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June 9, 2009

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

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-09295

Subject: MHI's Response to US-APWR DCD RAI No.321

References: 1) "Request for Additional Information No. 321 Revision 1, SRP Section: 09.05.08 - Emergency Diesel Engine Combustion Air Intake and Exhaust System, Application Section: Tier 2 Section 9.5.8," dated April, 6, 2009

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No.321 Revision 1."

Enclosed are the responses to 17 RAIs contained within Reference 1

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

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

Enclosure:

1. Response to Request for Additional Information No.321 Revision 1

CC: J. A. Ciocco
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Docket No. 52-021
MHI Ref: UAP-HF-09295

Enclosure 1

UAP-HF-09295
Docket No. 52-021

Responses to Request for Additional Information No.321 Revision 1

June 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 321-2271 REVISION 1**
SRP SECTION:	**9.5.8 – Emergency Diesel Engine Combustion Air Intake and Exhaust System**
APPLICATION SECTION:	**9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-1

The FSAR description does not address the seismic classification of the ventilation/cooling portion of this system. Presumably the ventilation/cooling function is essential to the continued operation of the GTGs and therefore must meet GDC 2. Therefore, the applicant should specifically describe the design bases of the ventilation/cooling portion of the system in the FSAR.

ANSWER:

As described in DCD Section 9.5.8.3.B, the combustion/exhaust ducts are designed to Seismic Category I. The ventilation/cooling portion of the system is also designed to Seismic Category I. The ventilation/cooling function is required for the continued operation of the GTGs and will be designed to meet GDC 2. DCD Section 9.5.8 will be revised to describe the design bases of the ventilation/cooling portion of the system.

Impact on DCD

The DCD (Section 9.5.8 and Table 9.5.8-1) will be revised to describe the design bases of the ventilation / cooling portion of the system.

DCD Section 9.5.8 and 9.5.8.1 will be revised as follows:

9.5.8 GTG Combustion Air Intake, Turbine Exhaust, Room Air Supply, and Air Exhaust Systems

A GTG combustion air intake and **turbine** exhaust system for each of the four GTGs supply combustion air of reliable quality to the gas turbine and exhausts combustion products from the gas turbine to the atmosphere. The **room** air ~~intake~~ **supply and air exhaust** ~~also~~ provides ventilation/cooling air to the GTG assembly. Each GTG consists of two gas turbines that drive one generator through one gearbox.

9.5.8.1 Design Bases

Protection of the GTG combustion air intake**, turbine exhaust, room air supply** and **air** exhaust system**s** from wind and tornado effects is discussed in Section 3.3. Flood design is discussed in Section 3.4. Missile protection is discussed in Section 3.5. Protection against dynamic effects associated with postulated rupture of piping is discussed in Section 3.6. Environmental qualification is discussed in Section 3.11.

- The combustion air intake and **turbine** exhaust system is capable of supplying adequate combustion air and disposing of resultant exhaust products to permit continuous operation of the GTGs for each unit at 110% of nameplate rating.
- The combustion air intake and **turbine** exhaust system is designed to remain functional during and after a SSE
- The combustion air intake and **turbine** exhaust system is designed so that a single failure of any component, assuming a LOOP, cannot result in complete loss of the power source.
- The GTG combustion air intake and **turbine** exhaust system is capable of being tested during plant operation in accordance with 10 CFR 50, Appendix A, GDC 18 (Ref. 9.5.2-4).
- **The ventilation/cooling portion of the system is designed to remain functional during and after a SSE.**
- **The ventilation/cooling portion of the system is designed so that a single failure of any component, assuming a LOOP, cannot result in complete loss of the power source.**
- **The ventilation/cooling portion of the system is capable of being tested during plant operation in accordance with 10 CFR 50, Appendix A, GDC 18 (Ref. 9.5.2-4).**

Codes and standards applicable to the systems are listed in Section 3.2 and Table 9.5.8-1.
The equipment class, seismic category, and principal design codes for the various components are shown.

DCD Section 9.5.8.3.B will be revised as follows:

B. The combustion air intake**, turbine exhaust, room air supply** and **air** exhaust system**s** ~~is~~ **are** designed to seismic category I requirements as specified in Section 3.2. Systems, equipment, and components which are not seismic category I and whose failure might impair the functioning of the combustion air intake and exhaust system are designed so that failure cannot impair the functioning of safety-related equipment.

DCD Table 9.5.8-1 will be revised as shown in Attachment A.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	NO. SBPB 321-2271 REVISION 1
SRP SECTION:	9.5.8 – Emergency Diesel Engine Combustion Air Intake and Exhaust System
APPLICATION SECTION:	9.5.8
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.08-2

FSAR Tier 2 Section 9.5.8.3.A states that the turbine intake and exhaust openings above the roof of the PS/Bs, and the portion of the piping/ducts above the roof is protected by a guard structure against precipitation and tornado missiles. FSAR Tier 2 Figure 9.5.8-1 shows a roof-top enclosure for one of the intakes, but not for the other air intake or for the GTG or cooling/ventilation air exhausts. In addition, the system description does not provide any specific information about the guard structures. Therefore the applicant should provide details of the guard structure for the GTG exhaust, GTG combustion air intake and ventilation/cooling air intake and exhaust and revise the FSAR to include these design details. In addition, the applicant should verify that the roof-top portions of the GTGCAIES are all designed in accordance with GDC 2.

ANSWER:

The GTG combustion air intake and exhaust gas openings and the cooling/ventilation intake and exhaust openings on the roof of the PS/Bs and the portion of the piping/ducts above the roof are all protected by guard structures. DCD Tier 2 Figure 9.5.8-1 is a schematic diagram.

The reinforced concrete guard structures are integrally attached to the roofs and act as extensions of the seismic category I PS/Bs. The guard structures are therefore designed as seismic category I to withstand the effects of natural phenomena in accordance with GDC 2 and to withstand environmental effects in accordance with GDC 4. This includes but is not limited to design and configuration of the guard structures to protect against tornado missiles and precipitation. The guard structures are designed to prevent tornado missiles from impacting safety-related equipment housed within the PS/Bs. The guard structures also protect the GTG and cooling/ventilation intake and exhaust paths from missile damage and precipitation that could impede or otherwise jeopardize GTG and cooling/ventilation safety functions. Wind and tornado loadings that are applicable to the guard structures are discussed further in Section 3.3 of the DCD. The tornado missile design requirements to which the guard structures have been designed are discussed further in Section 3.5 of the DCD. The structural design bases applicable to the seismic category I guard structures are described in Section 3.8.4 of the DCD.

DCD section 9.5.8.3.A will be updated to include additional description of the guard structures. DCD Tier 2 Figure 9.5.8-1 title will be updated in DCD Revision 2 to indicate that the drawing is a schematic representation and not a physical drawing that depicts the gas turbine generator air intake and exhaust gas components.

Impact on DCD

- Add the following description of guard structures as second sentence in the fifth paragraph to DCD section 9.5.8.3.A.:

  "The reinforced concrete guard structures are integrally attached to the roofs and act as extensions of the seismic category I PS/Bs. The guard structures are designed as seismic category I to withstand the effects of natural phenomena in accordance with GDC 2 and to withstand environmental effects in accordance with GDC 4."

- DCD Tier 2 Figure 9.5.8-1 title will be revised as follows to indicate that the drawing is a schematic representation:

  "Figure 9.5.8-1 Gas Turbine Generator Air Intake and Exhaust Component Schematic Diagram"

- DCD Tier 2 Figures 9.5.8-1 will be revised to show the guard structure openings for the GTG intake and exhaust openings and room cooling / ventilation air intake and exhaust schematically as shown in Attachment B.

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	NO. SBPB 321-2271 REVISION 1
SRP SECTION:	9.5.8 – Emergency Diesel Engine Combustion Air Intake and Exhaust System
APPLICATION SECTION:	9.5.8
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.08-3

The staff requires information regarding potential damage to the GTGCAIES from naturally occurring or plant accident generated missiles for portions of the system that are not contained within a reinforced concrete, seismic Category I, missile-protected, flood-protected structure. The applicant should identify portions of the system that are not contained within this type of structure and describe how they will be protected to meet GDC 4 and revise the FSAR to include these design details.

ANSWER:

See response to RAI 321-2271 Question No. 09.05.08-2.

Impact on DCD

There is no impact on the DCD

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 321-2271 REVISION 1**
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APPLICATION SECTION:	**9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-4

FSAR Tier 2 Section 9.5.8 provides no design information for the ventilation fans or the associated ductwork. The equipment classification of the fans and ductwork and the design standards should be stated. This information should also be included in FSAR Tier 2 Table 3.2-2, Item 27. In addition the description should state whether the ventilation fans are required to operate during an accident. The applicant should provide additional details in describing the ventilation fans and revise the FSAR to include these design details.

ANSWER:

As described in DCD Section 9.5.8.3.B, the combustion air intake and turbine exhaust ducts are designed to Seismic Category I. The ventilation/cooling portion of the system is also designed to Seismic Category I. The ventilation/cooling function is required for the continued operation of the GTGs and will be designed to meet GDC 2. DCD Table 3.2-2 will be revised to include the classification of the ventilation / cooling equipment.

Impact on DCD

The revised DCD Table 3.2-2 will be incorporated in the tracking report.

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 321-2271 REVISION 1**
SRP SECTION:	**9.5.8 – Emergency Diesel Engine Combustion Air Intake and Exhaust System**
APPLICATION SECTION:	**9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-5

FSAR Tier 2 Section 9.5.8.3.D states that a variable damper in the air exhaust duct controls air pressure in the room. The design description does not provide any explanation of how this damper ensures that adequate cooling is maintained to ensure continued operation of the GTGs throughout the full range of ambient conditions; does not address the potential for failure of this controller and the possible affect on operation of the GTGs; and does not specify the design requirements for the controller. In addition, SRP Section 9.5.8 Section III.4 instructs the reviewer to verify that if intake air flow or engine exhaust depends upon the actuation of flow control devices, the GTGCAIES will function if there is a failure of an active component. This criteria would also apply to the cooling air function if it is required for continued operation of the GTGs. The applicant should provide design details of the variable damper in the air exhaust and revise the FSAR to include these design details.

ANSWER:

The variable damper located in the air exhaust duct of the Gas Turbine Generator (GTG) is not intended to provide a control function of the cooling air supply required for GTGCAIES operation. The operation of the GTGs under adequate temperature conditions is ensured by the cooling air supplied by the ventilation fan. The variable damper is intended to relieve any pressure build-up in the room containing the GTGs. The position of variable damper will be aligned and set at the installation. Therefore the failure of the damper is not need to consider.

Impact on DCD

The last sentence of Subsection 9.5.8.3.D will be revised to clarify function of variable damper as following:

A variable damper is **installed** in the air exhaust duct **and their position will be aligned and set at the installation to relieve** ~~controls~~ air pressure in the room.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

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Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 321-2271 REVISION 1**
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APPLICATION SECTION:	**9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-6

FSAR Tier 2 Section 9.5.8.5 states that at 100% load, the GT intake manifold air pressure is approximately 50 in. Hg + 5 in. Hg. It's assumed that this should be ± 5 in. Hg. Table 9.5.8-1 indicates that the inlet filter pressure drop is 3 in. WG which is approximately 0.2 in. Hg. Consequently, the proposed air pressure gage would not be able to detect an increase in filter differential pressure due to dirt build-up. The applicant should explain how the operability of the inlet air filter will be monitored and maintained and should revise the FSAR to include these design and programmatic details.

ANSWER:

The intake filters are not needed to install in the combustion air intake system, because GTG does not have sliding surface such as diesel. Therefore the descriptions related to the intake filters will be deleted.

Impact on DCD

The item (1) of DCD Section 9.5.8.2.1 will be revised as following:

(1) A combustion air intake and exhaust system consisting of ~~air filter,~~ silencer~~,~~ and associated piping and flexible connections.

DCD Section 9.5.8.2.2.1 and 9.5.8.2.2.2 will be revised as follows:

9.5.8.2.2.1 ~~Room Intake Air Filter~~ Deleted

~~Each GTG room contains a combustion air intake filter. Mist eliminator pads are installed within the filter to remove any oil mist from the filtered air.~~

9.5.8.2.2.2 ~~GTG Package Intake Air Filter~~ Deleted

~~A combustion air intake filter is installed in each GTG enclosure.~~

The first sentence and second sentence of DCD Section 9.5.8.2.3 will be revised as follows:

Upon initiation of a GTG start signal, combustion air is drawn into the intake piping to the GT intake ~~manifolds~~ **duct**. The combustion air intake ~~filter,~~ silencer~~,~~ and the combustion air piping are sized to supply an adequate supply of air to the GT while operating at 110% of nameplate rating.

The first sentence of DCD Section 9.5.8.3.A will be revised as following:

The GTG combustion air intake and exhaust system is capable of supplying an adequate quantity of ~~filtered~~ combustion air to the GT and of disposing the exhaust gases without creating an excessive backpressure on the GT when operating at 110% of nameplate rating.

The third paragraph of DCD Section 9.5.8.4 will be revised to delete as following:

~~A visual inspection of the intake air filters is performed during surveillance testing.~~

The third paragraph of DCD Section 9.5.8.5 will be revised to delete as following:

~~GT intake manifold air pressure is measured by a pressure gauge located at the GTG control cabinet. At 100% rated load, the GT intake manifold air pressure is approximately 50 in.Hg + 5 in.Hg. The combustion air intake and exhaust system has no interlocks or alarm instrumentation.~~

The Table 9.5.8-1 will be revised as shown in Attachment A.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 321-2271 REVISION 1**
SRP SECTION:	**9.5.8 – Emergency Diesel Engine Combustion Air Intake and Exhaust System**
APPLICATION SECTION:	**9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-7

According to FSAR Tier 2 Section 9.5.8.3.A, the turbine exhaust is located "appropriately away" from the engine air intake to ensure that exhaust is not drawn into the inlet. SRP Section 9.5.8 states that the turbine exhaust should also be situated so that it does not circulate back to any potentially occupied part of the plant. The FSAR states that the nearest gas storage facility to the power source building is the carbon dioxide storage tank which is located 260 ft. from the GTGs. Hydrogen and nitrogen bulk storage facilities are 600 feet from the GTGs. This distance to the carbon dioxide storage is stated to be adequate to ensure that an accidental release of carbon dioxide does not degrade GTG performance. The bases for these statements are not discussed in FSAR Tier 2 section 9.5.8 and the potential for recirculation to inhabited areas of the plant is not addressed. The applicant should provide the bases for their conclusions and demonstrate that GTG exhaust gases will not impact plant personnel and should revise the FSAR to address this issue.

ANSWER:

The US-APWR design locates the gas turbine combustion air intake as far away from the turbine exhaust as possible within the confine of the PS/B roof. The combustion air intake is located on the roof, while the turbine exhaust is located at the opposite end of the roof to provide the maximum separation. The design also considers that the hot flue gas exits at high temperature (exceeding 1000°F) and is driven by the gas turbine to exit the exhaust stack at high velocity. The combination of the high turbine exhaust upward gas velocity and the buoyancy from the temperature ensure the exhaust is not being drawn back to circulate into the intake, thus protecting potentially occupied parts of the plant.

GTG exhaust and control room

The US-APWR design also took into consideration the potential recirculation of gas turbine exhaust for the control room. The appropriate distance is maintained between GTG exhaust and control room HVAC air inlet. This issue will be responded in RAI No.327 Question No. 09.04.01-9.

The carbon dioxide storage is adequate to ensure that an accidental release of carbon dioxide does not degrade GTG performance. During laying out the plant, US-APWR carbon dioxide gas storage is located away from the GTG.

Impact on DCD

There is no impact on the DCD

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 321-2271 REVISION 1

SRP SECTION: 09.05.08 – Emergency Diesel Engine Combustion Air Intake and Exhaust System

APPLICATION SECTION: 9.5.8

DATE OF RAI ISSUE: 4/6/2009

QUESTION NO.: 09.05.08-8

In accordance with SRP Section 9.5.8.II.4.C, the combustion air intake system should have a means of reducing airborne particulate material over the entire time period requiring emergency power. FSAR Tier 2 Section 9.5.8 does not include any design criteria for the air intake filters with respect to their ability to support full load operation of the GTGs for a period of 7 days following an accident and loss of offsite power, without filter replacement. The applicant should provide design criteria that ensures that the intake filters will continue to pass sufficient intake air to support full-load operation and should revise the FSAR to include these design details.

ANSWER:

Please see response to Question No.09.05.08-6.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 321-2271 REVISION 1

SRP SECTION: 09.05.08 – Emergency Diesel Engine Combustion Air Intake and Exhaust System

APPLICATION SECTION: 9.5.8

DATE OF RAI ISSUE: 4/6/2009

QUESTION NO.: 09.05.08-9

FSAR Tier 2 Table 9.5.8-1 indicates a design pressure of atmospheric for the air intake filter. Since there is a pressure drop across this filter, the filter housing downstream of the filter will be operating at a negative pressure. In addition, the intake ductwork and silencer will also operate at a negative pressure. The negative design pressure should be indicated in this table. In addition, the pressure drop through the filter at rated load is indicated as a single number. The filter will likely have a new and clean pressure drop and a maximum, dirty pressure drop. The design criteria should reflect this change in pressure drop during operation. The applicant should provide these additional design parameters in Table 9.5.8-1.

ANSWER:

Please see response to Question No.09.05.08-6.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 321-2271 REVISION 1

SRP SECTION: 09.05.08 – Emergency Diesel Engine Combustion Air Intake and Exhaust System

APPLICATION SECTION: 9.5.8

DATE OF RAI ISSUE: 4/6/2009

QUESTION NO.: 09.05.08-10

The FSAR Tier 2 Section 9.5.8 does not provide all of the important operational design criteria for this system. Examples of data that should be added are as follows:

- GTG room design temperatures that must be maintained by this system, both maximum and minimum.
- Design heat removal rates for the operating equipment (the "Qualification and Test Plan of Class 1E Gas Turbine Generator System" provides some heat radiation data in Section B.5.3, but there will be other equipment and piping in the GTG rooms that will radiate heat)
- Total allowable pressure drop in both the intake duct and the exhaust pipe – FSAR Tier 2 Table 9.5.8-1 provides some pressure loss design data for individual components, but the "Qualification and Test Plan of Class 1E Gas Turbine Generator System" sets limits on the overall total pressure drop for both the intake and exhaust.

The applicant should include in the FSAR the system operation design criteria for the GTGCAIES that are critical to the continued operation of the GTGs at rated performance.

ANSWER:

- DCD Tier 2 Table 9.4-1 "Area Design Temperature and Relative Humidity" provides the minimum temperature for the gas turbine area as 50°F and the maximum temperature as 105°F at normal operating conditions. The maximum design temperature as 122°F at GTG operating condition will be added in Subsection 9.5.8.2.

- Main expected heat removal rate of the Gas Turbine Generator package other than Section B.5.3 of the "Qualification and Test Plan of Class 1E Gas Turbine Generator System" is as follows:
  Generator: approx. 160kW
  Exhaust silencer: 20kW
  Exhaust duct: 17kW

- The limits on the overall pressure drop for both the air intake and exhaust system will be included in the DCD Tier 2, Table 9.5.8-1.

In addition, text referring to the technical report "Qualification and Test Plan of Class 1E Gas Turbine Generator System" will be added in DCD Tier 2 Section 9.5.5. Reference to this technical report already exists in the DCD as Reference 9.5.4-1.

Impact on DCD

Item (2) of Subsection 9.5.8.2.1 will be revised to add as following:
The system maintains GTG room temperature of 122 °F or less.

See Attachment A for the mark-up of DCD Tier 2, Table 9.5.8-1 to be incorporated. Information about the intake air pressure loss and exhaust air pressure loss has been added.

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 321-2271 REVISION 1

SRP SECTION: 09.05.08 – Emergency Diesel Engine Combustion Air Intake and Exhaust System

APPLICATION SECTION: 9.5.8

DATE OF RAI ISSUE: 4/6/2009

QUESTION NO.: 09.05.08-11

FSAR Tier 2 Table 9.5.8-1 lists the design flow of the exhaust silencer at a temperature of 1,103°F, while the design temperature of the exhaust silencer is indicated as 900°F. The applicant should address this apparent inconsistency and revise the FSAR accordingly.

ANSWER:

The design temperature of the exhaust silencer is 1103°F.

Impact on DCD

DCD Table 9.5.8-1 will be revised as shown in Attachment A to indicate the correct design temperature of the exhaust silencer.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 321-2271 REVISION 1

SRP SECTION: 09.05.08 – Emergency Diesel Engine Combustion Air Intake and Exhaust System

APPLICATION SECTION: 9.5.8

DATE OF RAI ISSUE: 4/6/2009

QUESTION NO.: 09.05.08-12

FSAR Tier 2 Table 9.5.8-1 identifies design standards for the system piping. However, this data is unclear. For example one item is identified as "Intake piping (except ASME Section III, flexible connectors)" with the design standard identified as "Class 3". The reference to Class 3 presumably is ASME Section III, Class 3 – this should be clarified. But this also implies that the ASME Section III flexible connectors are some class other than Class 3. The design requirements for the flexible connectors should be stated. The entry for the exhaust piping is confusing in that this item identifies the design standard as "Flexible connectors (intake Manufacturer's standard and exhaust) design". The applicant should review this table and correct the design descriptions.

ANSWER:

The system piping of air intake, turbine exhaust, air supply and air exhaust is designed to manufacturer's standard. Table 9.5.8-1 will be revised.

Impact on DCD

Revised Table 9.5.8-1 is shown in Attachment A to show the changes described above.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.: NO. 321-2271 REVISION 1

SRP SECTION: 09.05.08 – Emergency Diesel Engine Combustion Air Intake and Exhaust System

APPLICATION SECTION: 9.5.8

DATE OF RAI ISSUE: 4/6/2009

QUESTION NO.: 09.05.08-13

The combustion air intake takes suction from the outside air at the roof of the PS/B. Under certain low temperature, high humidity conditions, the acceleration of the intake air into the piping system could cause a reduction in temperature and cause ice to form. If sufficient ice buildup occurs on the inner surfaces of the duct it may impede sufficient air flow to the GTGs. In the event of a snow storm, the filters could potentially attract enough snow to reduce air flow. These situations represent a possible common mode failure for all of the Class 1E GTGs. The FSAR does not provide information concerning mitigation of ice formation or snow accumulation and maintaining adequate air flow to the gas turbines. In addition to weather conditions, the plume from a cooling tower is also a potential source of high humidity air. This moisture could also cause failure of the inlet air filters. The applicant should address the criteria for siting evaporative type ultimate heat sink cooling towers with respect to the GTG combustion air intake. The applicant should address this potential reliability issue.

ANSWER:

The air intakes and exhaust openings are sufficiently large as to prevent the impedance of air flow even under low freezing temperature, high humidity conditions. In the event of a snow storm, the openings will be protected from snow and ice by the guard structure. As described in DCD Section 9.5.8.3, the combustion air intakes, located above the roof of the Power Source Building, are protected from precipitation by this guard structure. The intake filters are not provided as answered in Question No. 09.05.08-6.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 321-2271 REVISION 0**
SRP SECTION:	**09.05.08–Emergency Diesel Engine Combustion Air Intake and Exhaust System**
APPLICATION SECTION:	**Tier 2 Section 9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-14

In FSAR Tier 2 Section 9.5.8.4, the applicant states that a visual inspection of the intake air filters is performed during surveillance testing. However, such surveillance testing requirements are not included in Chapter 14 or Chapter 16 of the FSAR Tier 2. The applicant should provide information regarding required periodic inspection of the GTGCAIES needed to confirm design acceptability and to document these requirements in the FSAR.

ANSWER:

Please see response to Question No.09.05.08-6.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 321-2271 REVISION 0**
SRP SECTION:	**09.05.08–Emergency Diesel Engine Combustion Air Intake and Exhaust System**
APPLICATION SECTION:	**Tier 2 Section 9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-15

NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability" recommends that emergency power supply equipment floors be painted with concrete or masonry type paint in all rooms to prevent concrete abrasive dust becoming airborne. The airborne dust had previously caused malfunctions of electrical contacts in existing nuclear power plants. The applicant should include in the FSAR design description appropriate protective measures to prevent concrete dust from becoming airborne in these areas.

ANSWER:

The emergency power supply equipment floors will be painted with concrete or masonry type paint in all rooms to prevent concrete abrasive dust from becoming airborne and causing malfunction of electrical contacts as indicated in NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability". The DCD will be modified to include this information.

Impact on DCD

The following sentence will be added to DCD Tier 2, Section 9.5.8.1 as a fifth bullet item:

"The emergency power supply equipment floors are painted with concrete or masonry type paint in all rooms to prevent concrete abrasive dust from becoming airborne and causing malfunctions of electric contacts."

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 321-2271 REVISION 0**
SRP SECTION:	**09.05.08–Emergency Diesel Engine Combustion Air Intake and Exhaust System**
APPLICATION SECTION:	**Tier 2 Section 9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-16

FSAR Tier 1, Section 2.6.4, "Emergency Power Sources," does not contain a design description of the GTGCAIES. The guidelines of Standard Review Plan, Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria," state that Tier 1 provides a design description, describing the most safety significant aspects of the system and be derived from the detailed design information contained in Tier 2. The applicant needs to provide a design description in Tier 1 for the GTGCAIES that describes the most safety significant aspects of the system.

ANSWER:

DCD Tier 1, Section 2.6.4, "Emergency Power Sources" will be revised to add the design description of the most safety significant aspects of the GTGCAIES.

Impact on DCD

Add the following in DCD Tier 1, Subsection 2.6.4.2:

"The Class 1E GTG combustion air intake and exhaust system is capable of supplying an adequate quantity of combustion air to the GT and of disposing of the exhaust gases without creating an excessive backpressure on the GT when operating at 110% of nameplate rating. The turbine intake and exhaust openings are above the roof of the power source buildings (PS/Bs), and the portion of the piping/ducts above the roof is protected by a guard structure against precipitation and tornado missiles."

Add the following ITAAC item to DCD Tier 1 Table 2.6.4-1:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
32. Each division of the Class 1E GTG combustion air intake and exhaust system is capable of supplying an adequate quantity of combustion air to the GT and of disposing of the exhaust gases without creating an excessive backpressure on the GT when operating at 110% of nameplate rating.	32. A test of each division of the as-built Class 1E GTG combustion air intake and exhaust system will be performed.	32. Each division of the as-built Class 1E GTG combustion air intake and exhaust system is capable of supplying an adequate quantity of combustion air to the GT and of disposing of the exhaust gases without creating an excessive backpressure on the GT when operating at 110% of nameplate rating.

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**321-2271 REVISION 1**
SRP SECTION:	**09.05.08 – Emergency Diesel Engine Combustion Air Intake and Exhaust System**
APPLICATION SECTION:	**TIER 2 9.5.8**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.08-17

RAI 9.5.8-17: Preoperational testing of the GTGs is described in Section 14.2.12.1.44. Although one objective of the tests is to demonstrate the operation of the combustion air and exhaust system, the test method and acceptance criteria description does not include the GTGCAIES. Although the operation of the air intake and exhaust portion of the GTGCAIES will be demonstrated by the GTG tests, the GTG/room cooling function will not necessarily be demonstrated by GTG operation. There are no provisions to monitor the room temperature, system air flow rate, outdoor temperatures, etc., to assess the proper operation of the cooling system. The applicant should provide testing and criteria to ensure that the cooling system is performing according to design.

ANSWER:

As shown on DCD Table 9.4-1 and Figure 9.4.3-1, the Class 1E GTGs in the power source building (PS/B) are served by the auxiliary building ventilation system (ABVS) during normal plant operation. The ABVS preoperational test abstract is found in DCD Subsection 14.2.12.1.99, which includes verification of automatic and manual controls in normal and shutdown modes, and verification of design air flow. Acceptance criteria for the ABVS preoperational test refer to DCD Subsection 9.4.3. Subsection 9.4.3.4, Inspection and Testing Requirements states, in part:

> "Preoperational testing of the auxiliary building ventilation system is performed as described in Chapter 14, Verification Programs, to verify that system is installed in accordance with applicable programs and specifications. All HVAC system airflows are balanced in conformance with the design flow, path flow capacity, and proper air mixing temperature throughout the A/B, R/B, PS/B, and AC/B."

The outdoor temperature is monitored plant wide and therefore no special provisions are made to monitor temperature outside the PS/B in particular.

As described in DCD Subsection 9.5.8 and shown on Figure 9.5.8-1, the GTG combustion air intake and exhaust system provides ventilation and cooling air to the GTG assembly. Thus, during Class 1E GTG operation, cooling air is provided by each GTG's own ventilation fan.

Ambient PS/B room temperatures and ventilation air flow rates will be measured during GTG preoperational testing. MHI will revise the DCD Subsection 14.2.12.1.44 preoperational test abstract for the Class 1E GTGs, to specifically state that ambient room temperatures and ventilation air flow rate will be measured and verified to be acceptable during the 24 hour endurance run.

Impact on DCD

Revise first paragraph in DCD Tier 2, section 9.5.8.4 as follows:

"The combustion air intake and exhaust system is tested prior to initial startup. Preoperational testing is described in Section 14.2. System performance during normal operation is verified. **The ventilation and cooling functions of the GTG combustion air intake and exhaust system are also tested as part of Class 1E GTG testing described in Subsection 14.2.12.1.44."**

Revise first paragraph in DCD Tier 2, section 9.5.8.5 as follows:

"The GTG combustion air intake and exhaust system is provided with instrumentation consisting of a combustion air pressure indicator and exhaust gas temperature indicators. **The GTG room is provided with thermometers to monitor room and air exhaust temperature, ventilation / cooling air flow meter."**

Revise Test Method Item 9 in DCD Tier 2 Subsection 14.2.12.1.44 as follows:

> "9. Demonstrate full load carrying capability for 24 hours, of which 22 hours are at a load equivalent to the continuous rating of the Class 1E gas turbine generator and 2 hours at a load equivalent to the two hour rating of the emergency generator. **Obtain ventilation air flow rate and ambient room temperature measurements during this test."**

Revise Acceptance Criteria Item 7 in DCD Tier 2 Subsection 14.2.12.1.44 as follows:

> "7. Each Class 1E gas turbine generator satisfactorily completes the full-load test for 24 hours with 22 hours at a load equivalent to the continuous rating of the Class 1E gas turbine generator and 2 hours at a load equivalent to the 2 hour rating of the Class 1E gas turbine generator. **Ventilation air flow rate is shown to meet design flow rate, and ambient room temperature is maintained within limits during the 24 hour run."**

Impact on COLA
There is no impact on the COLA

Impact on PRA
There is no impact on the PRA.

This completes MHI's response to the NRC's question.

Attachment A – Revised Table 9.5.8-1

Table 9.5.8-1 Combustion Air Intake and Exhaust System Component Data

~~Air intake filter~~	
~~Quantity (per engine)~~	~~1~~
~~Design flow at 100 °F (cfm)~~	~~49,440~~
~~Design pressure/temperature (psig/°F)~~	~~Atmospheric/120~~
~~Pressure drop at rated load (in. WG)~~	~~3~~
~~Seismic Category~~	~~I~~
Intake silencer	
Quantity (per engine)	1
Make/model/size	AAF, 4R, 24
Type	Pulsco tubular duct
Design flow at 100 °F (cfm)	49,440
Design pressure/temperature (psig/°F)	Atmospheric/120
Seismic Category	I
Turbine Exhaust silencer	
Quantity (per engine)	1
Type	Vertical
Design flow at 1,103 °F (cfm)	135,255
Design pressure/temperature (psig/°F)	Atmospheric/**1103**
~~Pressure drop at rated load (in. WG)~~	~~5.6~~
Seismic Category	I
Piping	
Intake piping ~~(except ASME Section III, flexible connectors)~~	~~Class 3~~ **Manufacturer's standard**
Intake air pressure loss (including intake silencer)	**less than 980 Pa**
Exhaust piping ~~(except ANSI B31.1 flexible connectors)~~	~~Flexible connectors (intake Manufacturer's standard and exhaust) design~~ **Manufacturer's standard**
Exhaust air pressure loss (including turbine exhaust silencer)	**less than 2940 Pa**
Flexible connectors	**Manufacturer's standard**
Ventilation/Cooling	**Manufacturer's standard**
Seismic Category	I
Ventilation	
Intake Flowrate (cfm)	31,783

Attachment B – Revised Figure 9.5.8-1

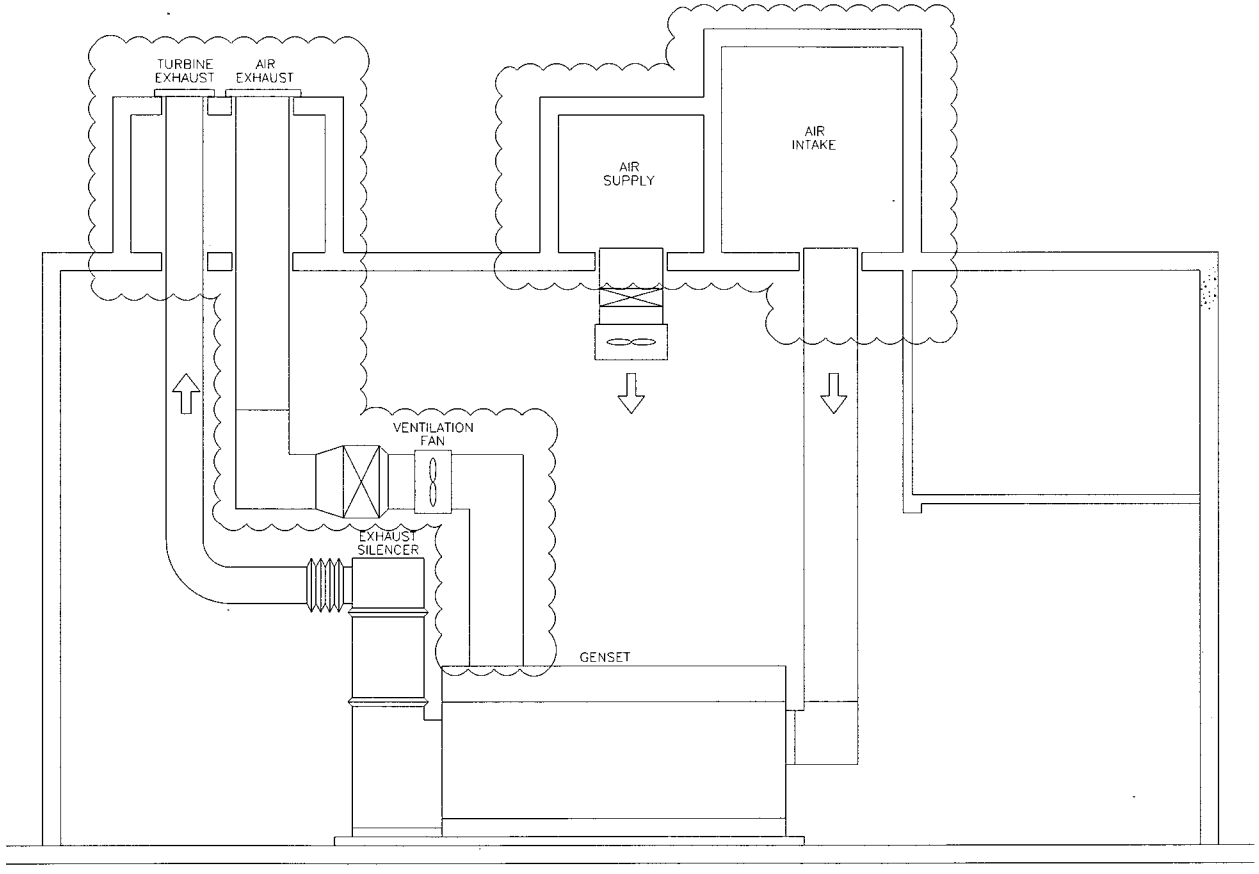

Figure 9.5.8-1 Gas Turbine Generator Air Intake and Exhaust Component Schematic Diagram