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## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

### APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 459-8573  
SRP Section: 09.05.04 – Emergency Diesel Engine Fuel Oil Storage and Transfer System  
Application Section:  
Date of RAI Issue: 04/14/2016

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### **Question No. 09.05.04-14**

In response to RAI 152-8006, Question 09.05.04-5, the applicant stated that the capacity of the fuel oil storage tank, fuel oil transfer pump, and fuel oil day tank will be based on the fuel consumption rate provided by the Emergency Diesel Generator (EDG) supplier. Consequently, the fuel consumption rates and capacity information were deleted from Table 9.5.4-1. The deletion of this information, however, does not address the original RAI question as to how design commitments can be verified against as-built configurations via inspection, tests, analyses, and acceptance criteria (ITAAC). Therefore, the applicant is requested to identify the designed fuel consumption rates and capacity of the fuel oil storage tank, fuel oil transfer pump, and fuel oil day tank in Table 9.5.4-1 and to provide the proper acceptance criteria in Table 2.6.2-3 (ITAAC) to confirm that the as-built conditions meet the design commitments. The reference to a future EDG-supplier report is not the proper acceptance criteria to be used in an ITAAC.

### **Response**

As stated in the response to RAI 152-8006, Question 09.05.04-5, values related with fuel consumption rate will be provided as plant-specific information by the EDG supplier. The deleted information of the fuel consumption rates and capacity is conceptual design information based on existing plant EDGs and preliminary design information. This information will be put back in Table 9.5.4-1 as bracketed to denote that it is conceptual design information.

In RAI 234-8284, Question No. 14.03.06-3 (reference MKD/NW-15-0142L dated 09/14/2015; ML15257A430), NRC staff requested to modify the acceptance criteria on design commitment item 9, for the fuel storage capacity of the EDG, and design commitment item 10, for the fuel day tank capacity of the EDG, in DCD Tier 1, Table 2.6.2-3. See Attachment 2 for the revised ITAAC wording.

Also, the acceptance criteria for design commitment item 8.a, with regards to the diesel fuel oil transfer pump's capacity of the EDG, is already provided to confirm that the as-built conditions meet the design commitment in Table 2.6.2-3 (4 of 7) of DCD.

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**Impact on DCD**

DCD Tier 2, Table 9.5.4-1 will be revised as indicated in Attachment 1.

DCD Tier 2, Table 2.6.2-3 provided for information only in Attachment 2.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical Specifications**

There is no impact on the Technical Specifications.

**Impact on Technical/Topical/Environmental Reports**

There is no impact on any Technical, Topical, or Environmental Report.

## APR1400 DCD TIER 2

Table 1.8-1 (2 of 2)

Structure, System or Component	Interface Type	DCD Tier 2 Section
Components		
UHS cooling tower	CDI	9.2.5.2.2.1
UHS piping, valves, and fittings	CDI	9.2.5.2.2.2
UHS cooling tower basin	CDI	9.2.5.2.2.3
UHS cooling tower basin screens	CDI	9.2.5.2.2.4
Circulating water pumps	CDI	10.4.5.2.1
Cooling tower	CDI	10.4.5.2.3
Cooling tower basin	CDI	10.4.5.2.3
Cooling tower basin screen	CDI	10.4.5.2.3
Cooling tower makeup and blowdown pump	CDI	10.4.5.2.3
ESW blowdown piping	CDI	9.2.1.2.1
Condenser vacuum pressure of a high pressure alarm and turbine trip	CDI	10.4.1.5, 10.4.2.2.2
Cooling tower chemical injection system	CDI	10.4.5.2.3
Cation-bed ion exchanger vessels	CDI	Table 10.4.6-1
Mixed-bed ion exchanger vessels	CDI	Table 10.4.6-1
Spent resin holding tanks	CDI	Table 10.4.6-1
Resin holding tank	CDI	Table 10.4.6-1
Resin mixing and holding tank	CDI	Table 10.4.6-1
Resin traps	CDI	Table 10.4.6-1

Fuel oil storage tanks, fuel oil day tanks, and fuel oil transfer pumps	CDI	Table 9.5.4-1
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APR1400 DCD TIER 2

RAI 152-8006\_ Question 09.05.04-5

Table 9.5.4-1 (1 of 2)

RAI 459-8573\_ Question 09.05.04-14

Emergency Diesel Engine Fuel Oil System Component Data

Fuel Oil Storage Tank	
Quantity	4
Type	Horizontal, Cylinder
Fuel Consumption Rate at Continuous Rated Load	31.5 L/min (8.32 gpm)
Capacity (usable volume)	363,360 L (96,000 gal)
Operating Pressure/Temperature	Atmosphere/Ambient
Material of Construction	Coated Carbon Steel (does not contain Cu or Zn)
Interior Coating	N/A
Design Pressure/Temperature	ATM/ 65 °C (150 °F)
Design Code	ASME Section III, Class 3
Seismic Category	I
Fuel Oil Transfer Pumps	
Quantity	8
Type	Horizontal, centrifugal
Capacity (each pump)	64.3 L/min (17 gpm)
Total Differential Head	21.3 m (70 ft)
Net Positive Suction Head	Flooded Suction
Material	-
Casing	Stainless Steel
Impeller	Bronze
Pump Shaft	Stainless Steel
Design Code	ASME Section III, Class 3
Driver	Electrical Motor
Horse Power	3 HP @ 1800 RPM
Power Supply	460 V, 60 Hz, 3-Phase, Class 1E safety motor control center
Seismic Category	I

Delete

Fuel Consumption Rate at Continuous Rated Load	[[31.5 L/min (8.32 gpm)]]
Capacity (usable volume)	[[363,360 L (96,000 gal)]]

Capacity (each pump)	[[64.3 L/min (17 gpm)]]
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APR1400 DCD TIER 2

RAI 152-8006\_ Question 09.05.04-5

Table 9.5.4-1 (2 of 2)

RAI 459-8573\_ Question 09.05.04-14

Fuel Oil Day Tanks	
Quantity	4
Type	Horizontal, Cylinder
<del>Fuel Consumption Rate at Continuous Rated Load</del>	<del>31.5 L/min (8.32 gpm)</del>
<del>Capacity (usable volume)</del>	<del>2,078 L (549 gal)</del>
Operating Pressure/Temperature	Atmosphere/Ambient
Design Pressure/Temperature	4.6 kg/cm <sup>2</sup> G (65 psig) / 65 °C (150 °F)
Material of Construction	Coated Carbon Steel (does not contain Cu or Zn)
Interior Coating	N/A
Design Code	ASME Section III, Class 3
Seismic Category	I
Piping, Fittings, and Valves	
Design Pressure	3.5 kg/cm <sup>2</sup> G (50 psig)
Design Temperature	65 °C (150 °F)
Material	Carbon Steel
Design Code (Safety-related Portion)	ASME Section III, Class 3
Seismic Category	I
Non-safety-related Portions	ASME B31.1
Flame Arrestors (Storage and Day Tanks)	Manufacturer's Standards

Delete

Fuel Consumption Rate at Continuous Rated Load	[[31.5 L/min (8.32 gpm)]]
Capacity (usable volume)	[[2,078 L (549 gal)]]

APR1400 DCD TIER 1

RAI 234-8284\_ Question 14.03.06-3

RAI 459-8573\_ Question 09.05.04-14

Table 2.6.2-3 (4 of 7)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6.c All displays required by the design exist in the MCR as defined in Table 2.6.2-2.	6.c Inspections will be performed on the displays in the MCR.	6.c All displays exist and be retrieved in the as-built MCR as defined in Table 2.6.2-2.
6.d All displays required by the design exist in the RSR as defined in Table 2.6.2-2.	6.d Inspections will be performed on the displays in the RSR.	6.d All displays exist and be retrieved in the as-built RSR as defined in Table 2.6.2-2.
7. Each mechanical division of EDG and its support systems (A, B, C & D) is physically separated from the other divisions.	7. Inspection of the as-built mechanical divisions will be performed.	7. Each mechanical division of the EDG is physically separated by a divisional wall or a fire barrier.
8.a Each diesel fuel oil transfer pump is capable of transferring oil from the diesel fuel oil storage tank to its corresponding day tank at sufficient pressure and flow to cover the maximum demand at EDG continuous rated load while simultaneously increasing day tank level.	8.a.i Analysis of each diesel fuel oil transfer pump will be performed to determine the required flow rate to support the maximum demand of the EDG at continuous rated load while simultaneously increasing day tank level.	8.a.i A report exists and concludes that each fuel oil transfer pump is sized to transfer fuel oil from the fuel oil storage tank to its as- built corresponding day tank, at a flow rate to support the maximum demand of the Class 1E EDG at continuous rated load while simultaneously increasing day tank level.
	8.a.ii Test of each diesel fuel oil transfer pump will be performed to verify that the fuel oil transfer pump flow rate bounds the analysis.	8.a.ii A report exists and concludes that each diesel fuel oil transfer pump flow rate bounds the analysis.
8.b The diesel fuel oil transfer pumps have sufficient net positive suction head (NPSH).	8.b Test to measure the as-built diesel fuel oil transfer pump suction pressure will be performed. Inspection and analyses to determine NPSH available to each pump will be performed based on test data and as-built data.	8.b A report exists and concludes that as-built calculated NPSH available exceeds each diesel fuel oil transfer pump's NPSH required.
9. Each EDG has fuel storage capacity to provide fuel to its EDG for a period of seven days with the EDG supplying the power requirements for the most limiting design basis event.	9. <del>Inspections and analyses will be performed to determine fuel storage capacities and EDG fuel consumption.</del>	9. <del>A report exists and concludes that each EDG has fuel storage capacity to operate the EDG for seven days with the EDG supplying power during the most limiting design basis event.</del>

9.a Analyses will be performed to determine fuel oil storage capacities and EDG fuel consumption.

9.b Inspection will be performed to verify that each as-built fuel oil storage tank's capacity bounds the analysis.

9. A report exists and concludes that each EDG has fuel storage capacity to operate the EDG for seven days with the EDG supplying power during the most limiting design basis event.

9.a A report exists and concludes that each fuel oil storage capacity is sufficient to operate the EDG for seven days with the EDG supplying power during the most limiting design basis event.

9.b The each as-built fuel oil storage tank's capacity bounds the analysis.

APR1400 DCD TIER 1

RAI 234-8284\_ Question 14.03.06-3

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10.a Analyses will be performed to determine day tank capacities and EDG fuel consumption.

10.b Inspection will be performed to verify that each as-built day tank capacity bounds the analysis.

Table 2.6.2-3 (5 of 7)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. Each day tank provides fuel oil for at least 60 minutes plus a minimum additional margin of 10 percent at EDG rated load.	10. <del>Inspections and tests will be performed to determine day tank capacities and EDG fuel consumption.</del>	10. <del>A report exists and concludes that each day tank's capacity is sufficient to provide fuel oil for at least 60 minutes plus a minimum additional margin of 10 percent at EDG rated load.</del>
11. One transfer pump in each train is designed to automatically supply diesel fuel oil from the storage tank to the day tank prior to actuation of low level alarm and stops automatically on a fuel oil day tank high-level signal.	11. Tests will be performed on the as-built fuel oil transfer pump in each train by providing a test signal of a simulated fuel oil day tank level in only one train at a time.	11. The as-built transfer pump in each train starts automatically to supply diesel fuel oil from the storage tank to the day tank prior to actuation of low level alarm and stops automatically on a fuel oil day tank high-level signal.
12. Each lube oil makeup tank provides lube oil to its respective EDG for seven continuous days of EDG full power rated operation.	12. <del>Inspections and tests will be performed to determine lube oil makeup tank capacities and EDG lube oil consumption.</del>	12. <del>A report exists and concludes that each lube oil makeup tank provides lube oil to its respective EDG for seven continuous days of EDG full power rated operation.</del>
13. The starting air system receiver tanks of each EDG have a combined air capacity for five starts of the EDG without replenishing air to the receiver tanks.	13. Tests will be performed with the EDGs and their air start systems.	13. Each EDG is started five times without replenishing air to the receiver tanks.
14. The air intakes for EDG combustion are separated from the EDG exhaust ducts.	14. Inspection and analysis of the as-built EDG air intakes and air exhaust will be performed.	14. The air intake and air exhaust for each EDG are separated. The air intakes and exhausts of the four EDGs are separated by the location of the EDGs on opposite sides of the nuclear island structures.

12.a Analyses will be performed to determine lube oil makeup tank capacities and EDG lube oil consumption.

12.b Inspection will be performed to verify that each as-built lube oil makeup tank capacity bounds the analysis.

12.a A report exists and concludes that each lube oil makeup tank provides lube oil to its respective EDG for seven continuous days of EDG full power rated operation.

12.b The each as-built lube oil makeup tank's capacity bounds the analysis.

10.a A report exists and concludes that each day tank's capacity is sufficient to provide fuel oil for at least 60 minutes plus a minimum additional margin of 10 percent at EDG rated load.

10.b The each as-built day tank's capacity bounds the analysis.