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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-09292

Subject: MHI's Response to US-APWR DCD RAI No.318

References: 1) "Request for Additional Information No. 318 Revision 1, SRP Section: 09.05.04 - Emergency Diesel Engine Fuel Oil Storage and Transfer System, Application Section: Tier 2 9.5.4," 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.318 Revision 1."

Enclosed are the responses to 37 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.318 Revision 1

CC: J. A. Ciocco
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Docket No. 52-021
MHI Ref: UAP-HF-09292

Enclosure 1

UAP-HF-09292
Docket No. 52-021

Responses to Request for Additional Information No.318 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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-6

RAI 9.5.4-01: FSAR Tier 2 Table 9.5.4-1 states that the safety related portion of the system piping, fitting and valves will be ASME Section III. This implies that a portion of the system piping will be non-safety related. SRP 9.5.4 stipulates that the demarcation between safety-related and non-safety related piping be indicated on the system drawings. There is no indication of the boundaries on FSAR Tier 2 Figure 9.5.4-1. The applicant should revise Figure 9.5.4-1 to indicate the demarcation between safety and non-safety related portions of the system.

ANSWER:

The safety-related boundary occurs on the line from the fuel fill connection. Figure 9.5.4-1 will be revised to show this boundary.

Impact on DCD
Figure 9.5.4-1 will be revised as shown in the attached markup.

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-7

RAI 9.5.4-02: The FSAR asserts that each of the four fuel oil storage tank containment structures is designed to withstand hurricane or tornado related damages, and that the systems are safe from flooding. However, the FSAR provides no evidence to demonstrate that these assertions are true. Specifically, SRP Section 9.5.4 requires that the fill line terminate above the flood level. No indication of this design feature was found within the FSAR. The applicant should provide specific design information to demonstrate protection against flooding.

ANSWER:

Protection of SSCs, including the fuel oil storage tanks, from the effects of tornados is addressed in DCD Section 3.3 (tornado loads) and 3.5 (tornado missiles) Hurricane effects are bounded by the effects of tornados and maximum floods.

The underground vaults are protected from flooding, according to Section 3.4.1.2, which states, "Below grade, the US-APWR nuclear island and other seismic category I and II structures are primarily protected against exterior flooding and the intrusion of ground water by virtue of their thick reinforced concrete walls and base mats. As recommended by NUREG-0800, SRP 14.3.2 (Reference 3.4-4), the external walls below flood level are equal to or greater than two feet thick to protect against water seepage, and penetrations in the external walls below flood level are provided with flood protection features. Construction joints in the exterior walls and base mats are provided with water stops to prevent seepage of ground water." A reference to this section will be added to Section 9.5.4 to show that flood requirements are met.

In addition, the fill connection is located above flood level, since according to DCD Table 2.0-1 the flood level is 1 ft below plant grade. The fill connection is located above grade so that the fuel can be replenished by an outside supply source, and is therefore located above the flood level.

Impact on DCD

The second to last paragraph of Section 9.5.4.2.2 will be revised to read:
"The system is safe from flooding **(see Section 3.4.1.2)**. The system is protected from the effects of low temperature in the building"

The third paragraph of Section 9.5.4.2.2.1 will be revised to read:

"Each fuel oil storage tank has a fill connection, which terminates in a box allowing replenishment of fuel from an outside supply source (e.g., truck) without interrupting operation of the GTG. **The fuel oil storage tank fill connection is located above flood level to prevent flood water from entering the FOS.** The fuel oil storage tank fill connection includes an internal pipe and diffuser to limit inlet filling velocities to prevent turbulence of sediment on the bottom of the tank. In addition, the fuel oil storage tank outlet connections are 6 inches above the tank bottom, to reduce the potential of sediment entry into the pipeline. A moisture separator and duplex filters are provided in the fuel oil piping and a duplex fuel oil filter is provided on each GTG to prevent detrimental effects on performance from sediment."

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-8

RAI 9.5.4-03: It is not clear from the GTGFSS system description in FSAR Tier 2 Section 9.5.4.2 that all of the system components are located within a reinforced concrete, seismic Category I, missile-protected, flood-protected structure. For example, it is not clear whether the fuel oil transfer pump skids are located within such a structure. The applicant should identify any equipment that is not located within this type of structure and describe how these portions of the system are protected from natural phenomena and environmental and dynamic effects as required by GDC 2 and GDC 4.

ANSWER:

All components of the GTG fuel oil transfer and storage system are located within reinforced concrete, seismic Category I, missile protected, flood-protected structures. The fuel oil transfer pump skids are located in the same compartments as the fuel oil storage tanks. As stated in the last paragraph of DCD Section 9.5.4.2, the "fuel oil storage tanks are contained in a separate reinforced concrete seismic category I, and missile protected underground compartment." Since the pump skids are located in these compartments they are protected from natural phenomena and environmental and dynamic effects as required by GDC 2 and GDC 4. The DCD will be revised for clarity to show that all components are in such structures as required.

Impact on DCD
The last paragraph of DCD Section 9.5.4.2 will be revised to read:

"Each of the four GTG fuel oil storage tanks are contained in a separate, reinforced concrete seismic category I, and missile protected underground compartment. **Each fuel oil storage tank compartment also contains the fuel oil transfer pumps, associated piping, valves, instrumentation, and connections for outside fuel oil supply.** Each GTG is located in a separate seismic category I compartment. Each GTG room contains the GTG, one fuel oil day tank, piping, valves, and instrumentation. The compartments are separated to prevent a fire from spreading to another compartment. System component characteristics are provided in Table 9.5.4-1."

Also, the first paragraph of DCD Section 9.5.4.2.2.2 will be revised to read:
Each GTG FOS is serviced by a modularized skid mounted fuel oil transfer assembly, consisting of suction strainers, two fuel oil transfer pumps, a moisture separator, and a fuel filter with the interconnecting piping, valves, and instrumentation. **These skids are located in the same compartments as the Fuel Oil Storage Tanks.**

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-9

RAI 9.5.4-04: Regulatory Guide 1.137 requires a seven-day fuel supply for each emergency power generator. It also clearly defines two methods that one may use to calculate the required fuel inventory volume. The FSAR states that a seven-day fuel volume is supplied for each GTG system. However, the FSAR does not provide any detail on how the required inventory volume was calculated. Neither the anticipated fuel consumption rate nor the accessible fuel inventory is stated within the FSAR. The same lack of detail applies to the one and one-half hour inventory in the day tanks. This information should be provided to the NRC. FSAR Tier 2 Section 9.5.4.1 states that the GTGFSS is also in accordance with ANSI/ANS-59.51-1997. Section 5.5.1 of ANSI/ANS- 59.51-1997 includes a requirement that the fuel oil day tank provide sufficient capacity below the low-level alarm setpoint plus a margin of 10 percent to maintain full load operation of the engine for another 60 minutes. This section of the standard also provides guidance for additional margins for tank level instrumentation error, etc. FSAR Tier 2 Section 9.5.4 does not address the specific criteria for establishing the capacity of the storage and day tanks and does not address the design requirements or guidance in the ANSI/ANS standard. The applicant should provide more specific information on the calculation of the 7-day storage volume and to verify compliance with this ANSI/ANS- 59.51requirement/guidance or to provide an alternative design criterion with justification.

ANSWER:

Each Class 1E GTG's fuel consumption rate at continuous rated load is 2050 L/hr. Using this flow rate and the formula given in Section 5.4 of ANSI/ANS-59.51-1997 gives a capacity for the Fuel Oil Storage Tank of 90,980 gallons. With 18 feet of liquid level in the tank and assuming a 6 inches of liquid depth from the bottom of the tank as unusable volume; the usable volume in the fuel oil storage tank is 131,000 gallons. This provides a margin of 40,020 gallons which represents the fuel capacity to be added to the minimum capacity required for 5.2, to accommodate for surveillance testing practices as required by ANSI/ANS-59.51-1997. The unusable volume is calculated to be 917 gallons based on the 6 inches of liquid depth from the bottom of the fuel oil storage tank. DCD Table 9.5.4-1 will be revised to reflect the usable volume of 131, 000 gallons for each fuel oil storage tank.

Using the same fuel consumption rate, the Fuel Oil Day Tank is calculated to require a volume of 990 gallons for the one and one-half hour time frame described including 10% margin (based on 60 minutes of operation after reaching the low level setpoint) and unusable fuel oil allowance due

to such factors as tank level instrumentation error, and unaccessible fuel oil due to the location of the outlet nozzle (6 inches from the bottom of the tank). The unusable volume is calculated to be 120 gallons based on the 6 inches of liquid depth from the bottom of the fuel oil day tank. The Fuel Oil Day Tank capacity in DCD Table 9.5.4-1 will be revised accordingly from 860 gallons to 870 gallons (usable volume). The low-level alarm setpoint will be established during detailed design so that the capacity below the setpoint will be enough to maintain full load operation of the engine for another 60 minutes (plus a margin of 10 percent).

For clarification, the anticipated fuel consumption rate will be added to DCD Table 9.5.4-1.

Impact on DCD

Table 9.5.4-1 will be revised for the fuel oil storage tank and fuel oil day tanks as follows:

Fuel Oil Storage Tanks	
Quantity	4
Type	Horizontal, Cylinder
Fuel Consumption Rate at continuous rated load (L/hr)	**2050**
Capacity, Gallons	~~119,000~~ **131,000 (usable volume)** for 7 days
Operating Pressure/Temperature	Atmosphere/Ambient
Design Pressure/Temperature (psig/°F)	20/200
Design Code	ASME Section III, Class 3
Seismic Category	I
Fuel Oil Day Tanks	
Quantity	4
Type	Vertical, Cylinder
Fuel Consumption Rate at continuous rated load (L/hr)	**2050**
Capacity, Gallons	~~860~~ **870 (usable volume)**
Operating Pressure/Temperature	Atmosphere/Ambient
Design Pressure/Temperature (psig/°F)	15/200
Design Code	ASME Section III, Class 3
Seismic Category	I

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-10

RAI 9.5.4-05: FSAR Tier 2 Section 9.5.4.1 states that the GTGFSS is designed in accordance with ANSI/ANS-59.51-1997. In general, there are a number of specific requirements in the ANSI/ANS-59.51-1997 standard that are not described in the FSAR or the description in the FSAR appears to be in conflict with the requirements of the standard. Some of the specific issues are addressed in the staff's RAIs, but the applicant should perform a detailed review of the ANSI/ANS standard, identify all deviations, and provide justification for the deviation.

ANSWER:

A comparison to ANSI/ANS 59.51-1997 is presented in the following table. Any changes to the DCD are discussed in the "MHI US-APWR Response" and described in the "Impact on DCD" section below.

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
3	The fuel oil system shall be capable of supplying an adequate supply of suitable fuel oil to the emergency diesel generators under all Plant Conditions	The fuel oil and transfer system (FOS) is designed to provide seven-day supply of fuel oil to each emergency power generator, per Regulatory Guide 1.137 requirement, to safely shut down the plant and maintain a safe shutdown condition following a design basis accident concurrent with a LOOP by supplying power to essential loads.	9.5.4.1
4	The fuel oil system consists of independent fuel oil subsystems, each dedicated to supplying fuel to a single emergency diesel generator unit. Each subsystem consists of tanks, pumps, filters, strainers, flame arresters, valves, piping, piping components, instruments, and controls	DCD Section 9.5.4.2.1 lists the components of the FOS for each of the 4 GTGs. The flame arresters and instrumentation are described in DCD Section 9.5.4.2.2.1; the strainers and valves are described in DCD Section 9.5.4.2.2.2	9.5.4.2.1, 9.5.4.2.2.1, 9.5.4.2.2.2
4	The fuel oil subsystem starts at the fill connection, and terminates at the connections to the diesel engine.	A schematic of the FOS is shown in DCD Figure 9.5.4-1, with the same boundaries as given in the standard.	Figure 9.5.4-1
4	This standard assumes the use of active components to transfer the oil from a storage tank to the diesel generator day tank. A gravity drain system may be used if potential system leakage and its consequences are evaluated.	Two 100% capacity fuel oil transfer pumps are provided for each GTG. Redundant and divisionally separated GTGs, with dedicated fuel oil transfer for each GTG, are provided to account for consequences with a single failure including leakage in one fuel transfer system	9.5.4.2.1
5.1	Fuel oil systems shall be designed to maintain their integrity and to remain functional during and after all design basis events. The reliability of the fuel oil system shall be addressed when the overall reliability requirements of the diesel generator units are satisfied.	The safety functions are described in DCD Section 9.5.4.1. The system will operate to safely shutdown the plant following a design basis accident concurrent with a LOOP. The FOS is designed to remain functional after a SSE.	9.5.4.1
5.2	The fuel oil system of single reactor unit nuclear stations shall be designed to applicable requirements of ANS-51.1 [6] Section 3.2.1, "Application of the Single Failure Criterion"	The FOS is designed so that a single failure of any active component cannot affect the ability of the system to store and deliver fuel oil.	9.5.4.1
5.2	The onsite fuel oil storage for each diesel generator shall be sufficient to operate the diesel generator following any design basis event either for seven days, or for the time required to replenish the fuel from sources outside the plant site following any design basis event without interruption of the operation of the diesel generator, whichever is longer. During this period it shall be assumed that no off site ac power is available. Storage	Each of the four GTG fuel oil storage tanks provides storage of fuel oil to support 7 days of operation at continuous rated load and an additional amount for periodic testing of the onsite power sources. This allows power to be supplied to the safety-related loads for postulated accident conditions, assuming the loss of all offsite power sources.	9.5.4.1

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
	capacity shall be calculated in accordance with 5.4.		
5.3	Multiple reactor unit nuclear stations should be designed with completely independent fuel oil systems for each unit. In this case, the fuel oil system for each reactor unit shall meet the requirements of 5.2.	N/A – the US-APWR is a single unit plant.	9.5.4.1
5.3	In the event that the fuel oil systems have components that are shared between reactor units, the fuel oil storage capacity shall be based on all of the following: (1) Operation of the safety-related systems and components required to accommodate any design basis event in anyone unit. (2) Operation of equipment necessary to shut down safely all reactor units at the site to cold shutdown status, and to maintain the cold shutdown condition of all reactor units. (3) No availability of offsite ac power.	N/A – the US-APWR is a single unit plant.	
5.3	The fuel oil system of multiple reactor unit nuclear stations shall be designed to applicable requirements of 3.2.3, "Single Failure Criterion," and 4.0, "Primary Design Function," of ANS-5 1. 1 [6] and ANS-52.1 [7]. Based on the minimum diesel generator capacity determined through the use of the above criteria, sufficient on-site fuel oil storage for each diesel generator shall be provided to operate the required number of diesel generators either for seven days, or for the time required to replenish the fuel from sources outside the plant site following any design basis event without interruption of the operation of the diesel or diesels, whichever is longer.	Each of the four GTG fuel oil storage tanks provides storage of fuel oil to support 7 days of operation at continuous rated load and an additional amount for periodic testing of the onsite power sources. This allows power to be supplied to the safety-related loads for postulated accident conditions, assuming the loss of all offsite power sources.	9.5.4.1
5.4	The fuel oil storage capacity requirements should be conservatively calculated, with the assumption that each of the required diesel generators operates continuously for the time period determined in 5.2 or 5.3 at its rated capacity	As per Reg. Guide 1.137, each of the four GTG fuel oil storage tanks provides 7 days storage of fuel oil and an additional amount for periodic testing of the onsite power sources to its respective GTG. This allows power to be supplied to the safety-related loads for postulated accident conditions, assuming the loss of all offsite power sources.	9.5.4.1
5.4	The calculation shall include an explicit allowance for fuel consumption required by periodic testing.	See Question No 09.05.04-9, RAI 9.5.4-04., allowance for fuel consumption required by periodic testing is included in capacity calculation	9.5.4.1
5.4	A conservative calculation is expressed as:	See Question No 09.05.04-9, RAI 9.5.4-	

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
	C = (FR) (7 days) (1440 min/day) + T where: C = Minimum storage capacity (liter or gal). F R = Fuel consumption rate associated with the continuous rating based on the minimum quality fuel oil that is acceptable and the most adverse operating conditions (liter/min or gal/min).' T = Fuel capacity to be added to the minimum capacity required for 5.2, to accommodate site-specific testing practices. An alternative calculation of the required storage capacity that takes into account the time dependence of diesel generator loads may be used in place of the previous equation.	04.	
5.5.1	Each diesel shall be equipped with one or more day or integral tanks whose capacity is sufficient to maintain at least 60 minutes of operation after reaching the low level alarm setpoint.	Each GTG FOS also has an associated fuel oil day tank with a capacity to supply sufficient fuel oil for a period of one and a half hours (90 minutes). The low level alarm setpoint is established to ensure 60 minutes of operation after reaching the low level alarm setpoint.	9.5.4.1
5.5.1	The integral and day tanks may be combined in establishing the available capacity. This capacity shall assume the fuel consumption with the diesel running at 100 percent continuous rated load plus a minimum additional margin of 10 percent based on the minimum quality fuel oil that is acceptable and the most adverse operating conditions	The fuel oil storage tanks contain 7 days storage of fuel oil, plus an additional amount for periodic testing, based on 100% rated load plus a margin of 10%. The 1 ½ hours of oil in the day tanks is not combined with the oil in the storage tank when establishing the available capacity.	9.5.4.1
5.5.1	In addition to usable fuel oil capacity, day and supply tank design should include allowance for unusable fuel oil due to such factors as tank level instrumentation error, unaccessible fuel oil volumes due to the location of the inlet and outlet nozzles and pipes, and vortexing effects.	See Question No 09.05.04-9, RAI 9.5.4-4.	
5.5.1	The design shall include provisions for automatically transferring fuel oil from the supply tank to the day or integral tanks prior to actuation of the low level alarm.	The fuel oil transfer pump is automatically started and stopped on day tank level control.	9.5.4.2.4
5.5.1	The day or integral tanks should be located physically above the supply tank. When this configuration is used, an overflow line from the day or integral tank to the supply tank shall be provided.	The FOS is shown in Figure 9.5.4-1. The fuel oil day tanks are elevated above the GTGs to maintain a positive pressure at the suction of each gas turbines startup and main shaft driven	Figure 9.5.4-1 Section 9.5.4.2.2.3

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
		fuel oil pumps. One of the two 100% fuel oil transfer pumps takes suction from its fuel oil storage tank and discharges fuel oil to its associated GTG fuel oil day tank. Each pump is capable of supplying its GTG and, simultaneously, increasing the inventory in the fuel oil day tank. The fuel oil transfer pump is automatically started and stopped on day tank level control. Part of the pump discharge flow is returned to the fuel oil storage tank via the recirculation line. Any overflow is returned to the fuel oil storage tank via the recirculation line.	Section 9.5.4.2.4
5.5.1	Suction from all tanks shall be from above the tank bottom.	The fuel oil storage tank outlet connections are 6 inches above the tank bottom.	9.5.4.2.2.1
5.5.1	Fuel supply tank refill should be possible without interruption of the operation of the diesel generators. Fill nozzles should be designed to avoid unacceptable overall fuel quality resulting from disturbance of residual sediment in the supply tank	Each fuel oil storage tank has a fill connection, which terminates in a box allowing replenishment of fuel from an outside supply source (e.g., truck) without interrupting operation of the GTG.	9.5.4.2.2.1
5.5.2	Pumps shall be located so that sufficient net positive suction head is available under all design conditions, including pump runout.	See Question No 09.05.04-22, RAI 9.5.4-17.	
5.5.2	Pumps shall have sufficient head and capacity to transfer fuel oil to day or integral tanks as required, assuming fuel consumption with the diesel running at 100% continuous rated load or worst case accident capacity, whichever is greater	The pump head and capacity are shown in Table 9.5.4-1.	Table 9.5.4-1
5.5.2	Pump design shall allow for partial strainer blockage (pressure difference across strainer less than or equal to design limits) and for pump degradation as defined in American National Standard ASME Boiler and Pressure Vessel Code--1995, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components [8].	Each GTG FOS is serviced by a modularized skid mounted fuel oil transfer assembly, consisting of suction strainers, two fuel oil transfer pumps, a moisture separator, and a fuel filter with the interconnecting piping, valves, and instrumentation. The redundancy in strainers and pumps allow for one pump to operate with clean strainer while the second strainer and pump experience blockage or degradation.	9.5.4.2.2.2
5.5.2	Pumps shall be sized and the controls arranged so that excessive cycling is prevented.	The oil supply pumps are sized to prevent excessive cycling.	
5.5.2	The transfer pump shall be provided with a START-AUTO-STOP control switch and	Each fuel oil day tank is provided with level instrumentation to control the fuel	9.5.4.5

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
	indicator lights on a control panel.	oil transfer pumps, provide level indication on the GTG control cabinet, and indicate low and high level alarms in the GTG Room and in the MCR. Also, the transfer pump shall be provided with a START-AUTO-STOP control switch and indicator lights on the GTG control panel.	
5.5.3	Strainers shall be provided for each engine and arranged in parallel to allow cleaning of a dirty strainer during engine operation. The mesh of the strainers shall be as required by the pump manufacturer to prevent pump internal damage, or by the diesel engine manufacturer to prevent overloading of the engine fuel oil filter.	The strainers are a part of the modularized skid, and as such the mesh will be determined by the pump manufacturer	9.5.4.2.2.2
5.5.4	Filters shall be provided in the fill line to each supply tank. The filters shall be properly sized to prevent coagulated fuel oil and contaminants from entering the supply tank.	A moisture separator and duplex filters are provided in the fuel oil piping and a duplex fuel oil filter is provided on each GTG to prevent detrimental effects on performance from sediment	9.5.4.2.2.1
6.1	The safety classification of the fuel oil system and its components shall be in accordance with the requirements of ANS-58.14 [1].	The FOS is safety-related and the classification is described in Section 3.2.	9.5.4.1
6.1	The fuel oil system and its components shall meet the requirements of American National Standard ASME Boiler and Pressure Vessel Code-1995, Section VIII, Pressure Vessels [9]; American National Standard Power Piping, ANSI/ASME B31.1-1995 [10]; ANS-51.1 [6]; and ANS-52.1 [7].	Table 9.5.4-1 shows that all safety-related components are designed to meet the requirements of ASME Section III. This is an even stricter standard than what is required by ASME Section VIII. All non-safety related components are designed to B31.1.	Table 9.5.4-1
6.2	The fuel oil system shall be designed to applicable requirements of 3.2, "Plant Conditions and Plant Nuclear Safety Criteria," as defined by ANS-51.1 [6] and ANS 52.1 [7], and for continuous operation to perform its design function.	The FOS is safety-related and the classification is described in Section 3.2. System readiness and reliability for continuous operation is monitored by Tech Spec Surveillance Testing requirements.	9.5.4.1
6.2.1	Appropriate design pressures and temperatures shall be selected for all system components. These values shall be based on factors such as the maximum static head of fuel oil in tanks and piping and the maximum pump head developed at shutoff.	The design temperatures and pressures are shown in Table 9.4.5-1	Table 9.4.5-1
6.2.2	The fuel oil system shall be designed to accommodate, within applicable code allowable limits, the maximum pressure and coincident temperature under all Plant Conditions as defined in 6.2 of this	The design temperatures and pressures are shown in Table 9.4.5-1	Table 9.4.5-1

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
	standard.		
6.2.2	In addition, subsystems which utilize transfer pumps in parallel (having one in standby) shall provide pump suction overpressure protection against standby pump discharge check valve leakage and stuck open conditions.	The fuel oil transfer from the storage tank to the day tank is designed with two parallel pumps. However, this subsystem is designed for low pressure transfer and pump suction overpressure protection is not required, as transfer pump suction piping design pressure rating is generally much higher.	
6.2.3	Materials for pressure-retaining components shall be in accordance with American National Standard ASME Boiler and Pressure Vessel Code-1995, Section II, Material Specifications [13], where applicable. Materials shall be compatible with the fuel oil or used in conjunction with coatings referred to in 6.2.5 to preclude corrosion products and other impairments of diesel engine operation.	Pressure retaining component materials are Quality Group C per RG 1.26, this quality group implies that the materials are designed to ASME Section III Class 3. Materials are compatible with the fuel oil.	Table 3.2-1
6.2.4	The fuel oil system shall be arranged so that the system performance requirements of Section 5 are met. The location of day or integral tanks shall be as required by the diesel engine manufacturer.	A schematic of the FOS is shown in Figure 9.5.4-1. Performance requirements of Section 5 are addressed above. Location of the day tanks per manufacturer's requirements is addressed as part of the normal design and procurement process.	9.4.5.2.2.2 Figure 9.5.4-1
6.2.4	Permanent interconnections between fuel oil supply tanks and auxiliary equipment other than the emergency power system (e.g., heating boilers and engine driven fire pumps) should not be used. If such interconnections are made, analysis shall be performed to ensure that the fuel oil system reliability is not degraded and the minimum fuel oil storage requirements of the plant Technical Specifications are not violated.	N/A, not used	
6.2.4	The fuel oil system is safety-related and shall be located in a vital area, except for underground supply tanks and fuel oil transfer lines.	The FOS is safety-related and the classification is described in Section 3.2. The system is located in the Power Source Building, which is a vital area.	9.5.4.1 Figure 1.2-27
6.2.4	Underground supply tanks and fuel oil transfer lines, including those portions of interconnections to or from the underground supply tanks that terminate above ground (e.g., vent and fill lines), may be located inside the plant protected area and provided with a level of protection equivalent to that for components located in the vital area.	Each of the four GTG fuel oil storage tanks are contained in a separate, reinforced concrete seismic category I, and missile protected underground compartment. These compartments also contain the fuel oil transfer pumps, associated piping, valves, instrumentation, and connections for outside fuel oil supply. Each GTG is located in a separate seismic category I	9.5.4.2.1

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
		compartment. Each GTG room contains the GTG, one fuel oil day tank, piping, valves, and instrumentation. The compartments are separated to prevent a fire from spreading to another compartment. System component characteristics are provided in Table 9.5.4-1. Vent and fill connections are designed with a level of protection equivalent to that for components located in the vital area. This will be added to the section, as shown in the "Impact on DCD"	
6.2.4	Fuel oil supply tanks may be located above or below ground. In either case, the fuel oil system, including tanks and the associated vent and fill lines, shall be protected from tornadoes, floods, missiles, and other severe internal phenomena and man-made hazards.	See above	
6.2.4	Tanks shall be provided with an access opening and adequate space for inspection and maintenance of the tank, instrumentation, valves, piping, and other components located therein.	Flanged openings are provided as manholes for access to the tank interior and each tank is equipped with an internal sump and a drain connection. Tank compartments are underground, but, as stated in the response to RAI 9.5.4-11, they are accessible at all time for maintenance of all the equipment. Sufficient space around the tanks is provided for inspection and maintenance. Top of the tanks are accessible.	9.5.4.2.2.1
6.2.4	Minimum and maximum fuel oil temperature conditions required by the fuel specifications shall be satisfied by the arrangement and location of components.	The fuel oil storage tank is located in an underground vault and is ventilated. This design provides natural insulation and facilitates general fuel oil temperature protection against minimum and maximum conditions. In regions where low temperature exists for extended durations, a space heater, and/or tank heater, may also be provided to maintain fuel oil temperature within specification.	9.5.4.2.1
6.2.4	Adequate illumination, heating, and ventilation shall be provided for the system.	These features are discussed in Section 9.5.8.	9.5.8

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
6.2.4	For fuel oil supply tanks installed underground, the supply tank vent, stick gauge, or other level instrumentation and. fill connections extending above ground shall be protected from severe natural phenomena and man-made hazards, including the maximum flood level.	The fill and sample connections are located at grade elevation with locked-closed isolation valves and are capped and locked to prevent entry of moisture. The fuel oil storage tanks are vented to atmosphere, and the vent connection is located above the grade elevation. The vent is located above the maximum flood level. Vent and fill connections are designed with a level of protection equivalent to that for components located in the vital area. This will be added to the section, as shown in the "Impact on DCD".	9.5.4.3
6.2.4	Provision shall be made to allow refilling of the supply tanks after a design basis event. Such provision shall include radiation protection to allow access, if necessary. State and local codes, and regulations (e.g., Environmental Policy Act), shall be satisfied for underground or outside supply tanks.	Each fuel oil storage tank has a fill connection, which terminates in a box allowing replenishment of fuel from an outside supply source (e.g., truck) without interrupting operation of the GTG. All state, local codes and regulations and EPA requirements will be complied with for site specific detail design.	9.5.4.2.2.1
6.2.4	The arrangement shall provide for inservice inspection and testing in accordance with the ASME B&PVC, Section XI [8].	Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI, as discussed in Section 6.6 (Ref. 9.5.4-11).	9.5.4.4
6.2.5	Each supply tank shall have a shutoff valve in the fill line. A common fill line may be used for all supply tanks, and an alternate emergency fill line may be connected to supply tanks or day tanks, provided that the criteria of 6.2.4 are met.	The fill line incorporates a normally closed valve and a filler cap at the end to preclude the entrance of water. The fill line is above grade.	9.5.4.2.4
6.2.5	A fill line filter shall be provided. The fill line shall include such design features, and features for administrative control, that protection is provided against accidental contamination or siphoning.	Each Fuel Oil Storage Tank fill line incorporates a normally closed valve and a filler cap at the end to preclude the entrance of water. The fill line is above grade. The fill line has a strainer located downstream of the isolation valve to prevent entrance of solid material into the tank.	9.5.4.2.4
6.2.5	Supporting services (e.g., electrical power) required for operation of the fuel oil subsystem shall be from systems designed as safety-related and provided by the same safety division that are served by that fuel oil subsystem.	Supporting systems are safety-related.	Section 8.3 Chapter 7
6.2.5	Protection shall be provided as required against internal and external corrosion, such as by coatings or cathodic protection, or both, in accordance with Recommended Practice-Control of External Corrosion on	The exterior and interior surfaces of the fuel oil storage tanks are painted with a primer and finish coat system for corrosion protection of the tank surface. Exterior surfaces of the fuel oil transfer	9.5.4.2.2.1

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
	Underground or Submerged Metallic Piping Systems, NACE Standard RP-OI-69-1983 [14], or as recommended by the coating manufacturer.	piping are painted for corrosion protection.	
6.2.5	The use of an internal or external corrosion allowance or a double wall design is an adequate means of meeting the requirements of this section. The use of a corrosion allowance only is acceptable provided that the allowance is large enough to ensure integrity of the components and conformance with applicable design criteria for the design life of the components, and provided that corrosion products do not impair diesel engine operation.	N/A	
6.2.5	Zinc coatings should not be used on the interiors of tanks.	See Question 09.05.04-1	
6.2.5	Coatings on internal surfaces shall be applied through the use of qualified procedures and applications, such as required by Standard Practice for Quality Assurance for Protective Coatings Applied to Nuclear Facilities, ASTM D3843-1989 [15].	See Question 09.05.04-14, RAI 9.5.4-09	
6.2.5	Each tank shall be provided with a vent and a flame arrester.	Each fuel oil storage tank is equipped with a vent line with a flame arrestor and a level transmitter.	9.5.4.2.2.1
6.2.5	Provision shall be made for detecting and draining accumulated water from each tank.	A drain connection is included in the fuel oil storage tanks and fuel oil day tanks to remove accumulated water. A flexible hose may be used to connect from the drain nozzle to the suction side of the transfer pump, or a temporary pump, to forward any degraded fuel oil to a tank car to facilitate removal of accumulated water.	9.5.4.2.4
6.2.5	Provision shall be made to take readings of actual fuel oil level in each supply tank by a dip stick or other level indication.	All tank levels can be determined by dipsticks and level instrumentation.	9.5.4.5
6.2.5	Provision should be included in the fuel oil storage system to allow for periodic recirculation and filtration of the fuel oil inventory when the sampling and testing program shows a need to reduce entrained particulate matter. This may be either a permanent system or suitable connections for the temporary installation of a portable filtration skid. If such provisions are included, only the permanent connections up to the system isolation boundaries shall meet the design requirements of this section.	Testing may be performed by operation of the system in recirculation mode (bypassing the service day tank) and pumping fuel through the recirculation line back to the fuel oil storage tank. Recirculation mode includes passing through the filter to remove entrained particulate matter.	9.5.4.4

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
6.2.5	Fire protection for the diesel generator fuel oil system shall be provided in accordance with the applicable requirements of local, state, and federal law and the requirements of NFPA 30-1996 [11] and NFPA 37-1994 [12]. In the event of a conflict among these requirements, the most stringent shall govern.	Each fuel oil storage tank and fuel oil day tank is enclosed in its respective enclosure/GTG room which is fire rated for three hours of fire separation. The redundant FO Storage Tank compartments/GTG rooms are separated from each other by concrete walls, which are three hour rated fire barriers.	9.5.4.3
6.3.1	The fuel oil system shall meet the flow, capacity, pressure, temperature, and fuel oil chemistry requirements specified for the diesel generators with which it interfaces. This standard does not include that portion of the fuel oil system that is engine mounted and supplied by the diesel generator manufacturer.	Samples of new fuel oil are quality tested prior to replenishing the fuel oil storage tanks. In addition, samples of fuel oil in the storage tanks are periodically tested to monitor for contamination and degradation. Fuel oil samples are tested for water and sediment content, viscosity, specific gravity, and impurity level in accordance with ASTM D975 requirements and manufacturer's recommendations.	9.5.4.2.3
6.3.2	The electrical systems that support a fuel oil system shall be designed consistent with the requirements of the electrical systems with which they interface within the diesel generator unit. The design criteria shall be as set forth in IEEE 308 [4].	Electrical systems that support the fuel oil system is designed consistent with the requirements of the GTG.	Section 8.3
6.3.3.1	The following instruments and controls shall be provided in the design of the system: (1) One local pressure indicator, to be located in the discharge line from the fuel oil transfer pump. (2) One differential pressure indicator, which should be located in the engine control room, and one alarm for each set of parallel strainers.	Pressure indicators and a differential pressure alarm on the fuel oil transfer pump discharge strainers are provided. The filter in the discharge line to the fuel oil day tank is monitored by measuring differential pressures across the filter and by providing a high differential pressure alarm. Instrumentation has been added to Figure 9.5.4-1.	9.5.4.5 Figure 9.5.4-1
6.3.3.2	The following instruments and controls shall be provided in the design of the system: (1) High and low level alarms for each integral tank and day tank. (2) One level indicator for each tank; the indicators should be located in the engine control room. (3) Level switches on each day tank and integral tank for automatic start-stop of the fuel oil transfer pump in case of "low" and "full" level. (4) High and low level alarms for the supply tanks.	(1 and 2) Each fuel oil day tank is provided with level instrumentation to control the fuel oil transfer pumps, provide level indication on the GTG control cabinet, and indicate low and high level alarms in the GTG Room and in the MCR. (3 and 4) The fuel oil transfer pumps start and stop on low and high level, respectively, and the tank level transmitter activates a fuel oil day tank high or low level alarm. The fuel oil transfer pumps start automatically when the level in the day tank decreases to	9.5.4.5

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
		the set capacity. The day tank low-level alarm annunciates when the level decreases to a set point. The fuel oil transfer pumps are automatically stopped when the day tank level has increased to a higher set level.	
6.3.3.3	Alarms shall either be annunciated in the main control room or incorporated into a general control room trouble alarm with local individual alarms.	See above.	9.5.4.5
6.3.3.4	In accordance with the design requirements of 3.3.1.3.m in ANS-51.1 [6] and ANS-52.1 [7], any of the preceding instruments or controls that provide Information or controls to ensure the capability for manual or automatic actuation of safety-related functions shall be designed to meet the requirements set forth in 6.1.	The system is designed to ANSI 59.51, which includes meeting the requirements in ANSI-51.1 and ANSI-52.1.	Table 9.5.4-1
6.3.3.4	Temperature and pressure indicators (i.e., inline thermometers and pressure gauges) may be locally mounted.	Pressure indicators are shown on Figure 9.5.4-1. Temperature indicators are located on the transfer line to the day tank.	Figure 9.5.4-1
6.3.4	Ventilation systems that serve components of the fuel oil system shall be designed to meet the applicable design criteria set forth in American National Standard Safety Criteria for HV AC Systems Located Outside Primary Containment, ANSI/ANS-59.2-1985 [16].	There is no ventilation provided for the fuel oil system.	
6.3.5	Structures or enclosures that house components of the fuel oil system shall be designed to meet Seismic Category I requirements, and Codes and Standards for safety related structures set forth by Table 3-5 of ANS-51.1 [6] and ANS-52.1 [7].	Each of the four GTG fuel oil storage tanks are contained in a separate, reinforced concrete seismic category I, and missile protected underground compartment. These compartments also contain the fuel oil transfer pumps, associated piping, valves, instrumentation, and connections for outside fuel oil supply. Each GTG is located in a separate seismic category I compartment. Each GTG room contains the GTG, one fuel oil day tank, piping, valves, and instrumentation. The compartments are separated to prevent a fire from spreading to another compartment. System component characteristics are provided in Table 9.5.4-1.	9.5.4.2.1
6.4.1.1	Cleaning, flushing, and hydrostatic testing of fuel oil system tanks and fuel oil piping shall be completed prior to the initial filling	The FOS is tested prior to initial startup. Preoperational testing is described in Section 14.2. System performance is	9.5.4.4

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
	of the fuel oil tanks.	verified during periodic GTG testing.	
6.4.1.1	The fuel oil system shall be designed so that it can be tested periodically and for durations as defined in the plant Technical Specifications or test procedures without loss of the system function.	Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI, as discussed in Section 6.6 (Ref. 9.5.4-11). Technical Specification surveillance testing and inspection of the FOS is performed to assure operational readiness, as described in Chapter 16. Clarification is added to DCD Section 9.5.4.4 to address that Technical Specifications surveillance requirements will be performed without loss of the system function.	9.5.4.4
6.4.1.1	Vents, drains, and necessary connections for permanent or temporary flow, level, and pressure measuring devices shall be provided in the design to meet the testing requirements. The design should provide for calibration of the instrumentation.	This information will be added to the DCD in Section 9.5.4.4. See the "Impact on DCD" section of this response.	9.5.4.4
6.4.1.2	The design of the fuel oil system shall accommodate the testing requirements of this standard and the pre-service and inservice testing requirements of the ASME B&PVC, Section XI [8]. The design shall also accommodate the testing required by the plant Technical Specifications and by the preoperational and startup test program.	Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI, as discussed in Section 6.6 (Ref. 9.5.4-11). Technical Specification surveillance testing and inspection of the FOS is performed to assure operational readiness, as described in Chapter 14 and 14 and Chapter 16 of the DCD.	9.5.4.4
6.4.1.2	The design of the fuel oil subsystem shall accommodate fuel oil sample testing requirements (withdrawal) for periodic analysis. The sampling capability should include provisions to obtain a flowing sample and a tank aggregate sample.	Periodic sampling of the fuel oil quality in fuel oil storage tank is performed. Sampling has been addressed by Question No. 09.05.04-16, RAI 9.5.4-11 response.	9.5.4.4
6.4.1.3	Provisions for pump performance testing shall accommodate the requirements of the ASME B&PVC, Section XI, Subsection IWP [8].	Pump periodic testing is accomplished by the Tech Spec Surveillance Testing requirements Section 3.8.3.	9.5.4.5
6.4.1.4	The design shall provide for the measurement or determination (such as measuring differential tank volume) of the transfer pump flow rate.	The transfer pump operation is controlled by the Fuel Oil Day Tank level. RAI Question No.09.05.04-38 addresses this issue to add provision to measure FO Transfer Pump Flow Rate.	9.5.4.5
6.4.1.5	Preservice hydrostatic or pneumatic tests (when water contamination is a concern) shall be provided for as required by the ASME B&PVC, Section XI [8]. The design shall permit periodic inservice hydrostatic or pneumatic testing as defined in the ASME B&PVC, Section XI [8].	The FOS is tested prior to initial startup. Preoperational testing is described in Section 14.2. System performance is verified during periodic GTG testing.	9.5.4.5

ANSI/ANS-59.51-1997 Section	ANSI/ANS-59.51-1997 Requirement	MHI US-APWR Response	DCD Section
6.4.2	The design of the fuel oil system shall accommodate the preservice and inservice inspection requirements of the ASME B&PVC, Section XI [8].	Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI, as discussed in Section 6.6 (Ref. 9.5.4-11).	9.5.4.5
6.4.3	The fuel oil system shall be designed so that maintenance can be performed within the plant Technical Specification limits, and so that it is possible to remove and replace the fuel oil before degradation proceeds to the point where operation of the diesel generator system is threatened. The design of the fuel oil system should provide the capability to clean the system if fuel oil degradation or contamination occurs.	Prior to addition of new fuel oil into the storage tanks, samples will be tested for specific gravity, cloud point, and viscosity and will be visually inspected for appearance in accordance with ASTM D975 limits. A drain connection is included in the fuel oil storage tanks and fuel oil day tanks to remove accumulated water. A flexible hose may be used to connect from the drain nozzle to the suction side of the transfer pump, or a temporary pump, to forward any degraded fuel oil to a tank car to facilitate removal of accumulated water and fuel oil for maintenance and/or cleaning. See Question No. 09.05.04-21, RAI 9.5.4-16 for a discussion of cleaning.	9.5.4.5
6.4.3	The following design bases shall be used in determining the maintenance provisions or features needed to ensure that the fuel oil system satisfies its design function. (1) Pumps, valves, instruments, and controls should undergo routine inspection and maintenance operations in accordance with frequencies and instructions provided by equipment suppliers. (2) Methods of disassembling, checking, assembling, and testing should be in accordance with manufacturers' recommendations. (3) Replacement of parts shall be accomplished so that the system function is maintained. (4) Adequate vent and drain capability shall be provided for all components which required maintenance. (5) Access to equipment for expected maintenance shall be provided as required to accomplish the planned maintenance.	(1,2,3) These maintenance features will be performed in accordance with the component manufacturers' maintenance and operations manuals. (4) See Question No. 09.05.04-21, RAI 9.5.4-16 (5) See Question No. 09.05.04-16, RAI 9.5.4-11	
6.5	Applicable portions of American National Standard Quality Assurance Program Requirements for Nuclear Facilities, ANSI/ASME NQA-1-1994 [17], shall be applied to the design of the fuel oil system and its components.	See Question No. 09.05.04-29, RAI 9.5.4-24	

Impact on DCD

The following will be added as a new paragraph to the end of Section 9.5.4.4:

Vents, drains, and necessary connections required for the calibration of the instrumentation shall be provided.

The last paragraph of DCD Section 9.5.4.2.1 will be revised to read:

Each of the four GTG fuel oil storage tanks are contained in a separate, reinforced concrete seismic category I, and missile protected underground compartment. Each GTG is located in a separate seismic category I compartment. **The vent and fill lines are provided with a level of protection equivalent to that for components located in the vital area.** Each GTG room contains the GTG, one fuel oil day tank, piping, valves, and instrumentation. The compartments are separated to prevent a fire from spreading to another compartment. System component characteristics are provided in Table 9.5.4-1.

The third paragraph of DCD Section 9.5.4.4 will be revised to read:

Technical Specification surveillance testing and inspection of the FOS is performed to assure operational readiness, **without loss of system function** as described in Chapter 16

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 318-2227 REVISION 1
SRP SECTION:	09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System
APPLICATION SECTION:	TIER 2 9.5.4
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.04-11

RAI 9.5.4-06: The physical provisions for sampling the fuel oil are not fully described in the FSAR. Tier 2 Section 9.5.4.2.2.1 mentions a sampling connection on the fuel oil storage tanks, but does not describe the piping configuration. Industry experience has shown that some drain/sample connections at the bottom of a tank have been connected to small internal standpipes inside the tank, such that the drain/sample point was not really at the bottom of the tank, and water can accumulate at the bottom of the tank and possibly above the fuel discharge pipe. In addition, ANSI/ANS 59.51-1997 Section 6.4.1.2 states that the sampling capability should include provisions to obtain a flowing sample as well as a tank aggregate sample. The US-APWR FSAR does not mention capability for a flowing sample. FSAR Tier 2 Section 9.5.4.3 states that the fuel oil storage tank sample connections are located at grade elevation. It is not clear how the contents of a below grade tank can be sampled from a connection at grade without some means of lifting the oil up to grade elevation. Sample connections should also be shown on FSAR Figure 9.5.4-1. The applicant should address the guidance provided by the ANSI/ANS standard and fully describe the fuel oil sampling configuration in the FSAR.

ANSWER:

In accordance with ANSI/ANS 59.51-1997, there are provisions in the Fuel Oil Transfer System for both a flowing and a tank aggregate sample. The DCD will be revised to clarify that both these sample points exist. Figure 9.5.4-1will be revised to show the connections for both of these sample points (flowing sample and tank aggregate sample).

The Fuel Oil Storage Tanks are located in underground vaults. These vaults are accessible at all times, so that samples can be taken from the tank, without needing to raise the oil up to grade elevation.

Impact on DCD

The last paragraph of Section 9.5.4.3 will be revised to read:

The fuel oil storage tank inventory is sampled for quality on a periodic basis for specific gravity, water sediment, viscosity, contamination, algae formation, etc. and if degradation is detected, corrective action is taken, as discussed in subsection 9.5.4.2.3. **A flowing sample point is**

provided on the inlet line to the Fuel Oil Day Tank. A tank aggregate sample point is provided from the top of the tank to sample the fuel oil (including sediments and water) in the fuel oil storage tank. These sample points are shown in Figure 9.5.4-1.

See attached markup for revision to Figure 9.5.4-1.

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-12

RAI 9.5.4-07: The guidelines of NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability," state that fuel storage tanks have a gravity drain from the very bottom of the tank. The fuel outlet pipe or opening should be approximately 2 or 3 inches above the bottom of the water outlet pipe to allow some tank volume for settling of water. The applicant should confirm that this guideline has been met in the US-APWR design and update the FSAR to state that the guideline has been met.

ANSWER:

According to DCD Section 9.5.4.2.2.1, "In addition, the fuel oil storage tank outlet connections are 6 inches above the tank bottom." This allows for room for any water to settle inside the tank. Section 9.5.4.2.2.1 also states that "each tank is equipped with a drain connection." This drain meets the gravity drain requirements in NUREG/CR-0660. Therefore, the guidelines of NUREG/CR-0660 cited in the question are met.

Impact on DCD
For clarity, Figure 9.5.4-1 will be updated to show the drain connection coming from the bottom of the Fuel Oil Storage Tank, as shown in the attached markup.

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 318-2227 REVISION 1
SRP SECTION:	09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System
APPLICATION SECTION:	TIER 2 9.5.4
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.04-13

RAI 9.5.4-08: FSAR Tier 2 Section 9.5.4.2.2.1 describes the flame arrestor on the fuel oil storage tank and the fuel oil day tank. Both flame arrestors are vented to the outside. In order to meet the availability requirements of GDC 17, fuel oil and day tank vent flame arrestors must remain clear of insect nests, ice, etc. The applicant should provide verification that equipment and/or procedures will be in place to ensure continuous safe operation of the flame arrestor/vents and describe the design to ensure that the vents remain functional.

ANSWER:

As discussed in Section 9.5.4.3, "The fuel oil storage tanks vents are fitted with a flame arrestor to protect the tanks from an exterior fire. The end of the goose necked vent is covered with a fine meshed screen to prevent insects and debris from entering the vent." The goose necked vent design covered by a fine meshed screen should be sufficient to ensure the vent flame arrestors will be clear of insect nests, ice, etc

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-14

RAI 9.5.4-09: FSAR Tier 2 Section 9.5.4.3 states that fuel oil storage tanks are protected from corrosion. Section 9.5.4.2.2.1 states that a primer and a finish coat are applied to both the exterior and interior surfaces of the fuel oil storage tanks. However information regarding the tank protection materials, application, and inspection is not provided. The following information is necessary for the staff to conclude the tanks are sufficiently reliable.

1. Specify coating materials used to protect the fuel oil tank from corrosion.
2. Specify the standards used in the coating process.
3. Specify the inspections that are required and their frequency.
4. Specify any cathodic protection used as required for underground tanks by Regulatory Guide 1.137
5. Specify any cathodic protection system tests as required by Regulatory Guide 1.137

Background

The applicant has committed to fuel oil quality and testing consistent with the SRP Acceptance Criteria, which are contained in RG 1.137, "Fuel-Oil Systems for Standby Diesel Generators." The RG cites ANS-59.51 (ANSI N195-1976) Standard as a principal reference, which in turn cites ASTM D975. This last standard (ASTM D975) mentions that exposure to Cu or Zn could enhance the fuel degradation and promote gel formation (Section X3.7.2).

ANSWER:

DCD Section 9.5.4.1 states that the fuel oil storage and transfer system (FOS) is designed in accordance with RG 1.137, "Fuel-Oil Systems for Standby Diesel Generators" and ANS-59.51 (ANSI N195-1976) Standard. ANS-59.51 (ANSI N195-1976), 6.2.5 states that zinc coatings shall not be used on the interiors of tanks. Coatings on internal surfaces shall be applied through the use of qualified procedures and applications such as required by "Standard Practice for Quality Assurance for Protective Coatings Applied to Nuclear Facilities", ASTM D3843-1989. ASTM D 5163-96 provides guidelines that are acceptable to the NRC staff for establishing an in-service

coatings monitoring program for Service Level I coating systems in operating nuclear power plants and for Service Level II and other areas outside containment (as applicable).

The specific answers are as follows:

1. The coating used for the interior surfaces of the tanks is a primer and finish coat system for corrosion protection. The coating material will be epoxy coating that does not contain Cu or Zn.
2. The standard used in the coating process is "Standard Practice for Quality Assurance for Protective Coatings Applied to Nuclear Facilities", ASTM D3843-1989.
3. The inspection required for coatings used for interior and exterior surfaces of the tanks shall be in accordance with the guidelines specified in Standard Guide for Establishing a Program for Condition Assessment of Coating Service Level I Coating Systems in Nuclear Power Plants, ASTM D5163-96. The inspection of the coating used on the interior surfaces of the tanks will be every 10-year intervals when the tanks are emptied and cleaned.
4. Cathodic protection is not required for the fuel oil storage tanks. The fuel oil storage tanks are separately located underground in concrete vaults per DCD Section 9.5.4.3. RG 1.137, C.1.g states that a protective coating and impressed current-type cathodic protection system should be provide for tanks not located within a vault.
5. Cathodic protection system tests are not applicable for the fuel oil storage tanks

Impact on DCD

DCD Section 9.5.4.4 will be revised to add last paragraph to read as follows:

Fuel oil storage tanks and fuel oil day tanks interior coating will be inspected in accordance with ASTM D5163 Standard requirements. The inspection of the coating used on the interior surfaces of the tanks will be every 10-year intervals when the tanks are emptied and cleaned.

DCD 9.5.10 References add reference 9.5.4-13 to read as follows:

9.5.4-13 Standard guide for Establishing a program for Condition Assessment of Coating Service Level 1 Coating Systems in Nuclear power Plants, ASTM D5163-1996

Also refer to Question No. 09.05.04-1and 09.05.04-5.

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 318-2227 REVISION 1
SRP SECTION:	09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System
APPLICATION SECTION:	TIER 2 9.5.4
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.04-15

RAI 9.5.4-10: FSAR Tier 2 Section 9.5.4.3 states that the piping between the underground storage tank and the GTG building is routed in tunnels. The description does not indicate how the underground piping will be inspected. SRP Section 9.5.4 Paragraph 9.5.4.I.1.G, specifies that the design include the capability to detect and control system leakage, including isolating system portions in the event of excessive leakage or component malfunction. The FSAR should explain how the system design includes the capability to detect and control system leakage, including isolating system portions in the event of excessive leakage or component malfunction. In particular, the description should address the underground portions of the system.

ANSWER:

The underground piping in the GTG FOS is welded so that leakage is considered unlikely. The underground tunnels which contain the piping between the underground storage tank and the GTG building are accessible by plant personnel to perform periodic inspection as necessary.

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. SPBP 318-2227 REVISION 1
SRP SECTION:	09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System
APPLICATION SECTION:	TIER 2 9.5.4
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.04-16

RAI 9.5.4-11: SRP Section 9.5.4 Section I(L) identifies that the GTGFSS review include verification that sufficient space is provided for inspection, maintenance and repair of the system. However, neither drawings nor discussions are provided that allow adequate review of this aspect of the system design. The applicant should provide appropriate drawings and/or description to address this issue.

ANSWER:

There is sufficient space around each of the Fuel Oil Storage Tanks to perform inspections, maintenance, and repair of the system. DCD Section 9.5.4 will be revised to confirm that there is adequate clearance around the tank.

Impact on DCD
The second paragraph of DCD Section 9.5.4.2.2.1 will be revised to include:

Sufficient space around each fuel oil storage tank is provided for inspection, 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.

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-17

RAI 9.5.4-12: The on-engine fuel oil pumps are fed by gravity from the fuel oil day tank. Since each day tank feeds two GTs (there are 2 GTs per GTG), an analysis should be performed based on the as-built piping arrangement to ensure that the oil drawn by one of the two pumps, does not starve the other pump. The applicant should describe the method used to ensure that both GT on-engine pumps will receive oil at the required pressure.

ANSWER:

The piping from the fuel oil day tanks to the on-engine fuel oil pumps is connected to smack in the horizontal middle between two on-engine pumps. The piping from there to each on-engine pump is laid on GTG bilaterally-symmetrically. This design assures required pressure for both of on-engine pumps.

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-18

RAI 9.5.4-13: The applicant's supplemental document, "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)), Mitsubishi Heavy Industries, Ltd. (which is referenced in the Tier 2 FSAR Section 8.3.1), lists both diesel fuel and kerosene as potential fuels for the GTG. However, ASTM D975 limits fuel selection to diesel fuels. The applicant should address this inconsistency.

ANSWER:

In accordance with ASTM D975, only diesel fuels will be used for the Class IE 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

Docket No. 52-021

RAI NO.:	**NO. SPBP 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-19

RAI 9.5.4-14: The use of alternative fuels such as biodiesel could affect the system operating characteristics, maintenance requirements and equipment life. The effects of these new fuels may not be well known, especially the long term effects. The applicant should state whether the use of alternative fuels is anticipated and if it is, what provisions will be made to determine the possible affect on the GTGFSS and what measures will be taken to ensure continued operation of the system.

ANSWER:

There are no plans to use alternative fuels. It is not deemed necessary to study the effects of alternative fuels on the GTG Fuel Oil Transfer System.

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-20

RAI 9.5.4-15: The FSAR Tier 2 states that the fuel oil system is protected from cold temperatures (Section 9.5.4.2.1), and that the oil is maintained above the cloud point temperature (Section 9.5.4.3). However, the FSAR does not state how the system is protected from cold temperature or how the cloud point temperature is monitored. FSAR Tier 2 Chapter 16 Surveillance Requirement 3.8.3.3 references the GTG Fuel Oil Testing Program for details of how the quality of the oil will be tested and maintained. However the GTG Fuel Oil Testing Program described in FSAR Tier 2 Chapter 16 Section 5.5.13 does not specifically mention cloud point measurement. This fuel oil testing program also references ASTM but does not specify which ASTM standard will be used as the basis for testing the oil.

The GTG Fuel Oil Testing Program requirement for periodic testing includes only the measurement of particulate. It does not mention cloud point as a parameter that will be measured periodically. The initial testing (prior to adding new fuel oil to the storage tank) and periodic testing should also include measurement of other parameters including the moisture content of the oil and the viscosity (e.g., see Regulatory Position 2.b of RG 1.137. The description of fuel oil testing in the GTG Fuel Oil Testing Program is inconsistent with the system description in FSAR Tier 2 Section 9.5.4.2.3. The applicant should describe how the oil will be protected from cold temperatures, how the oil will be maintained above the cloud point and provide specific details on the testing and maintenance program for the oil. The FSAR should be revised to incorporate these requirements and to provide a consistent description.

ANSWER:

DCD Chapter 16 Technical Specifications (TS) Surveillance Requirement (SR) Bases 3.8.3.3 specifies the ASTM standards that are used for the basis for testing the oil. SR Bases 3.8.3.3, third paragraph states that "Within 31 days following the initial new fuel oil sample, the fuel oil is analyzed to establish that the other properties specified in Table 1 of ASTM D975-07b (Ref. 7) are met for new fuel oil when tested in accordance with ASTM D975-07b (Ref. 6), except that the analysis for sulfur may be performed in accordance with ASTM D1552-03, ASTM D2622-07, or ASTM D4294-03 (Ref. 6). The 31 day period is acceptable because the fuel oil properties of interest, even if they were not within stated limits, would not have an immediate effect on GTG

operation. This Surveillance ensures the availability of high quality fuel oil for the GTGs." Table 1 of ASTM D975-07b refers to ASTM Test Method D2500 for cloud point measurement.

Maintenance of the fuel oil temperature above the cloud point is achieved by an area electric heater located in the fuel oil storage tank vault, as necessary and by routing of the transfer piping in underground tunnel to the power source building. The fuel oil system can be maintained above the cloud point temperature with the area electric heater in service, as necessary and operation in the recirculation mode (bypassing the day tank) back to the fuel oil storage tank.

Impact on DCD

DCD Subsection 9.5.4.3 eighth paragraph will be revised to read as follows:

The fuel oil temperature is maintained above the cloud point to assure its quality. **The fuel oil temperature above the cloud point is achieved by an area electric heater located in the fuel oil storage tank vault, as necessary and by routing of the transfer piping in the underground tunnel to the power source building. The fuel oil in the transfer line can be maintained above the cloud point temperature with the area electric heater in service and operation in the recirculation mode (bypassing the day tank) back to the fuel oil storage tank.**

DCD Subsection 9.5.4.5, last paragraph will be added to read as follows:

The fuel oil storage tanks are provided with temperature instrumentation for temperature indication in the GTG control panel. The temperature instrumentation is provided to control the electric heaters in the fuel oil storage tank vaults to maintain the fuel oil system above the cloud point temperature.

See attached markup for revision to Figure 9.5.4-1 to include the temperature instrumentation.

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. SPBP 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-21

RAI 9.5.4-16: Aging of fuel is a quality issue that is typically addressed via a testing program. The FSAR does not specifically address fuel aging. In addition, US-APWR surveillance requirement 3.8.3.5 specifies that the fuel oil storage tanks will be checked for water accumulation and any water removed every 31 days or in accordance with the Surveillance Frequency Control Program. The guidance provided in Regulatory Positions 2.d through 2.f of RG 1.137 includes tests for the day tanks as well as the storage tanks and additional guidance for checking for water accumulation, corrective action to be taken if water is found, etc. This guidance also includes the complete removal of oil from the tanks and cleaning of the tanks at 10-year intervals. The applicant should provide specific information regarding the program to address fuel oil degradation and the guidance provided in RG 1.137.

ANSWER:

Aging of fuel is a quality issue that is typically addressed via a testing program per Surveillance Requirement SR 3.8.3.3 that states; "Verify fuel oil properties of new and stored fuel oil are tested in accordance with and maintained within limits of, the GTG Fuel Oil Testing program". As stated in the TS Bases for SR 3.8.3.3,

> "Fuel oil degradation during long term storage shows up as an increase in particulate, due mostly to oxidation. The presence of particulate does not mean the fuel oil will not burn properly in a gas turbine engine. The particulate can cause fouling of filters and fuel oil injection equipment, however, which can cause engine failure. Particulate concentrations should be determined in accordance with ASTM D5452-06 ....
> The Frequency of this test takes into consideration fuel oil degradation trends that indicate that particulate concentration is unlikely to change significantly between frequency intervals (31 days) per GTG Fuel Oil Testing program, DCD Chapter 16, Section 5.5.13.c."

The guidance provided in Regulatory Positions 2.d through 2.f of RG 1.137 which includes tests for the day tanks as well as the storage tanks and additional guidance for checking for water accumulation, corrective action to be taken if water is found, etc is included in responses to question no. 09.05.04-2.a, b and e.

The complete removal of oil from the tanks and cleaning of the tanks at 10-year intervals is addressed in response to question no. 09.05.04-5 (RAI CIB1 317-2061).

Impact on DCD

Refer to Question No. 09.05.04-5 (RAI CIB1 317-2061).

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 318-2227 REVISION 1
SRP SECTION:	09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System
APPLICATION SECTION:	TIER 2 9.5.4
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.04-22

RAI 9.5.4-17: Section 9.5.4.2.2.2 describes the fuel oil transfer pumps as components on modularized skids. FSAR Tier 2 Table 9.5.4-1 indicates that the fuel oil transfer pumps are designed to operate with a flooded suction. From Figure 9.5.4-1, it would appear that this transfer pump skid is at grade elevation and therefore above the tank. In order to ensure the GTGFSS design meets the availability requirements of GDC 17, staff needs information regarding available NPSH based on the design and on specified fuels. In addition, the applicant should specify a minimum NPSH required by the fuel oil transfer pumps. Available/required NPSH should be based on all pump design operating conditions, including pump runout.

ANSWER:

Figure 9.5.4-1 is a sketch, not meant to show the actual elevations of the equipment, however this figure is being revised for clarity as shown in the attached drawing. As addressed in RAI No. 09.05.04-08, these pumps are located in the storage tank vault, below the tank outlet, and are therefore able to operate with flooded suction.

The fuel oil transfer pumps are located in the fuel oil storage tanks vaults, as shown in the updated Figure 9.5.4-1, such that sufficient net positive suction head is available under all design conditions, including pump runout. The available NPSH is calculated based on all pump design operating conditions and is incorporated as part of the oil transfer pumps specifications to provide assurance from the pump vendor to properly design and fabricate the oil transfer pumps for their intended purpose. Once a vendor has been selected, the specific parameters for the pumps, including available NPSH, will be confirmed based on vendor documents.

Impact on DCD

Figure 9.5.4-1 will be updated as shown in the attached markup.

For clarity a paragraph will be added to the end of Section 9.5.4.2.2.2 stating:

Fuel oil transfer pumps are located in the fuel oil storage tanks vaults such that sufficient net positive suction head is available under all design conditions, including pump runout.

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

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US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	NO. SBPB 318-2227 REVISION 1
SRP SECTION:	09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System
APPLICATION SECTION:	TIER 2 9.5.4
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.04-23

RAI 9.5.4-18: Section 5.5.2 of ANSI/ANS-59.51-1997 includes a requirement that the fuel oil transfer pump design shall allow for partial strainer blockage and for pump degradation as defined in ASME Section XI. In addition, the standard requires that the pumps shall be sized and the controls arranged to prevent excessive cycling. FSAR Tier 2 Section 9.5.4 does not address this design criterion and therefore the applicant should state the design's compliance with the requirements of the ANSI/ANS standard or provide alternative criteria with justification.

ANSWER:

Each GTG FOS is serviced by a modularized skid mounted fuel oil transfer assembly, consisting of suction strainers, two fuel oil transfer pumps, a moisture separator, and a fuel filter with the interconnecting piping, valves, and instrumentation.

The redundancy in strainers and pumps allow for one pump to operate with clean strainer while the second strainer and pump experience blockage or degradation. DCD Chapter 16 Technical Specification (TS) surveillance testing, referenced in DCD Subsection 9.5.4.4, includes Inservice Testing (IST) in accordance with ASME Section XI (TS 5.5.8). Allowances for pump degradation are established as required by IST program requirements.

The fuel oil transfer pumps are sized to meet the system design requirements. This size ensures that there will not be excessive cycling of the pump.

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-24

RAI 9.5.4-19: FSAR Tier 2 Figure 9.5.4-1 indicates a containment curb around the fuel oil transfer pumps. If these pumps are located outdoors and uncovered, the applicant should provide a description of how rainwater accumulation will be monitored and removed to ensure that pump operation is not adversely impacted by the water.

ANSWER:

The FO Storage Tank and the fuel oil transfer pumps are located inside the underground compartments. Any spill will be contained inside the compartments. Since they are located in underground compartment, these components are not outdoors and not impacted by rainwater. Figure 9.5.4-1 will be revised to schematically show the location of the pumps in relation to the storage tanks. The location of the pumps in the underground vaults is clarified in response to Question No. 09.05.04-08.

Impact on DCD

The DCD has been changed by RAI No. 09.05.04-08, which also addresses this question.

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**TIER 2 9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-25

RAI 9.5.4-20: The description of system filters and strainers in FSAR tier 2 Section 9.5.4.5 is unclear and inconsistent with Figure 9.5.4-1. This section describes instrumentation for "fuel oil transfer pump discharge strainers" and separately describes instrumentation for "the filter in the discharge line to the day tank". These are the same lines – between the pump discharge and the day tank inlet – implying that there are both strainers and a filter in the line between the pump discharge and the day tank. In addition, neither the described filter nor the strainers are shown on Figure 9.5.4-1 or described in Table 9.5.4-1. The figure indicates only a single Y-type strainer in the transfer pump suction line. ANSI/ANS-59.51-1997 requires that two strainers be provided in a parallel arrangement that allows cleaning of a dirty strainer during engine operation. In addition, according to the "Qualification and Test Plan if Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)), Section C.2.2.6.4, a filter is provided between the day tank and the engine driven pump. Figure 9.5.4-1 does not show this filter. The applicant should resolve these inconsistencies, provide design information on the strainers/filters and revise the FSAR accordingly.

ANSWER:

The correct equipment description should state that there is a filter between the pump discharge and the day tank. The strainers and associated instrumentation described in Section 9.5.4.5 are on the fuel oil transfer pump suction. The description in Section 9.5.4.5 will be updated to reflect the correct design. Also, the filter between the pump discharge and the day tank will be added to Figure 9.5.4-1.

The strainers on the suction side of the fuel oil transfer pumps are part of the fuel oil transfer skid. There are two of these strainers, arranged in parallel. Figure 9.5.4-1 will be updated to show the correct arrangement of these strainers.

Impact on DCD

The second to last paragraph in Section 9.5.4.5 will be revised as follows:
Pressure indicators and a differential pressure alarm on the fuel oil transfer pump ~~discharge~~ **suction** strainers are provided.

Also, Figure 9.5.4-1 will be revised as shown in the attached markup.

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 318-2227 REVISION 1
SRP SECTION:	09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System
APPLICATION SECTION:	9.5.4
DATE OF RAI ISSUE:	4/6/2009

QUESTION NO. : 09.05.04-26

RAI 9.5.4-21: Section 5.5.4 of ANSI/ANS-59.51-1997 requires that filters be provided in the fill line to each fuel oil storage tank. FSAR Tier 2 Figure 9.5.4-1 does not show this filter and the system description in FSAR Tier 2 Section 9.5.4.2.4 states that a strainer is provided in the fill line. In addition, Figure A1 of the standard, while not considered a part of the standard, does provide a level of detail that reflects the design requirements of the standard and this level of detail should be used as the basis for Figure 9.5.4-1 of the FSAR. The applicant should fully and specifically address the requirements of the ANSI/ANS standard and to revise Figure 9.5.4-1 to provide a level of detail similar to that in Figure A1 of the standard and reflect the design commitments included in FSAR Tier 2 Section 9.5.4.

ANSWER:

The requirements of ANSI/ANS-59.51-1997 are fully and specifically addressed in Question No. 09.05.04-10 (RAI 9.5.4-05) response. Figure 9.5.4-1 will be revised to include the filters in the fill line to each fuel oil storage tank to provide a level of detail similar to that in Figure A1 of ANSI/ANS-59.51-1997. DCD Section 9.5.4.2.4 will be revised to state that a filter not a strainer is provided in the fill line.

Impact on DCD

Figure 9.5.4-1 will be revised as shown in the attached markup.

DCD Subsection 9.5.4.2.4, first paragraph, last sentence will be revised to read as follows:

The fill line has a ~~strainer~~ **filter** located downstream of the isolation valve to prevent entrance of solid material into the tank.

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 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-27

RAI 9.5.4-22: FSAR Tier 2 Section 9.5.4.2.4 states that part of the fuel oil transfer pump discharge is returned to the fuel oil storage tank via the recirculation line. The piping configuration shown on FSAR Tier 2 Figure 9.5.4-1 will not allow this function. The only path for recirculation to the storage tank is via the overflow from the day tank or by aligning the normally closed valves in the day tank drain line. The overflow is not an acceptable means to continuously return flow to the storage tank. The day tank drain line is shown on the figure with normally closed valves. The applicant should describe how the continuous recirculation function will work and show the piping for this function on Figure 9.5.4-1.

ANSWER:

The overflow is not intended to be used to continuously return flow to the storage tank. Recirculation is provided by appropriately lining up the recirculation valves in the open position to allow for periodic recirculation and filtration of the fuel oil inventory when the sampling and testing program shows a need to reduce entrained particulate matter. During the fuel oil day tank filling mode, part of the pump discharge do not need to be returned to the fuel oil storage tank. DCD Section 9.5.4.2.4 will be revised accordingly. Figure 9.5.4-1 will be revised to show the appropriate valves normally open during fuel oil day tank filling mode.

Impact on DCD

The second paragraph of Section 9.5.4.2.4 will be revised to delete the following sentence:

~~Part of the pump discharge flow is returned to the fuel oil storage tank via the recirculation line~~

Figure 9.5.4-1 will be revised as shown in the attached markup.

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

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US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-28

RAI 9.5.4-23: SRP Section 9.5.4, Paragraph 9.5.4 I.1.I specifies that adequate and acceptable sources of fuel oil are available, including the means of transporting and recharging the fuel storage tank, following a design basis accident. The staff considers that the combined license (COL) applicant is responsible for this in that it is a site specific item. The DCD applicant should include a COL information item for this provision.

ANSWER:

A COL information item will be added to address that adequate and acceptable sources of fuel oil are available, including the means of transporting and recharging the fuel storage tank, following a design basis accident.

Impact on DCD

DCD Section 9.5.9, COL 9.5(11) will be added to read:

COL 9.5(11) The COL Applicant is to specify that adequate and acceptable sources of fuel oil are available, including the means of transporting and recharging the fuel storage tank, following a design basis accident.

DCD Table 1.8-2, Compilation of All Combined License Applicant Items for Chapters 1-19 (sheet 42 of 44), will be revised as follows:

COL ITEM NO.	COL ITEM
COL 9.5(9)	*The COL Applicant addresses the emergency communication system requirements delineate in 10 CFR 73.55(f) such that a single act cannot remove onsite capability of calling for assistance and also as redundant system during onsite emergency crisis.*
COL 9.5(10)	*Deleted*
COL 9.5(11)	***The COL Applicant is to specify that adequate and acceptable sources of fuel oil are available, including the means of transporting and recharging the fuel storage tank, following a design basis accident.***
COL 10.2(1)	*Inservice Inspection* *The Combined License Applicant is to develop turbine maintenance and inspection procedure and then to implement prior to fuel load Plant startup procedure including warm-up time will be completed therein.*

Impact on COLA

There is 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

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Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-29

RAI 9.5.4-24: According to the "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)), the on-engine fuel oil pump is a screw-type pump. This type of pump will likely require a fuel oil recirculation line back to the day tank to relieve excess flow. Figure 9.5.4-1 does not show a recirculation line from the engine back to either of the fuel oil tanks. Also note that Section C.2.2.6.6 (2) states that the day tanks will include a connection for "engine pressure return". The applicant should explain how excess flow from the on-engine pump will be handled and to revise the FSAR as appropriate.

ANSWER:

GTG has fuel oil recirculation line internally (Please refer to Figure B.4.1-1 of "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0))). Therefore, fuel oil recirculation line back to the day tank is not needed for 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

Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-30

RAI 9.5.4-25: The NRC staff review of the quality assurance program found no specific mention of the GTGFSS within Section 9 or Section 17 of the FSAR Tier 2 document. Regulatory Guide 1.137 refers to Regulatory Guide 1.28 as the acceptance criteria for the GTGFSS quality assurance program. The applicant should describe the GTGFSS quality assurance program, including the acceptance criteria.

ANSWER:

The GTGFSS is classified per DCD Chapter 3, Table 3.2-2 as equipment class 3 and NRC quality group class C meeting the QA criteria of 10 CFR 50, Appendix B as stated in DCD Section 3.2.2.3 and Table 3.2-2 items for the Emergency Gas Turbine Auxiliary System. DCD Section 17.5 states that "During the Design Certification phase for US-APWR standard plant design, the MHI-NESH US-APWR Project Quality Assurance Program (QAP) is the top-level policy that establishes the quality assurance policy and assigns major functional responsibilities. The QAP provides for the methods and establishes the QAP and administrative control requirements described in "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1)" (MHI QAPD)(Ref 17.5.5-4), that meet 10 CFR Part 50, Appendix B and 10 CFR Part 52".

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

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Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 0**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-31

RAI 9.5.4-26: The "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)) references ANSI N195-1976 for the fuel oil system. This standard has been replaced by ANSI/ANS-59.51-1997. The applicant should update the references in the qualification and test plan document.

ANSWER:

The "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)) will be revised to replace references ANSI N195-1976 for the fuel oil system with ANSI/ANS-59.51-1997.

Impact on DCD

There is no impact on the DCD.
The "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)) will be revised.

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.

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RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-32

RAI 9.5.4-27: According to the "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)), Section C.2.2.6.6, the fuel oil day tanks shall be constructed in accordance with Underwriter's Laboratories Specification UL-142, Steel Aboveground Tanks for Flammable and Combustible Liquids. These tanks should be in accordance with ASME Section III, Class 3 as indicated in FSAR Tier 2 Table 9.5.4-1. The applicant should revise the qualification and test plan accordingly.

ANSWER:

The "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)), Section C.2.2.6.6, shall be revised to state that the fuel oil day tanks are constructed in accordance with ASME Section III, Class 3 in lieu of Underwriter's Laboratories Specification UL-142, Steel Aboveground Tanks for Flammable and Combustible Liquids.

Impact on DCD

There is no impact on the DCD.
The "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)) will be revised.

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.

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RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-33

RAI 9.5.4-28: According to the "Qualification and Test Plan of Class 1E Gas Turbine Generator System," December 2007(MUAP-07024-P(R0)), Section C.2.4.3 (2)(h) the fuel oil storage tanks will have a high-level alarm. FSAR Tier 2 Section 9.5.4.5 only mentions a low-level alarm for the storage tanks. The applicant should revise the FSAR to include the oil storage tank high-level alarm.

ANSWER:

DCD Tier 2 Section 9.5.4.5 will be revised to clarify that the fuel oil storage tanks are provided with low and high fuel oil level alarms in the MCR.

Impact on DCD

DCD Tier 2 Section 9.5.4.5, first paragraph, last sentence will be revised to read as follows:

Low and **high** fuel oil level in the fuel oil storage tanks ~~is~~ **are** alarmed in the MCR.

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.

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Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-34

RAI 9.5.4-29: The SRP Section 9.5.4 states that fuel oil temperature, pressure and level should be monitored to assure proper operation of the fuel supply system. The FSAR Tier 2 Section 9.5.4 does not state if the fuel oil temperature is monitored. The NRC staff requests that the applicant justify this apparent departure from the SRP.

ANSWER:

Refer to question no. 09.05.04-20, RAI 9.5.4-15, which has revised Figure 9.5.4-1 to include this instrumentation.

Impact on DCD
Refer to question no. 09.05.04-20, RAI 9.5.4-15

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.

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Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-35

RAI 9.5.4-30:

ITAAC items specific to the emergency power sources are listed in FSAR Tier 1 Table 2.6.4-1. Item 8 requires type tests and/or analyses to verify that the Class IE and ASME Section III portions of the GTG support systems are designed to seismic Category I. This item appears to be essentially the same as Item 6. The applicant should explain the distinction between Items 6 and 8 and revise the FSAR as appropriate.

ANSWER:

In response to RAI 182-1888 question 14.03.06-08 (MHI Ref: UAP-HF-09157, dated April 6, 2009), ITAAC items 6 and 8 in DCD Tier 1 Table 2.6.4-1 are being revised. ITAAC Item 6 in Table 2.6.4-1 will verify the seismic qualification of each Class 1E emergency power source (EPS). ITAAC Item 8 in Table 2.6.4-1 will verify the seismic qualification of the ASME Code Section III portions of the EPS support systems.

Impact on DCD

Refer to MHI's response to RAI 182-1888 question 14.03.06-08.

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.

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RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-36

RAI 9.5.4-31:

ITAAC Item 12 requires an inspection to ensure that each GTG system is independent of the other systems. There is a typographical error in this item in the Acceptance Criteria – "are isolated each other" should be "are isolated from each other". In addition, ITAAC Item 19 requires an inspection to ensure that the as-built GTGFSS is as described in FSAR Tier 1 Section 2.6.4.1. However the GTGFSS is described in Section 2.6.4.2.

ANSWER:

The requested editorial corrections to ITAAC items 12 and 19 in DCD Tier 1Table 2.6.4-1 are included in Attachment 1 to MHI's response to RAI 182-1888 (MHI Ref: UAP-HF-09157, dated April 6, 2009).

Impact on DCD

Refer to MHI's response to RAI 182-1888.

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.

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RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-37

RAI 9.5.4-32:

ITAAC Item 20 requires an inspection of the as-built GTGFSS to ensure that it is designed and constructed to ASME Section III and seismic Category I requirements. However, an inspection of the as-built system may not be sufficient to verify compliance with ASME Section III and seismic Category I requirements. Documentation, including analyses and tests, should also be examined to verify that the acceptance criteria are met. The applicant should expand the inspection requirements as required to ensure compliance and revise the table to clearly identify the additional inspections. This RAI also requests the applicant to verify that components that are not available as ASME Section III are verified to be of equivalent quality through application of this ITAAC.

ANSWER:

As described in response to RAI 242-2153 (MHI Ref: UAP-HF-09215 dated April 27, 2009), MHI will enhance the ITAAC for emergency power source (EPS) support systems in DCD Tier 1 Table 2.6.4-1, which apply to the fuel oil storage and transfer system (FOS). These changes to Tier 1 DCD Table 2.6.4-1 include the following:

- ITAAC Item 7 will be expanded to require hydrostatic testing of the EPS support systems' ASME Code Section III piping and components.
- ITAAC Item 26 will be added to require ASME Code Section III data reports and as-built reconciliation of the EPS support systems' ASME Code Section III piping and components.
- ITAAC Item 27 will be added to require non-destructive examination of the as-built EPS support systems' ASME Code Section III piping and components.

DCD Tier 2 Subsection 9.5.4.3 includes the following provision for the FOS: "... when an ASME Class 3 design component is not available, the component is proven to be of equivalent quality (through seismic design, testing, qualification and documentation)." Therefore, MHI will revise DCD Tier 1 Subsection 2.6.4.2 and Table 2.6.4-1 to address non-ASME III, safety related portion of the FOS.

Impact on DCD

DCD Tier 1 Subsection 2.6.4.2 renamed as "EPS Support Systems Design Description" based on response to RAI No.319 Question No.09.05.06-1, will be revised to add as follows:

If a safety-related mechanical component in the EPS support systems is not designed to ASME Code, Section III, then quality of the component is demonstrated and documented (e.g., seismic design, testing and qualification).

DCD Tier 1 Table 2.6.4-1, *EPS Systems Inspections, Tests, Analyses, and Acceptance Criteria,* will be revised to add the following ITAAC item:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
28. Quality is demonstrated and documented for each safety-related mechanical component of the EPS support systems that is not designed to ASME Code Section III.	**28. An inspection for the existence of a report will be performed.**	**28. A report exists and documents the quality of each as-built safety-related mechanical component of the EPS support systems that is not designed to ASME Code Section III.**

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.

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Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-38

RAI 9.5.4-33:

ITAAC Item 21 requires an inspection to ensure that each fuel oil transfer pump transfers fuel from the oil storage tank to the day tank. An inspection alone will not verify that the rate and pressure of the fuel oil delivered to the GTG is in accordance with the design. The applicant should provide testing requirements that will ensure that each GTGFSS can deliver oil at the required pressure and flow rate to support operation of the GTG per the design. These tests should also verify that the as-built configuration provides at least the minimum NPSH required by the as-purchased transfer pumps.

ANSWER:

As described in DCD Tier 2 Subsection 9.5.4.2, each Class 1E GTG is provided with 2 transfer pumps. Each transfer pump is capable of supporting GTG operation while simultaneously increasing day tank inventory.

The Tier 1 Subsection 2.6.4.2 fuel oil storage and transfer system (FOS) design description will be revised to describe the transfer pumps' capability in greater detail. ITAAC Item 21 in DCD Tier 1 Table 2.6.4-1 will be revised to require a test to demonstrate the ability of each FOS transfer pump to achieve a flow rate greater than the fuel consumption rate of the GTG at its continuous rated load.

MHI considers that net positive suction head (NPSH) is not directly measured during testing. Therefore, instead of establishing FOS transfer pump NPSH as an ITAAC test requirement, ITAAC Item 21 in Table 2.6.4-1 will be revised to require a report that documents the as-built FOS maintains sufficient NPSH under all design conditions. Refer to MHI's response to RAI 9.5.4-17 for changes to DCD Tier 2 Subsection 9.5.4 regarding transfer pump NPSH.

Impact on DCD

DCD Tier 1 Subsection 2.6.4.2, "EPS Fuel Oil Storage and Transfer Systems (FOS) Design Description," will be revised as follows (only the affected paragraph is shown):

"One of the two pumps transfers fuel oil from the fuel oil storage tank to the Class 1E EPS fuel oil day tank. **Each transfer pump is capable of supporting EPS operation at continuous rated load while simultaneously increasing day tank level. Sufficient transfer pump NPSH is maintained under all design conditions.** Fuel oil in the fuel oil day tank flows by gravity to feed the Class 1E EPS."

ITAAC Item 21 in DCD Tier 1 Table 2.6.4-1, will be revised as follows:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
21. Each fuel oil transfer pump transfers fuel oil from the fuel oil storage tank to the Class 1E EPS day tank **at a flow rate to support Class 1E EPS operation at continuous rated load while simultaneously increasing day tank level. Sufficient transfer pump NPSH is maintained under all design conditions.**	**21.a A test of each as-built Class 1E EPS FOS transfer pump will be performed.**	21.**a** Each as-built fuel oil transfer pump is designed to transfer fuel oil from the fuel oil storage tank to the as-built Class 1E EPS day tank, **at a flow rate to support Class 1E EPS operation at continuous rated load while simultaneously increasing day tank level.**
	21.**b** An inspection of each **division of the** as-built **Class 1E EPS FOS** ~~fuel oil transfer pump~~ will be performed.	**21.b A report exists and concludes that the as-built FOS is capable of supporting operation of the Class 1E EPS at continuous rated load while simultaneously increasing day tank level and maintaining sufficient NPSH under all design conditions.**

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

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RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-39

RAI 9.5.4-34:

ITAAC Item 22 requires an inspection to validate the gravity feed system from the day tank. As in Item 21, the fuel oil flow rate and pressure should be verified by tests.

ANSWER:

ITAAC Item 22 in DCD Tier 1 Table 2.6.4-1 is intended to verify by inspection that the EPS day tanks are located above each EPS gas turbines' fuel oil pumps, such that positive suction pressure is maintained at the fuel oil pumps. ITAAC Item 22 of Table 2.6.4-1 will be revised to clarify this feature as shown in response to RAI 9.5.4-35.

Impact on DCD

Refer to MHI's response to RAI 9.5.4-35.

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.

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Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-40

RAI 9.5.4-35:

FSAR Tier 1 does not include an ITAAC to verify the design volumes of the fuel oil day tank and fuel oil storage tank. The applicant should include an ITAAC to verify these volumes.

ANSWER:

The fuel oil storage and transfer system (FOS) design features in DCD Tier 1 Subsection 2.6.4.2 include the following:

- "Each fuel oil storage tank provides a seven day supply of fuel oil to its respective Class 1E EPS.
- Each fuel oil day tank provides sufficient fuel for 1.5 hours of Class 1E EPS operation and is elevated above its Class 1E EPS to provide gravity flow."

MHI will create individual ITAAC items for each of the above design features. ITAAC Item 22 in DCD Tier 1 Table 2.6.4-1, which currently addresses the day tanks' gravity flow design feature, will be revised to include the capacity requirement of 1.5 hours of GTG operation.

Impact on DCD

DCD Tier 1 Table 2.6.4-1 will be revised to modify ITAAC Item 22 and add new ITAAC Item 26 as follows:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
22. **Each Class 1E EPS FOS day tank's capacity is sufficient to provide fuel oil for 1.5 hours of GTG operation.** The fuel oil in ~~the~~ **each** fuel oil day tank flows by gravity to **maintain positive pressure at the fuel pumps for each** ~~feed the~~ Class 1E EPS.	22. An inspection **for the existence of a report for** ~~of~~ the as-built ~~fuel oil day tank~~ **FOS** will be performed.	**A report exists and concludes that each as-built Class 1E EPS FOS day tank's capacity is sufficient to provide fuel oil for 1.5 hours of GTG operation. The fuel oil in each fuel oil day tank flows by gravity to maintain positive pressure at the fuel pumps for each Class 1E EPS.** ~~The as-built fuel oil in the day tank flows by gravity to feed the as-built Class 1E EPS.~~
29. Each fuel oil storage tank provides a seven day supply of fuel oil to its respective Class 1E EPS.	**29. An inspection for the existence of a report for each as-built fuel oil storage tank for the Class 1E EPS will be performed.**	**29. A report exists and concludes that each as-built fuel oil storage tank for the Class 1E EPS provides a seven day supply of fuel oil to its respective Class 1E EPS**

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.

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Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-41

RAI 9.5.4-36: The GTGFSS operability may be demonstrated during tests of the GTG, or testing may be performed by operation of the system in recirculation mode (bypassing the service day tank) and pumping fuel through the recirculation line back to the fuel oil storage tank. This latter method of testing has the potential to inadvertently leave the system in a configuration that would not allow the system to perform its safety function. The test procedure should include measures to ensure that the system valves are correctly aligned following completion of the test.

ANSWER:

It is normal practice that the plant operating procedures to include the measures to ensure that the system operability is restored or maintained after the required system testing is performed. This includes the proper valve alignment for system operability following completion of the test in the recirculation mode.

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.

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Docket No. 52-021

RAI NO.:	**NO. SBPB 318-2227 REVISION 1**
SRP SECTION:	**09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System**
APPLICATION SECTION:	**9.5.4**
DATE OF RAI ISSUE:	**4/6/2009**

QUESTION NO. : 09.05.04-42

RAI 9.5.4-37: FSAR Tier 2 Section 9.5.4.2.2.3 states that the fuel oil day tanks are located separately from the adjacent GTG compartments by 3-hour rated fire barriers. This is in accordance with the guidance in RG 1.189. However, FSAR Tier 2 Figure 1.2-27 does not show any wall enclosing the fuel oil day tanks, separating them from the GTG area. The applicant should confirm that each day tank is enclosed by a 3-hour fire barrier which separates the day tank from the GTG and revise Figure 1.2-27 to show these barriers.

ANSWER:

According to RG 1.189, systems important to safety should be isolated or separated from combustible materials. However, the RG also states, "Examples of such combustible materials that may not be separable from the remainder of its system are EDG fuel oil day tanks, turbine-generator oil and hydraulic control fluid systems, and RCP lube oil systems." Therefore the GTG fuel oil day tanks do not need to be separated from the GTG. The sentence in the DCD will be clarified to show that the 3-hour rated fire barriers are between each GTG compartment, not between the day tanks and the GTG.

Impact on DCD

The first paragraph of DCD Section 9.5.4.2.2.3 will be revised to say:

Each GTG fuel oil day tank provides one and half (1 ½) hours of operation for its associated GTG at continuous rating without refilling from the corresponding fuel oil storage tank. The fuel oil day tanks are located **in the GTG compartments which are** separate~~ly~~**ed** from the adjacent GTG compartments by 3-hour rated fire barriers.

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 Figure 9.5.4-1

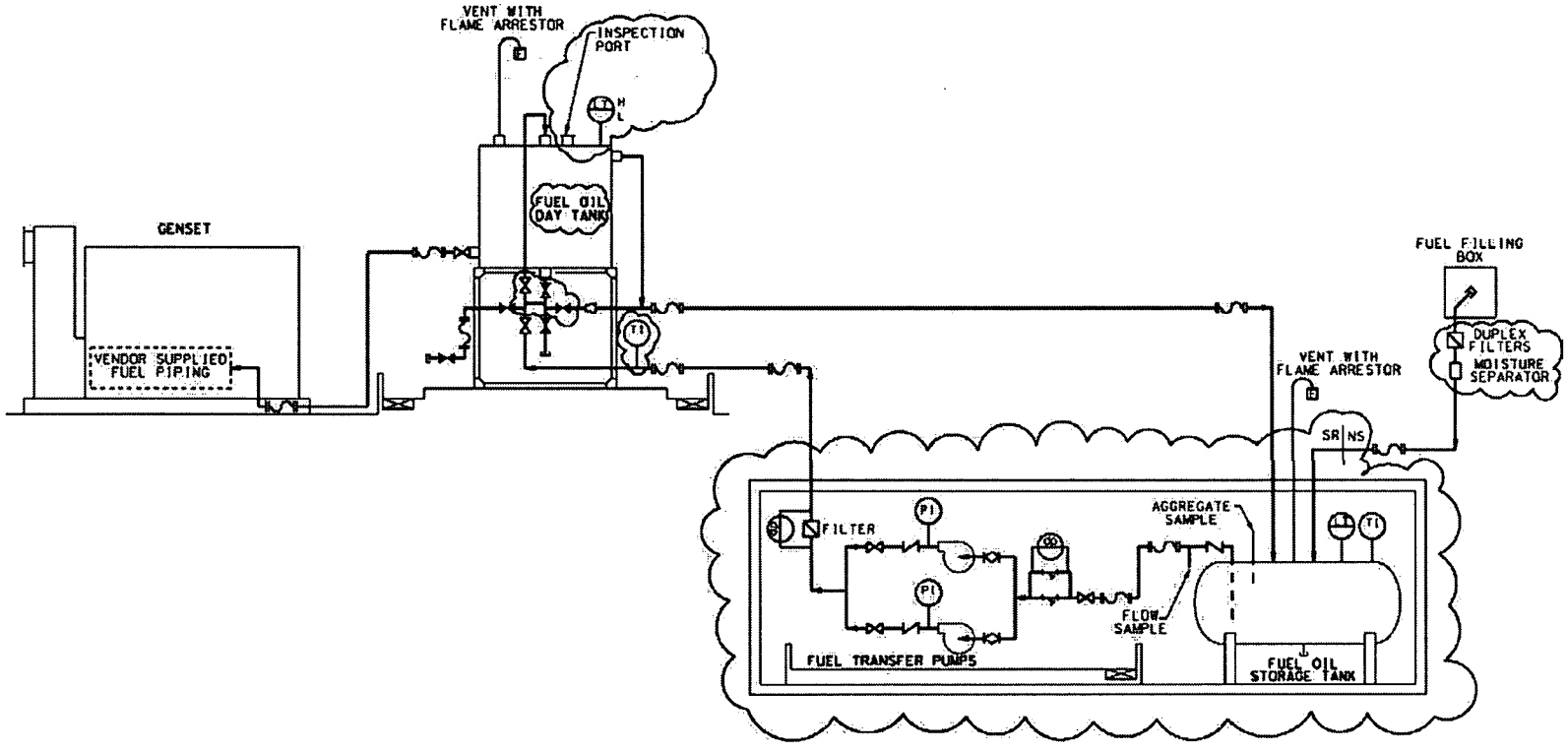

Figure 9.5.4-1 Gas Turbine Generator Fuel Oil Storage and Transfer System Schematic Diagram