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TOKYO, JAPAN

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-09293

Subject: MHI's Responses to US-APWR DCD RAI No. 319-2147 REVISION 1

Reference: 1) "REQUEST FOR ADDITIONAL INFORMATION NO. 319-2147 REVISION 1, SRP Section: 09.05.06 - Emergency Diesel Engine Starting System, Application Section: Tier 2 Section 9.5.6", 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. 319-2147 REVISION 1."

Enclosed is the responses to Questions 09.05.06-1 through 09.05.06-23 that are contained within Reference 1.

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

Sincerely,

Y. Ogata

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

Enclosure:

1. Responses to Request for Additional Information No.319-2147 Revision 0

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

D081
NRO

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Docket No. 52-021
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Enclosure 1

UAP-HF-09293
Docket No. 52-021

Responses to Request for Additional Information No. 319-2147
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. 319-2147 REVISION 1**
SRP SECTION:	**09.05.06 - EMERGENCY DIESEL ENGINE STARTING SYSTEM**
APPLICATION SECTION:	**TIER 2 SECTION 9.5.6**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-1

FSAR Tier 1, Section 2.6.4, "Emergency Power Sources," does not contain a design description of the gas turbine starting system. 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 should provide a design description in Tier 1 for the gas turbine starting system that describes the most safety significant aspects of the system.

ANSWER:

Design description of significant aspect of starting air system will be added in Tier 1 Subsection 2.6.4.2.

Impact on DCD

Tier 1 Subsection 2.6.4.2 title will be revised as following:
2.6.4.2 EPS ~~Fuel Oil Storage and Transfer Systems (FOS)~~ Support Systems Design Description

Tier 1 Subsection 2.6.4.2 will be revised to add as follows:
(Note: The first item is based on response to RAI No.182 Question No. 14.03.06-11 with modification of Subsection No.)
The stored air starting system is capable of providing starting air to each of the four Class 1E EPSs without requiring replenishment.

The safety-related portions of starting air system components are designed to seismic Category I standards. These portions are designed to meet the requirements of the ASME Code, Section III.

Alarms are provided in the MCR for low pressure in air receivers.

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-2

FSAR Tier 1 Table 2.6.4-1 item 7 requires a test to assure that the as-built piping support systems within the gas turbine generator (GTG) system is qualified as seismic Category I. It is unclear to the NRC staff how a pressure test, as specified under ITAAC item 7 in Table 2.6.4.1, is going to qualify a piping support to seismic Category I. This item should be reconsidered by the applicant.

ANSWER:

Tier 1 Table 2.6.4-1 item 8 describes type test and analysis to assure that support systems within the GTG system is qualified as seismic Category I.

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.

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QUESTION NO. : 09.05.06-3

FSAR Tier 1 Table 2.6.4-1 item 10 specifies that a test be performed to demonstrate that the gas turbine generator starting system (GTGSS) can perform a single start of the GTG system. This is insufficient in that FSAR Tier 2 Section 9.5.6 states that the stored air within the GTGSS is capable to perform three starts without recharging. The ITAAC item should be revised to demonstrate that 3 starts can be achieved without recharging the receivers.

ANSWER:

The Tier 1 Table 2.6.4-1 item 10 will be revised to demonstrate that 3 starts can be achieved without recharging the receivers.

Impact on DCD
DCD Tier1 Table 2.6.4-1 will be revised to modify ITAAC item 10 as following:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. The stored air starting system is capable of providing start of the Class 1E EPS without requiring replenishment.	10. A test of the as-built Class 1E EPS starting system will be performed.	10 The results of **the** test concludes that the as-built Class 1E EPS stored air starting system is capable of providing **three starts** of the as-built Class 1E EPS without requiring replenishment.

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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QUESTION NO. : 09.05.06-4

There is no ITAAC provided to assure that the low-pressure alarm for the air receiver is received in the main control room as specified by the SRP Section 9.5.6. An ITAAC should be added to verify this function.

ANSWER:

Tier 1 Table 2.6.4-1 ITAAC item will be revised to verify the low-pressure alarm for the air receiver in the main control room.

Impact on DCD

Tier 1 Subsection 2.6.4.2 will be revised based on response to Question No. 09.05.06-1.

Tier 1 Table 2.6.4-1 item 23 will be revised as below:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
23. Alarms are provided in the MCR for **EPS support systems as described in this Subsection 2.6.4.2.**~~low fuel oil level in the fuel oil storage tanks and low and high level in the fuel oil day tanks.~~	23. A test will be performed on the as-built **EPS support systems** ~~fuel oil storage and transfer system~~ by providing simulated ~~fuel oil storage and fuel oil day tank~~ **status** test signals.	23. The result**s** of **the** test concludes that alarms are provided in the as-built MCR for **status condition in the as-built EPS support systems** ~~low fuel oil level in the as-built fuel oil storage tanks and low and high level in the as-built fuel oil day tanks~~.

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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QUESTION NO. : 09.05.06-5

The description of the GTGSS provided in FSAR Tier 2 Section 9.5.6 appears to contain a number of inconsistencies. The description should be revised to clarify the system design. Areas of apparent discrepancy are as follows:

- It is stated in FSAR Tier 2 Section 9.5.6 that each GTG starting system includes four air starting units. According to Figure 9.5.6-1, there are only two starting air units per GTG.

- It is stated in FSAR Tier 2 Section 9.5.6.2.1.1 six compressors are provided for the two starting systems per GTG. According to Section 9.5.6.2.1.2, each starting system is equipped with two receivers. That would imply a total of four receivers. Figure 9.5.6-1 and the rest of the description indicate that only two receivers are provided per GTG.

- It is stated in FSAR Tier 2 Section 9.5.6.2.2 that each compressor keeps one receiver pressurized. However, this is not consistent with Figure 9.5.6-1. According to Figure 9.5.6-1, all six compressors feed both air receivers via a common header with no isolation between air compressors.

- The starting sequence is stated in FSAR Tier 2 Section 9.5.6.1 to require 100 seconds. It is claimed that this time period is less than that assumed in FSAR Chapter 15. According to the description of the accident analysis in Chapter 15, this time period is identical to what is assumed in the accident analysis.

- FSAR Tier 2 Section 9.5.6.1 states that the codes and standards applicable to the GTGSS are listed in Section 3.2. Section 3.2 only lists the air receiver for this system in Table 3.2-2. The FSAR Tier 1 Section 2.6.4.1 requires that all associated GTG equipment that is required to operate be seismic Category I and ASME Code Section III Class 3, including piping and valves.

- In FSAR Tier 2 Section 9.5.6.2 it is stated that each starting system consists of six compressors. In Section 9.5.6.2.1.1 it is stated that six compressors constitutes two starting systems.

ANSWER:
Each discrepancy is responded as follows:

- The aim of the description was to show that there are four starting air valves in two starting units. The description will be revised.

- The description will be revised to show that each GTG starting system consists of two system and each system is equipped with one air receivers.

- The description will be revised. Starting system is designed to reach set voltage and frequency within 100 seconds. Delay time is assumed 100 seconds in accident analysis of Chapter 15.

- Tier 1 Subsection 2.6.4.1 states that "The support systems that are required to perform safety functions of starting and operating the Class 1E EPS are classified ASME Code Section III, Class 3. The Class 1E EPS and the ASME Code Section III, Class 3 portion of the support systems are seismic Category I." This dose not require that all equipment are classified ASME Code Section III Class 3 and seismic Category I. Air compressors and associated valves, piping are inapplicable.

- The description will be revised. Each GTG starting system consists of two system. There are a total of six compressors.

Impact on DCD
The last sentence of Item A in DCD Subsection 9.5.6.1 will be revised as following:

This time frame is ~~less than~~ **consistent with** that assumed in the accident analyses presented in Chapter 15.

The second sentence of the second paragraph in DCD Subsection 9.5.6.2 will be revised as following:

Each GTG starting air system is equipped with six (6) air compressors with an air cooler in each, three (3) drain chambers, two (2) air receivers, compressor air intake filters, ~~four (4)~~ **two (2)** air starting units that include solenoid valves, piping, valves, and associated instrumentation.

The sentence of Subsection 9.5.6.2.1.1 will be revised as following:

Six motor-driven compressors are provided for two ~~starting systems~~ **air receivers** per GTG.

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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QUESTION NO. : 09.05.06-6

In addition to the discrepancies noted, the description of the system provided in FSAR Tier 2 Section 9.5.6 does not adequately describe how the system is configured and the level of redundancy. Each GTG system includes two gas turbines (GTs). According to Figure 9.5.6-1 each starting unit (one receiver and two solenoid valves) serves only one GT. Presumably failure of one GT to start will prevent the GTG system from starting. Consequently it appears that both air receivers are required to start the two GTs and there is no redundancy provided by the air receivers. The applicant should clearly describe the relationship between the two starting units and the two GTs as well as with the starting of the overall GTG system.

ANSWER:

Description of relationship between the starting unit and GT will be added.

Impact on DCD
New paragraph will be added after the last paragraph in DCD Subsection 9.5.6.2.
A GTG is composed of two gas turbine engines which have two air start motors respectively. The GTG starts properly by turning effort of four air start motors. An air receiver supplies air to two air start motors through two starting valves mounted on a starting unit.

The second sentence of DCD Subsection 9.5.6.2.1.2 will be revised as following:
~~An~~ **Two** air receiver**s** **are** capable of providing starting air for three consecutive GTG starts without compressor assistance.

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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QUESTION NO. : 09.05.06-7

The GTGSS must have the capability to meet independence and redundancy criteria stated in SRP Section 9.5.6. FSAR Tier 2 Section 9.5.6.1 states that the starting system is designed so that a single failure of any component cannot result in complete loss of the power source. Each GTG includes four starter motors. It is unclear from the descriptions in FSAR Section 9.5.6 how many of the four motors are required to start the GTG. The applicant should provide this detail so the level of redundancy can be determined.

ANSWER:

Each GTG and its supporting system are completely independent between four trains. Therefore, even if one GTGSS failed, the other GTGs keep their functions. Required number of air start motor to start GTG is responded in Question No. 09.05.06-6.

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.

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QUESTION NO. : 09.05.06-8

GDC 17 requires the onsite electric power system to have sufficient independence and redundancy to perform their safety functions, assuming a single failure. Guidance provided in the SRP Section 9.5.6 states that as a minimum, the air starting system should be capable of attempting five starts without recharging the receiver(s). However, Item A of Section 9.5.6.3 in the FSAR Tier 2, states that the system holds sufficient air to start the GTG three times. The applicant should provide information justifying this departure.

ANSWER:

Please refer to RAI No.5 Question No. 8.3.1-1.

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.

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QUESTION NO. : 09.05.06-9

GDC 17 requires the EDG starting system to meet independence and redundancy criteria. SRP Section 9.5.6 provides guidance for determining if air starting systems meet GDC 17 requirements. One criterion specifies that starting air should be dried to a dew point of not more than 10ºC (50ºF) when installed in a normally-controlled 21ºC (70ºF) environment; otherwise, the starting air dew point should be controlled to at least 5.5ºC (10ºF) less than the lowest expected ambient temperature. Another criterion is that the starting system design precludes fouling of the air start valve or filter with moisture and contaminants like oil and rust carryover. Air dryers should be installed upstream of air receivers to remove entrained moisture as described in SRP Section 9.5.6 and recommended by NUREG-0660. The FSAR does not address these issues. The applicant should provide design information for the GTGSS sufficient to demonstrate how the possible effects from water, oil, rust and other contaminants are prevented or mitigated. Also note that Section C.2.2.3 of "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007 (MUAP-07024-P(R0)) states that the air starting system includes an air dryer.

ANSWER:

Subsection 9.5.6.2.1 will be revised to provide design information of air dryer.

Impact on DCD
Subsection 9.5.6.2.1.6 will be added as following:
9.5.6.2.1.6 Air Dryer
Air dryers are equipped as part of the air compressor skid to dry starting air to a dew point of not more than 10ºC (50ºF) when installed in a normally-controlled 21ºC (70ºF) environment; otherwise, at least 5.5ºC (10ºF) less than the lowest expected ambient temperature.

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-10

SRP Section 9.5.6 states that the GTGSS should be reviewed as to its ability to be maintained and repaired in a timely fashion. Sufficient space must be provided to allow these operations. Neither discussion nor detailed design drawings are provided within the FSAR to review the design against this acceptance criterion. The applicant should provide drawings that show the spatial arrangement of the components so this criterion can be reviewed.

ANSWER:

New paragraph will be added in Subsection 9.5.6.2 to describe that sufficient space to maintain and repair is created.

Impact on DCD
Subsection 9.5.6.2 will be revised to add following:
The layout of the air start system main components (i.e., air compressors, air receivers and air starting units) provides the sufficient space required to permit inspection, cleaning, maintenance, and repair of the system.

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-11

The NRC Staff needs more details regarding start reliability of gas turbine generator systems in order to evaluate the reliability of the proposed system. The applicant should provide data from actual operational experience of similar gas turbines in similar operational conditions. The details should include:

- The type of systems that are included in the database
  - § Size
  - § Service (emergency, standby, base load, etc.)
  - § Start motor type (electric, air, etc.)
- Time required for start of the systems within the database
- The types of start events that is included in the database (rapid, cold, hot, etc.)
- The documentation level of the start events (confidence level for data)
- Definitions for the database as compared to Regulatory Guide 1.9 definitions for the following:
  - § Start attempt
  - § Failed start attempt

ANSWER:

MHI provided some reliability data to NRC. Confirm following documents:

- Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007 (MUAP-07024-P (R0))
- Response to RAI No.5 Question No. 8.3.1-2 and No.8.3.1-3
- "US-APWR Gas Turbine Generator used as Emergency Power Supply" distributed in "Public Forthcoming Meeting with Mitsubishi Heavy Industries to Discuss US-APWR Gas Turbine Generator Reliability and Diversity as an Alternate AC Power Source" conducted on April 13, 2009

In addition, technical report is due to be provided after concluding Class 1E qualification test of GTG which includes reliability test.

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.

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QUESTION NO. : 09.05.06-12

Most gas turbine systems include an instrumentation interlock that prevents restart after turbine trip until the turbine spins down to a low speed. This coast down can take minutes depending on the speed at which a trip occurs. The applicant should address how this coast down requirement impacts the start time and reliability of the US-APWR GTGs. As a minimum, the NRC staff needs the following information:

- o Interlocks that are included in the GTG system that will prevent a rapid restart attempt
- o Braking system that is included in the GTG system to minimize the coast down period
- o The time between start failure and restart initiation
- o The fraction of turbine failed start attempts would require a coast down period

ANSWER:

GTG includes interlock that can restart when rotational speed is less than 50%. GTG system dose not include braking system to minimize the coast down period but it is possible to restart immediately when turbine fails to start due to ignition failure at 50% rotational speed. If GTG trip occurs in rated operation, it is about 15 seconds to down rotational speed to less than 50%.

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.

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QUESTION NO. : 09.05.06-13

FSAR Tier 2 Section 9.5.6.2.2 describes a check valve in the receiver charging line. These valves are not shown on Figure 9.5.6-1. Due to the critical function of these valves, they should be including on Figure 9.5.6-1.

ANSWER:

Figure 9.5.6-1 will be revised to add checks valve in the receiver charging lines.

Impact on DCD
Figure 9.5.6-1 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.

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QUESTION NO. : 09.05.06-14

FSAR Tier 2 Section 9.5.6.2.2 states that "the valves in the compressor discharge header can be aligned manually so that either air receiver can be recharged from either air compressor." "Either" air compressor implies that there are only two compressors and should be corrected. In addition, the compressors are all headered together according to Figure 9.5.6-1 and all together supply both receivers. Or any one of the compressors can feed both air receivers. Verify that all of the valves described in Section 9.5.6.2.2 are shown on Figure 9.5.6-1 and that the normal valve positions indicated on the figure are correct and consistent with the description.

ANSWER:

The last sentence of the first paragraph in DCD Subsection 9.5.6.2.2 will be revised to correct description.
Figure 9.5.6-1 will be revised to add check valve based on Question No.09.05.06-13

Impact on DCD
The last sentence of the first paragraph in DCD Subsection 9.5.6.2.2 will be revised as following:
The valves on the cross-connect and discharge piping can be aligned manually**, and these valves normally open** so that either air receiver can be recharged from ~~either~~ **any** air compressor.

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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QUESTION NO. : 09.05.06-15

FSAR Tier 2 Section 9.5.6.3.B states that a failure of a compressor is indicated by an air receiver low-pressure alarm. Since there are five other compressors that will automatically restore and maintain receiver pressure, the applicant should explain how this arrangement will detect a failed compressor?

ANSWER:

Normally, air receivers are filled with compressed air. Air receivers consume compressed air when GTG starts. It is supposed a failure of a compressor when air receiver low-pressure alarm is initiated by air consumption. The failed compressor will be detected at the local.

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.

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QUESTION NO. : 09.05.06-16

FSAR Tier 2 Section 9.5.6.3.C notes that the GTGSS is seismic Category I and ASME Section III Class 3 except for the air compressors and air coolers. In accordance with SRP Section 9.5.6, the piping interfaces between seismic and non-seismic as well as between ASME Section III and non-Section III should be indicated on the P&ID (Figure 9.5.6-1).

ANSWER:

Figure 9.5.6-1 will be revised to indicate the piping interfaces between seismic and non-seismic as well as between ASME Section III and non-Section III.

Impact on DCD
Figure 9.5.6-1 will be revised 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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 319-2147 REVISION 1**
SRP SECTION:	**09.05.06 - EMERGENCY DIESEL ENGINE STARTING SYSTEM**
APPLICATION SECTION:	**TIER 2 SECTION 9.5.6**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-17

FSAR Tier 2 Section 9.5.6.3.C states that systems, equipment and components (SSCs) which are not seismic Category I and, "whose failure could impair the functioning of the lubrication system are upgraded in design to seismic Category I." In this statement, "lubrication" should be changed to "starting". In addition, this statement should be reworded for clarity – SSCs "which are not seismic Category I" should be changed to SSCs "which are not normally required to be seismic Category I based on their safety function, but whose failure could impair..."

ANSWER:

The last sentence of Subsection 9.5.6.3.C will be reworded for clarity.

Impact on DCD
The last sentence of Subsection 9.5.6.3.C will be revised as following:

System, equipment, and components which are not **normally required to be** seismic category I **based on their safety function, but** ~~and~~ whose failure could impair the functioning of the ~~lubrication~~ **air starting** system are upgraded in design to seismic category I.

I 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

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Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 319-2147 REVISION 1**
SRP SECTION:	**09.05.06 - EMERGENCY DIESEL ENGINE STARTING SYSTEM**
APPLICATION SECTION:	**TIER 2 SECTION 9.5.6**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-18

FSAR Tier 2 Table 9.5.6-1 includes non safety-related piping, fittings and valves designed to ANSI B31.1 (this should be ASME B31.1). Whereas Section 9.5.6.3 states that the starting system, except for the air compressors and air coolers are ASME Code Section III, Class 3. The latter statement implies that there will not be any piping designed to ASME B31.1. The applicant should clarify the design. Note that the check valves that maintain air receiver pressure and all piping, fittings and valves downstream of these check valves must be ASME Section III and seismic Category I.

ANSWER:

Piping installed compressor side from check valves that maintain air receiver pressure may be designed to ASME B31.1. The check valves that maintain air receiver pressure and all piping, fittings and valves downstream of these check valves are designed to ASME Section III and seismic Category I.

Impact on DCD
The third sentence of Subsection 9.5.6.3.C will be revised as following:
These components are designed to manufacturer's standards **or ASME B31.1**and are pressure tested

Impact on COLA
There is no impact on the COLA.

Impact on PRA
There is no impact on the PRA.

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Docket No. 52-021

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APPLICATION SECTION:	**TIER 2 SECTION 9.5.6**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-19

FSAR Tier 2 Table 9.5.6-1 indicates the air volume for one start in units of Nm3. This volume should be in ft3 to be consistent with the rest of the table.

ANSWER:

Table 9.5.6-1 will be revised to convert air volume in units of Nm3 into units of ft3.

Impact on DCD
Table 9.5.6-1 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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 319-2147 REVISION 1**
SRP SECTION:	**09.05.06 - EMERGENCY DIESEL ENGINE STARTING SYSTEM**
APPLICATION SECTION:	**TIER 2 SECTION 9.5.6**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-20

Section C.2.2.3 of "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007 (MUAP-07024-P(R0)) states that the air starting system air receivers will be in accordance with ASME Section VIII. Verify that the US-APWR starting air system air receivers will be in accordance with ASME Section III, Class 3.

ANSWER:

Air receivers are designed to not ASME Section VIII but ASME Section III, Class 3.

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

Docket No. 52-021

RAI NO.:	**NO. 319-2147 REVISION 1**
SRP SECTION:	**09.05.06 - EMERGENCY DIESEL ENGINE STARTING SYSTEM**
APPLICATION SECTION:	**TIER 2 SECTION 9.5.6**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-21

Section C.2.2.11.3 of "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007 (MUAP-07024-P(R0)) indicates normal air pressure and air pressure after three starts for the air receiver in psig units. For the same parameters, FSAR Tier 2 Table 9.5.6-1 indicates the same parameters with essentially the same numerical values except that the units are psia. The applicant should correct this discrepancy.

ANSWER:

Table 9.5.6-1 will be revised to convert air pressure in units of psia into units of psig.

Impact on DCD
Table 9.5.6-1 will be revised as shown in Attachment A which includes revisions based on response to RAI No.134 Question No 16-43.

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

Docket No. 52-021

RAI NO.:	**NO. 319-2147 REVISION 1**
SRP SECTION:	**09.05.06 - EMERGENCY DIESEL ENGINE STARTING SYSTEM**
APPLICATION SECTION:	**TIER 2 SECTION 9.5.6**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-22

Section C.2.2.11.4 of "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007 (MUAP-07024-P(R0)) indicates that pipes from air tanks to the generator set shall be zinc coated to prevent pipes from rusting. FSAR Tier 2 Table 9.5.6-1 indicates that piping will be stainless steel and carbon steel. The applicant should provide more specific information on which piping is carbon steel, which is stainless steel and which is zinc coated. The description should address the potential for loose rust, failed zinc plating, etc., in piping subject to moist air to cause failure of the starting system.

ANSWER:

Stainless steel piping and carbon steel piping are provided in air starting system. Stainless steel piping is applied between air compressor slid and air starting unit skid. Carbon steel piping is applied between air starting unit skid and gas turbine air enclosure. The zinc coated piping is not applied.

Air dryers are provided as part of the compressor skid to prevent significant deterioration of the air receivers internal surfaces. Carbon steel air receivers are provided.

Impact on DCD
Table 9.5.6-1 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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 319-2147 REVISION 1**
SRP SECTION:	**09.05.06 - EMERGENCY DIESEL ENGINE STARTING SYSTEM**
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DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.06-23

The guidance in Regulatory Guide 1.9 includes a monthly "slow start" and a "fast start" every six months. The distinction is intended to minimize stress and wear on the system while ensuring start reliability, based on the assumption that fast starts create more stress and wear on the diesel generator system. Surveillance Requirement 3.8.1.2 of FSAR Tier 2 Chapter 16 requires a monthly start test for the GTG. In the report "Justification for deviations between NUREG-1431 Rev. 3.1 and USAPWR Technical Specifications," dated August 2008 the applicant states that the GTG system does not require a slow start. The applicant should address the potential for increased wear and stress on the GTG system caused by more frequent fast starts and the possible effect on system performance and reliability.

ANSWER:

Gas turbine is very simpler rotating engine than diesel engine consisted of piston and crankshaft. Starting time of gas turbine has little influence on stress and wear. Therefore Gas turbine dose not have two starting mode as "slow start" and "fast start".

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.

Attachment A Revised Table 9.5.6-1

Table 9.5.6-1 Starting System Component Data

Compressors	
Quantity (per GT)	6
Type	Reciprocating, air cooled
Capacity	776.9 cu-ft/hr
Discharge pressure (normal)	~~426.4 psia~~ **psig**
Pressure in receiver after 3 starts	~~188~~**170**.6 ~~psia~~ **psig**
Air Compressor on/off	On: ~~384.4~~ **398.2** ~~psia~~ **psig**; Off: 435.1 ~~psia~~ **psig**
Air Compressor Low Alarm	On: ~~311.8~~ **378.3** ~~psia~~ **psig**; Off: ~~362.6~~**398.2** ~~psia~~ **psig**
Air temperature leaving cooler ºF	120-135
Number of stages/cylinders	2/3 (2 low pressure, 1 high pressure)
Revolutions per minute	790
Regulation	Dual control
Design code	Manufacturer's standard
Driver	
Type	Electric motor (totally enclosed, fan cooled)
Horsepower	7.5
Revolutions per minute	1200
Power supply	460-V, 60-Hz, 3-phase
Seismic Category	II
Air receivers	
Quantity (per GTG)	2
Type	Vertical, cylindrical
Capacity (ft^3)	~~318~~**353** cu-ft
Design pressure/temperature (psig/ºF)	440/150
Operating pressure/temperature (psig/ºF)	410/120
Material	Carbon steel SA 516-70
Code	ASME Section III, Class 3
Seismic Category	I
Air Start Necessary Air Vol/one start	~~1204238Nm^3~~ **cu-ft**
Lower limit pressure at inlet	142 psig
Numbers of starts/GTG	3
Piping, fittings, and valves (safety-related)	
Material	Carbon steel and stainless steel
Design code	ASME Section III, Class 3
Seismic Category	I
Piping, fittings, and valves (non safety related)	
Material	~~Carbon steel and~~ Stainless steel
Design code	Manufacturer's standard or ~~ANSI~~ **ASME** B31.1

Attachment B Revised Figure 9.5.6-1

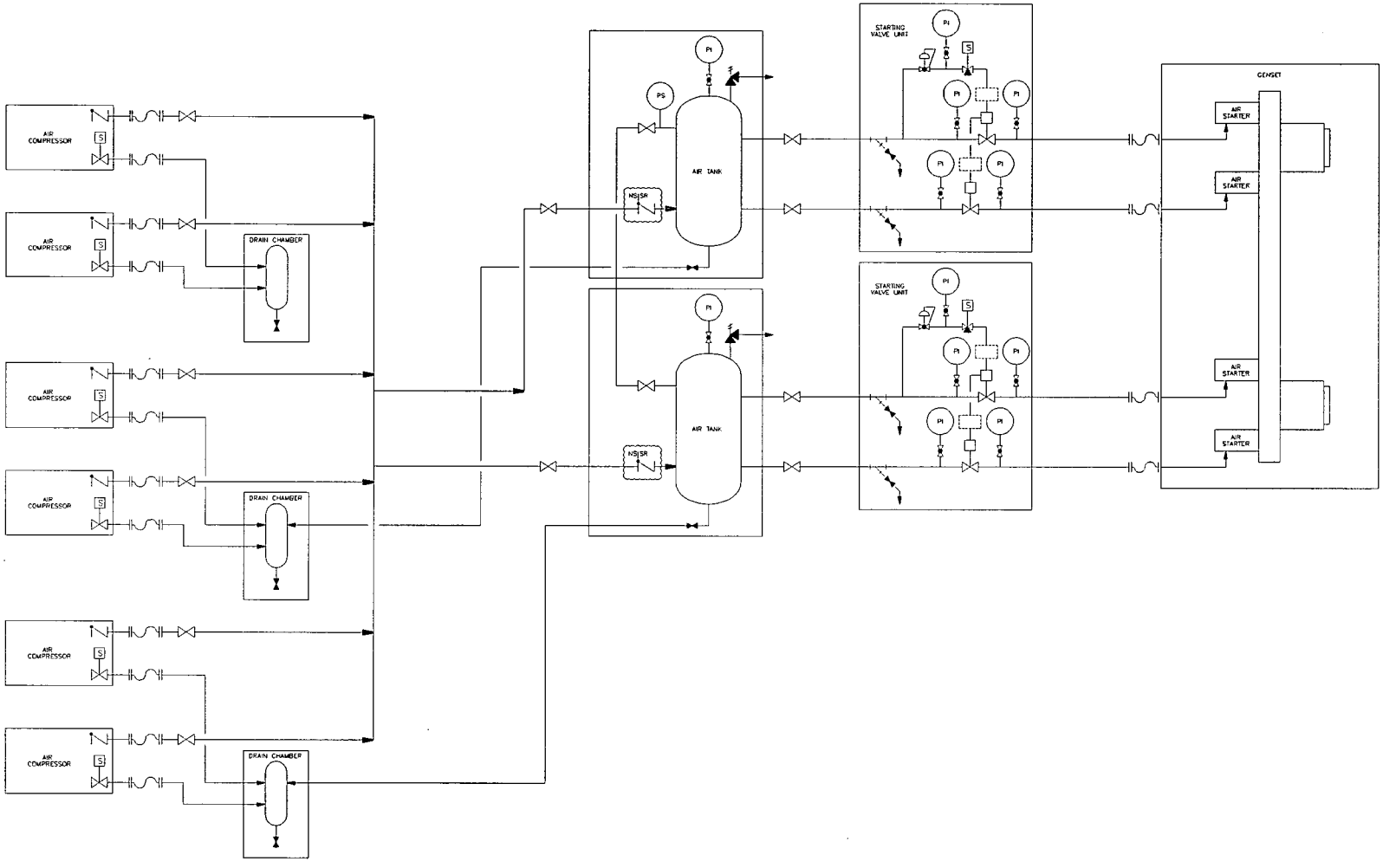

Figure 9.5.6-1 Gas Turbine Generator Starting System Schematic Diagram