voltage, 20 seconds (typical value) later. The integrity loads can be kept because specification of minimum acceptable voltage (normal condition) of load is designed 90%.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-11

1. The automatic transfer of class 1E buses initiated by loss of offsite power from the reserve auxiliary transformer (RAT) with the class 1E gas turbine generator (GTG) operating in parallel with the offsite power source during the testing of the GTG is described in Section 8.3.1.1.2.4.B. The DCD states that power is restored either from the unit auxiliary transformer (UAT) or the GTG by slow transfer after tripping of the GTG breaker, load breakers and incoming circuit breaker from the RAT. Further it states that loads required during LOOP are started in sequence by the LOOP load sequencer.
   If power is restored from the UAT to the Class 1E bus then it is no longer a LOOP condition. Discuss your rationale for loading LOOP loads when offsite power is available to the bus from the UAT during this scenario.

ANSWER:

If a loss of power from RAT occurs under parallel running both of RAT power supply and Class 1E GTG power supply, Class 1E GTG breaker is tripped by under frequency signal of respective Class 1E MV bus because of the resulting overload. After GTG breaker is tripped, respective bus is in undervoltage condition. The RAT incoming breaker and feeder breakers are tripped.
And then the UAT or GTG breaker is re-closed later and load feeder breakers are closed in accordance with LOOP sequence. In this case, undervoltage of bus occurs at once, and circuit work is gone by slow transfer scheme continuously after this.

As mentioned above, this design is standard practice that all loads are tripped once and restart sequentially at slow transfer scheme. It is preferable that voltage drop can be controlled and limited even if onsite power system is supplied power from transformer system. And also it is preferable from view point of easy operation.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	NO.10 REVISION 4
SRP SECTION:	08.03.01 – AC Power Systems (Onsite)
APPLICATION SECTION:	8.3.1
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.03.01-12

1. The automatic transfer of class 1E buses from RAT to UAT due to loss of offsite power from RAT and LOCA occurring simultaneously is described in Section 8.3.1.1.2.4.D. The DCD states that incoming circuit breaker from UAT is closed after one second which implies a slow transfer from the RAT to UAT. One of the conditions described under this scenario is that the main transformer circuit breaker is closed or generator load break switch (GLBS) is closed in order to have power available from the UAT. Answer the following questions:

    a. Under this scenario, is it correct to assume that offsite power is lost only from the RAT but not from the switchyard? Describe the conditions and automatic transfer schemes for the scenario when offsite power is not available in the switchyard.

    b. Under this scenario, the motor loads on the affected bus are tripped and after one second the incoming breaker from the UAT is closed, and the accident loads are started by the ECCS load sequencer. Discuss whether the residual voltage of the motors that were tripped at the beginning of this sequence has decayed sufficiently so as to not cause out-of-phase closing of the motor loads to the bus. Discuss what protection features are installed in the motor load circuits to prevent these motors from loading on to the bus under out-of-phase conditions.

    c. In a letter dated February 8, 2008 from MHI to the NRC, MHI provided a response to question 3 on grid stability analysis that justifies the assumed 3-second time delay for loss of offsite power. 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. Therefore it can be assumed that with a turbine trip, the unit generator will be running in parallel with the offsite power (via the MT) feeding the UAT, i.e., the MT breaker and the GLBS are both closed. This condition is contrary to the condition described in Section 8.3.1.1.2.4.D of the DCD, therefore clarify and revise the assumed condition in this section of the DCD.

    d. In the scenario assuming when all offsite power is lost, i.e., the UAT cannot be supplied via the MT and the GLBS remains closed for at least 15 seconds to supply power to the UATs. However in this mode it cannot supply ECCS loads beyond 15 seconds for mitigating LOCA. Revise this section to clarify the transfer of class 1E buses from RAT

to UAT when offsite power is available from the MT breaker and the GLBS.

ANSWER:

a. The slow transfer from RAT to UAT for this scenario is carried out when undervoltage signal is initiated, whether or not the power supply from UAT is available or not.
If both power supply from UAT and RAT are not available due to a failure in the switchyard, power supply from UAT is not used and GTG will backup continuously.

b. At the slow transfer, loads are tripped by undervoltage signal 0.8 second (typical value) later from UV signal initiated, and UAT incoming breaker is closed 1 second later more.
And loads are restarted in accordance with ECCS sequencer. Even restarts of first load (safety injection pump) starts 5 seconds later more, restarted loads don't affect to bus such an out-of-phase restarting.

c. Basically, even if LOCA and LOOP occur concurrently, power supply from offsite transmission system can be expected available for short period such 3 seconds. Also power supply from main generator can be expected available during turbine inertia for 15 seconds.
The LOOP of transfer scheme and logic of onsite power system starts after above "3 seconds", "15 seconds".
The DCD states from view point of electrical logic scheme.

d. Class 1E GTG has completed started and restoration of Class 1E bus is within 100 seconds from initiating starting signal. The safety analysis is performed under this condition that is no power supply for 100 seconds from when the LOCA occurred.
If a LOOP occurs concurrent with LOCA, ECCS loads operate for 15 seconds until turbine trip. And these are tripped again by undervoltage signal over 15 seconds in actual. However, safety analysis doesn't expect this operation to mitigate the plant condition.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-13

1. Section 8.3.1.1.2.4.E, item 3 states that the power to one of the class 1E 6.9 kV buses A or B can be restored from the A alternate AC (A-AAC) GTG. The SBO loads required on the class 1E buses A (or B) are manually started and loads that are not required to be running on the bus P1 are tripped and blocked from starting. The SBO loads are shown in Table 8.3.1-6 as 3283 kW. The AAC-GTG loading (LOOP condition) on Bus P1 are shown in Table 8.3.1.5 as 3836 kW. Since the AAC GTG is sized at 4000 kW, it is not clear what loads are not required to be running during an SBO on the permanent bus P1. Discuss and clarify what are the required and not required loads on the P1 bus during an SBO. Also, discuss what administrative controls and procedures are planned to be put in place to minimize the probability of overloading the AAC-GTG during an SBO event.

ANSWER:

The Table-1 provided in answer for RAI No.11 (answer No.08.04-4) shows load list of P1 control center to be operated under the SBO condition. Loads of P1 control center except for loads listed in Table-1 are stopped manually under the SBO condition. These un-operated loads are stopped manually at once, and are maintained to prevent restart by using locked open control of switching devise. It's possible to prevent overload condition of AAC-GTG.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-14

1. The description in Section 8.3.1.1.2.5 on the degraded voltage protection does not address the guidance in BTP 8-6 with regard to GDC 17 as it relates to the onsite 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. However, MHI has not provided any analyses or data to support its conclusions. Therefore to support the above conclusion, provide the following:

    a. Actual minimum and maximum voltages (or a nominal voltage with ± tolerance) for each level of onsite distribution system in accordance with BTP 8-6 position B.3. At the interface of the offsite and onsite power distribution system, specify the minimum and maximum required offsite system voltage that the COLA applicant has to meet for satisfying the requirements of the onsite distribution system. This offsite voltage requirement should be made the responsibility of the COLA applicant since it is site specific.

    b. In accordance with BTP 8-6 (B4), the analytical techniques and assumptions used in the analyses must be verified by actual measurement before initial full-power reactor operation. The COL applicant should be responsible for meeting the BTP 8-6 position B4, since it is site specific. Therefore it should be identified as a COLA action item.

    c. Provide a description of the analytical techniques, methodology, and assumptions used in performing the analyses per BTP 8-6 position B.3.
    Provide the results of these analyses for each level of onsite electrical power distribution system.

ANSWER:

a. The requirement of BTP 8-6 position B3 is to be resolved and evaluated through the voltage variation analysis and short circuit analysis. The voltage variation analysis including offsite power condition is addressed as COLA item "COL 8.3(3)"

b. BTP 8-6 position B.4 is required as verification activity for the above voltage analysis. This activity is to be performed in site before initial full-power reactor operation.

c. Please see answer a above

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

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

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-15

1. The description in Section 8.3.1.1.2.6 on the testing of the onsite ac power system is incomplete. To satisfy GDC-18, address specifically how you meet the guidance of RG 1.32, RG 1.47, 1.118 and 1.153 on testing of the onsite electrical power system and equipment.

ANSWER:

MHI will add the description in Section 8.3.1.1.2.6 of DCD that testing of the onsite ac power system is determined in accordance with detail requirements of IEEE 308, IEEE 338, IEEE 603 which are endorsed in RG 1.32, RG 1.47, RG 1.118, RG 1.153.

MHI will revise the description in the DCD Revision 2 which will include detail requirements required in above regulations.

Impact on DCD

MHI will add the above description. MHI will revise the description in the DCD Revision 2.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-16

1. In Section 8.3.1.1.3.3 you provided a description of class 1E GTG starting system. You did not provide a discussion on whether the class 1E GTG can also be started from the Remote Shutdown Panel (as required by Appendix R) in case of evacuation of the main control room (MCR) due to a fire. Provide your rationale for not including the capability of starting the class 1E GTGs from the Remote Shutdown Panel.

ANSWER:

Remote Shutdown Panel is designed such that it has the same operation of safety system, primary system and secondary system as MCR. Class 1E GTG can be started by Remote Shutdown Panel.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-17

1. In describing class 1E GTG testing in Section 8.3.1.1.3.8, item 2b states that the class 1E GTG will be loaded to maximum expected loadcarrying capability for not less than 1 hour. Explain the term 'maximum expected load-carrying capability in view of the criteria given in RG 1.9 and IEEE 387 for loading it to 90–100 percent of the continuous rating until temperature equilibrium is attained. Also, discuss the power factor (PF) of the load when conducting this test. Provide your rationale if the PF of the load for this test is different than the rated PF of the machine, or the LOOP and ECCS load PF.

ANSWER:

MHI will revise the description in the DCD Revision 2 that loading condition of test should be carried condition of 90 – 100% of the Class 1E GTG rating.
The parallel running test is to be performed with PF 0.8 of GT generator which is rated PF of generator.
PF of loads is provided in DCD Table 8.3.1-4.

Impact on DCD

MHI will revise the description in the DCD Revision 2 that loading condition of test should be carried condition of 90 – 100% of the Class 1E GTG rating.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	NO.10 REVISION 4
SRP SECTION:	08.03.01 – AC Power Systems (Onsite)
APPLICATION SECTION:	8.3.1
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.03.01-18

1. In Section 8.3.1.1.9, "Design Criteria for Class 1E Equipment," you refer to Table 8.3.1-2 for acceptable bus and motor voltages. In Table 8.3.1-2, under column acceptable variations for voltage and frequency, you list voltage variation of ±10% and frequency variation ±5%. It is not clear from the listing whether these limits are applied independently or as combined voltage and frequency limits. Refer to the guidance given in NEMA MG-1-20.45.A3, "Variations from rated voltage and rated frequency" which states that a combined variation in voltage and frequency of ±10% of rated values provided the frequency does not exceed ±5% of rated frequency. Correct the riteria for voltage and frequency as listed in Table 8.3.1-2 to reflect the industry guidance given in MG-1, or provide justification for departure from industry recommended practice for voltage and frequency variations.

ANSWER:

MHI has described the Table 8.3.1-2 as requirement for electrical equipment. Acceptable frequency variation is stated like an independently from voltage variation condition. However, US-APWR requires the actual specification satisfied with NEMA MG-1 completely that frequency variation is required with voltage variation condition. And MHI has stated that NEMA is to be conformed too in DCD Section 8.1.5.3.5.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	NO.10 REVISION 4
SRP SECTION:	08.03.01 – AC Power Systems (Onsite)
APPLICATION SECTION:	8.3.1
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.03.01-19

1. Section 8.3.1.1.9, "Design Criteria for Class 1E Equipment," under "interrupting capacities," states that switchgear, load centers, MCCs and distribution panels are selected to be greater than the maximum calculated short circuit current at the point of application. It is not clear whether you have already performed the short circuit current calculations including the selection of transformer impedances. If such analyses have been conducted, then provide the result of the analyses, and assumptions used in the analysis to evaluate acceptable ratings for equipment, such as circuit breakers, switchgear short circuit ratings, the containment penetration assemblies and other electrical equipment requiring such analyses. If these analyses have not been performed, then elaborate who is going to conduct it, and if it is the responsibility of the COLA applicant then it needs to be identified as COLA Action Item.

ANSWER:

The analysis is provided in Attachment A.

MHI will carry the evaluation and analysis as design documents by using specifications of actual components. These detail data will be updated depending on design stage and include the proprietary information of not only MHI but also suppliers.

Based on these backgrounds, MHI provides to NRC this Attachment A which is summary of evaluation and analysis of Class 1E AC system for standard design as reference information for RAI response.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.10 REVISION 4**
SRP SECTION:	**08.03.01 – AC Power Systems (Onsite)**
APPLICATION SECTION:	**8.3.1**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.03.01-20

1. Section 8.3.1.1.9, "Design Criteria for Class 1E Equipment," under "electric circuit protection," refers to Subsection 8.3.1.1.2.5 for a description of electric circuit protection. Neither of these sections provide sufficient information on the analyses and studies required for the electric circuit protection to prevent damage to the equipment, maintain operational continuity, and reduce the safety hazard to the plant personnel. Elaborate on the electrical distribution system protection and coordination studies that are required for the electric circuit protection of the onsite electrical power distribution system equipment and circuits including the containment penetration assemblies. The required studies should be performed in accordance with the guidance given in pertinent industry standards, such as IEEE Std. 242-2001 and IEEE std 741-2007 to develop a selectively coordinated system or alternatives that are adequately justified. Provide the results from those studies, and acceptance criteria and assumptions used such analyses.

ANSWER:

The detail specification of protection devices is designed in accordance with actual procurement specification.
However, MHI has performed short circuit analysis provided in Attachment A.
Result of this, the 35kA rated circuit breaker (VCB) can be applied to 6.9kV MV bus. In this case, coordination between bus incoming breaker and feeder breakers can be achieved by setting of over current relay.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	NO.10 REVISION 4
SRP SECTION:	08.03.01 – AC Power Systems (Onsite)
APPLICATION SECTION:	8.3.1
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.03.01-21

1. Section 8.3.1.1.9, "Design Criteria for Class 1E Equipment," under "class 1E cables," describes cables of different voltage levels. Medium voltage (6.9 kV) cables that are installed in duct banks, or underground conduits, or direct buried, and therefore are inaccessible are known to be susceptible to degradation from moisture. Generic Letter 2007-01 addresses this issue for the current fleet of nuclear plants and for new reactors. You need to include in your discussion on medium voltage cables how US-APWR design incorporates a program to monitor and mitigate the degradation of inaccessible cables in accordance with the guidance of Generic Letter 2007- 01. Since degradation of the inaccessible medium voltage cables is an ongoing problem, it will be necessary to address this issue over the life of the plant in accordance with the guidance of Generic Letter 2007-01. It will be the responsibility of the COLA applicant after the plant is licensed therefore it needs to be identified as COLA Action Item.

ANSWER:

For indicate the incorporating a program to monitor and mitigate the degradation of inaccessible cables in accordance with the guidance of Generic Letter 2007-01, MHI will add the following description in US-APWR DCD Section 8.3.1.1.9.
"In accordance with the guidance of Generic Letter 2007-01, for prevent the degradation of medium voltage cables that are installed in underground duct banks, the manholes are at the low point with the conduits in the connecting duct banks sloped for water drain into the manholes. The manholes are available for temporary sump pumps for water draining. The medium voltage cables whether in a duct bank or in a conduit are monitored by periodical testing, such as partial discharge testing, time domain reflectometry, dissipation factor testing, and very low frequency AC testing."

Impact on DCD

Add the following description in Section 8.3.1.1.9 in the DCD Revision 2.

In accordance with the guidance of Generic Letter 2007-01, for prevent the degradation of medium voltage cables that are installed in underground duct banks, the manholes are at the low point with the conduits in the connecting duct banks sloped for water drain into the manholes. The manholes are available for temporary sump pumps for water draining. The medium voltage cables whether in a duct bank or in a conduit are monitored by periodical testing, such as partial discharge testing, time domain reflectometry, dissipation factor testing, and very low frequency AC testing.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

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

RAI NO.:	NO.10 REVISION 4
SRP SECTION:	08.03.01 – AC Power Systems (Onsite)
APPLICATION SECTION:	8.3.1
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.03.01-22

1. Regulatory Guide 1.206, Section C.I.8.3.1.3, "Electrical Power System Calculations and Distribution system studies for AC System," states that the FSAR (DCD) should include electrical power calculations and distribution system studies. The US-APWR FSAR does not include information on the specific studies required for the AC power system in accordance with Section C.I.8.3.1.3 of RG 1.206. Answer the following questions.

   a. Describe and provide assumptions and summary results of the studies listed in Section C.I.8.3.1.3 of RG 1.206 for each voltage level distribution system. If the studies listed in the Section C.I.8.3.1.3 of RG 1.206 for AC power system have not been performed, then indicate when these studies will be performed. Also, indicate when the results of these studies will be submitted to the staff.

   b. Identify the analytical software (and its version) used for performing these studies.

   c. Submit to the staff an electronic copy of the electrical distribution system model that formed the basis of the analytical studies 1 through 6 listed in Section C.I.8.3.1.3 of RG 1.206.

ANSWER:

Basically, analysis is performed as actual design of MHI.
The analysis of power systems will be updated in accordance with revising of actual components data. MHI thinks it is not adequate that the analysis is submitted in order to evaluate of DCD. However, MHI is able to show data at the audit by NRC.

MHI provides to NRC this Attachment A which is summary of evaluation and analysis of Class 1E AC system as reference information for RAI response.

a. Please see the Attachment A

b. MHI performs analysis by using the software named ETAP Ver.5.5.6N described in Attachment A.

c. MHI believes Attachment A includes information of input data, and analysis condition needed for evaluation by NRC. If NRC requires other information of analysis in order to evaluate, MHI is able to show these data at the audit by NRC.

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.