

# REQUEST FOR ADDITIONAL INFORMATION 321-2271 REVISION 1

4/6/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 09.05.08 - Emergency Diesel Engine Combustion Air Intake and Exhaust System  
Application Section: Tier 2 Section 9.5.8

QUESTIONS for Balance of Plant Branch 2 (ESBWR/ABWR) (SBPB)

09.05.08-1

**RAI 9.5.8-1:** 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.

09.05.08-2

**RAI 9.5.8-2:** 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.

09.05.08-3

**RAI 9.5.8-3:** 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.

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09.05.08-4

**RAI 9.5.8-4:** 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.

09.05.08-5

**RAI 9.5.8-5:** 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.

09.05.08-6

**RAI 9.5.8-6:** 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  $\pm 5$  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.

09.05.08-7

**RAI 9.5.8-7:** 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

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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.

09.05.08-8

**RAI 9.5.8-8:** 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.

09.05.08-9

**RAI 9.5.8-9:** 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.

09.05.08-10

**RAI 9.5.8-10:** 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)

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- 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.

09.05.08-11

**RAI 9.5.8-11:** 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.

09.05.08-12

**RAI 9.5.8-12:** 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.

09.05.08-13

**RAI 9.5.8-13:** 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.

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09.05.08-14

**RAI 9.5.8-14:** 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.

09.05.08-15

**RAI 9.5.8-15:** 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.

09.05.08-16

**RAI 9.5.8-16:** 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.

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.