MITSUBISHI HEAVY INDUSTRIES, LTD.
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-08128

Subject: MHI's Responses to US-APWR DCD RAI No.11

References: 1) "Request for Additional Information No. 11 Revision 4, SRP Section: 08.04 – Station Blackout, Application Section: 8.4," 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.11 Revision 4."

Enclosed are the responses to 7 RAI's 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.
Enclosures:

1. Responses to Request for Additional Information No.11 Revision 4

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

D081
NRO

Docket No. 52-021
MHI Ref: UAP-HF-08128

Enclosure 1

UAP-HF-08128
Docket No. 52-021

Responses to Request for Additional Information No.11 Revision 4

July 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO.11 REVISION 4**
SRP SECTION:	**08.04 – Station Blackout**
APPLICATION SECTION:	**8.4**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.04-1

1. Section 8.4.1.2, states that the US-APWR class 1E onsite power system comprises of 4 trains each supplied from a class 1E gas turbine generator (GTG). The DCD states that availability of two trains is adequate to meet the electrical load requirement during LOOP, and LOOP and LOCA occurring simultaneously. Clarify whether it is any two of the 4 trains, or it is a defined set of any two out of 4 trains that are required for LOOP, and LOOP and LOCA occurring simultaneously.

ANSWER:

Each four train system safety-related load is connected to respective train Class 1E bus system. There are four Class 1E bus systems, and each bus system connects to Class 1E GTG. Based on this, any two out of four trains can achieve the safety function of plant.

There are some two train system safety-related loads. Each two train system safety-related load is addressed in A1 or D1 system. The A1 loads can be supplied power from both A or B Class 1E buses, and D1 loads can be powered from train C or D similarly. The US-APWR class 1E onsite power systems can achieve plant safety function, even with one system is in OLM and under one system is considered to be in single failure.
These two train system safety-related loads can be operated due to transfer of power supply, even if four train electrical component such Class 1E GTG fails.

Thus, any two out of four trains can achieve the safety function of plant with no limitation basically.

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.11 REVISION 4
SRP SECTION:	08.04 – Station Blackout
APPLICATION SECTION:	8.4
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.04-2

1. Section 8.4.1.2, states that in the US-APWR design power to the shutdown buses can be restored from the AAC sources (2- non-class GTGs) within 60 minutes. Does the 60 minutes time required for the restoration of power of the shutdown buses include powering of the SBO loads? If the 60 minutes time does not include restoration of the SBO loads, then provide information on the expected time required to load the SBO loads on the shutdown bus.

ANSWER:

MHI has designed such that restoration of Class 1E bus and restarts of safety-related loads required under SBO condition are completed within 60 minutes.

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.11 REVISION 4
SRP SECTION:	08.04 – Station Blackout
APPLICATION SECTION:	8.4
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.04-3

1. Section 8.4.1.3, states that two 100% capacity alternate AC (AAC) sources provides greater reliability for coping with an SBO event. Further you state that the AAC GTGs of different rating with diverse starting system are provided to minimize the potential for common mode failures with the Class 1E GTGs.
   Discuss and provide a response to the following questions:

   a. Based on the description in the DCD, the 2- AAC GTGs power the nonsafety buses P1 and P2 during normal and LOOP conditions. During an SBO event one of the two AAC GTGs will be used to power the SBO loads while the second AAC GTG will power its non-safety loads from its non-safety bus P1 or P2. Clarify the statement of how greater US-APWR reliability for coping is achieved when only one AAC GTG is used to cope with an SBO event.

   b. Table 8.3.1-6 "Electrical Load Distribution-AAC GTG Loading (SBO Condition)" provided in the DCD shows the Residual Heat Removal Pump is not included in the SBO loads that are powered by the AAC GTG during an SBO event, thereby keeping the plant in hot shutdown. This is contrary to the guidance provided in the SECY 94-084 which recommends the preferred method of demonstrating compliance with an SBO (10 CFR 50.63) for evolutionary designs to be a full-capacity AAC power source of a diverse design that can power a larger complement of shutdown equipment to bring the plant to cold shutdown. Justify and provide your rationale for not meeting the guidance provided on SBO in the SECY 94-084 for evolutionary designs.

   c. Based on your description of GTGs, the rating of the AAC GTGs is 4000kW compared to 4500 kW for Class 1E GTGs. The NRC staff does not consider the difference in kW rating of the Class 1E and non-Class 1E GTGs to be of great significance when classifying them as diverse GTGs because the difference in the sizes of the GTGs is small. Although the AAC GTGs have different starting system, the staff needs additional information that demonstrates that the Commission guidance as documented in SECY 94-084 on diversity of the AAC power source is addressed. Discuss and provide additional information on the differences between the AAC GTGs and Class 1E GTGs and provide justification on why these are diverse power sources and meet the intent of SECY 94- 084.

ANSWER:

a. MHI understands that regulatory position requires maintaining the plant to safe shut down condition during SBO. MHI has determined that hot shut-down is the target of safe shut down condition during SBO. The US-APWR can achieve the hot shut-down condition by using only one AAC-GTG and one train Class 1E system.
Also the other AAC-GTG can be used an additional back-up to Class 1E system. Result of this , the plant can achieve to keep the cold shut down condition. This design concept has provided in answer for RAI No.5 submitted in 6/6/2008 (answer No. 08.03.01-6).

b. Please see the answer for RAI No.5 submitted in 6/6/2008 (answer No. 08.03.01-6).

c. Please see the answer for RAI No.5 submitted in 6/6/2008 (answer No. 08.03.01-6).

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.11 REVISION 4**
SRP SECTION:	**08.04 – Station Blackout**
APPLICATION SECTION:	**8.4**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.04-4

1. Section 8.4.1.3, item 6 on page 8.4-4 states that loads that have been started and running due to LOOP on the non-Class 1E bus P1 but are not required during an SBO condition are tripped manually before restoring the power supply to the Class 1E buses from the A-AAC GTG. Describe the loads and their KVA rating on the P1 bus that are not tripped when restoring the power to the Class 1E buses from the A-AAC GTG. Discuss the capability of the A-AAC GTG to block start the loads that remain connected to the Class 1E bus (feeders to the 480 volt centers, battery charging and emergency lighting) plus the loads that are not tripped on the P1 bus. Discuss the capacity (kW) of the GTG to power its loads in view of the SBO loads of 3283 kW (Table 8.3.1-6) plus the loads on the P1 bus that are not tripped.

ANSWER:

In the SBO condition, the A(B)-AAC GTG backup the Class 1E MV bus A or B (C or D), therefore unnecessary loads of P1 (P2) power system are stopped and blocked.
The loads which need to operate AAC-GTG, P power system are required to operate as minimum. All of these loads remained and operated on P1 (P2) system under the SBO condition are supplied from motor control center P11 and P12 (P21 and P22). Please see the Table 1.These are evaluated as total 200kW, and listed in load summing up list of Table 8.3.1-6 in DCD.

Table 1: P11 & P12 (P21 & P22) motor control center loads operated under the SBO condition

Load	Capacity	Function
A part of I&C loads (via the N UPS units)	50kVA	Instrument and control of P power system components
T/B ventilation system	46kW	Ventilation of Electrical Room installed P power system components
A part of DC loads (via the battery chargers)	50kVA	Starting of AAC-GTG system
AAC-GTG supporting component	50kW	Starting and operating of AAC-GTG system

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.11 REVISION 4**
SRP SECTION:	**08.04 – Station Blackout**
APPLICATION SECTION:	**8.4**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.04-5

5. The RG 1.155 Position C3.4 addresses procedures and training to cope with station blackout. Section 8.4 of DCD does not describe how Position C3.4 of RG 1.155 is met. Add a requirement for a COL applicant that references the US-APWR design certification to address the RG1.155 position C.3.4 related to procedures and training to cope with an SBO. Provide an interface requirement in US-APWR DCD that a COL applicant should develop and submit a summary of SBO coping procedures and training guidelines for staff review.

ANSWER:

The high level procedure of SBO operation has been described on Section 8.4.1.3 and 8.4.1.4 in DCD. The COL applicant will submit the detail procedure and training program.
These have been addressed as COL item in Chapter 13, 13.4(1); Training program, 13.4(2); Procedure.

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.11 REVISION 4**
SRP SECTION:	**08.04 – Station Blackout**
APPLICATION SECTION:	**8.4**
DATE OF RAI ISSUE:	**6/18/2008**

QUESTION NO. : 08.04-6

5. The RG 1.155 Position C3.5 addresses quality assurance and specifications for SBO equipment that is not safety-related. Section 8.4 does not address Position C3.5 of RG 1.155 in discussion on SBO. Provide an interface requirement in the US-APWR DCD for a COL applicant that references the US-APWR design certification to address the RG1.155 position C.3.5 related to quality assurance and specifications for SBO equipment that is not safety-related.

ANSWER:

The AAC-GTG system is important system from view point of plant safety, although non safety-related system. MHI designs the AAC-GTG system to comply with this position C3.5 of R.G 1.155. The quality assurance of AAC-GTG will be controlled in accordance with DCD Chapter 17 and related topical report PQD-HD-19005 Revision 1.

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.11 REVISION 4
SRP SECTION:	08.04 – Station Blackout
APPLICATION SECTION:	8.4
DATE OF RAI ISSUE:	6/18/2008

QUESTION NO. : 08.04-7

5. Since the power from the AAC GTG to Class 1E buses is not restored until 60 minutes into an SBO, you have discussed the station blackout coping analysis for 1 hour in Section 8.4.2.1.2. This discussion does not provide sufficient information on the systems and equipment required for coping for 1 hour without ac power. Answer the following questions:

   a. Items 2(1) and 2(2) on page 8.4-7, you discussed the core and reactor system conditions but did not provide information on ability to maintain adequate reactor coolant system (RCS) inventory to ensure that the core is covered and cooled. Discuss and provide information on RCS inventory taking into consideration shrinkage, leakage from pump seals, and inventory loss from letdown or other normally open lines.

   b. Discuss and provide information on the capacity of the condensate storage tank to ensure that there will be sufficient water inventory to remove decay heat during the SBO duration of 1 hour.

   c. Discuss and provide information on the compressed air capacity to ensure that air operated valves required for decay heat removal have sufficient reserve air and maintain appropriate containment integrity for an SBO duration of 1 hour.

   d. Discuss and provide information on the adequacy of battery capacity to support loads required for decay heat removal for the SBO duration of 1 hour, and GTG field flashing for recovering onsite power sources.

   e. Item 2(3) on page 8.4-8, discusses the integrity of electrical cabinets. However you did not discuss and provide information on effects of the loss of ventilation to other equipment, such as Turbine driven emergency feed water pump, valves, battery room and other equipment credited in mitigating an SBO event. Discuss and provide the information on the effects of loss of ventilation in all dominant areas of concern and on the equipment credited during an SBO event.

ANSWER:

a. The RCS is not in shrinkage condition, because plant is operated with keeping the RCS temperature during SBO. The seal return line is closed, and leakage of pump will not occur. Also letdown line and any other lines are closed, any inventory loss is not occurs during SBO condition.

b. The emergency feed water pit supplies water to cool the RCS during SBO. The capacity of emergency feed water pit is designed to maintain 8 hours of hot standby condition keeping and 6 hours cool down as normal safe shut down function.
Thus the pit has sufficient capacity for coping SBO over 8 hours.

c. US-APWR applies the motor operated valves for safety-related valves. The non safety-related air valves are not operated during SBO condition.

d. Class 1E battery supplies power to respective DC system for one hour after SBO occurs. After Class 1E system is restored by AAC-GTG, Class 1E battery charger supplies power to DC system. During this one hour, Class 1E battery supplies power to DC loads described in DCD Section 8.3.2. Class 1E battery has sufficient capacity, because the rating of battery is designed to supply to these loads during two hours.

e. Other equipment except for electrical equipment credited in mitigating an SBO event during loss of ventilation is located in following areas. Each equipment can keep the integrity within one hour from SBO occurrence without ventilation. The summary is shown in Table 2.

Table 2

Area	Equipment	Integrity
Emergency Feedwater Pump (T/D) Area	Pump, Transmitter	The pump and transmitter are rated to keep their integrity up to approx. 175°F (80°C) temperature. The temperature of this area will not reach 175°F (80°C) during loss of ventilation.
Corridor	Transmitter	Transmitter is rated to keep their integrity up to 175°F (80°C) temperature. Ambient temperature of corridor does not rise than Emergency Feedwater pump (T/D) area.
Containment Vessel	Transmitter	The transmitters are qualified to keep their integrity in postulated accident condition. Therefore their integrity is kept in SBO condition.
Main Steam/Feedwater Piping Area	Valve, Transmitter	The valves and transmitters are qualified to keep their integrity in postulated accident condition. Therefore their integrity is kept in SBO condition.
Battery Room	Battery	Heat generation from the battery in discharge mode does not rise the temperature significantly in the battery room.

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.