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.:	**57-7965**
SRP Section:	**08.03.01 – AC Power Systems (Onsite)**
Application Section:	**08.03.01**
Date of RAI Issue:	**07/01/2015**

Question No. 08.03.01-2

DCD Tier 2, Section 8.3.1.1.2.4, page 8.3-8, states that “The Class 1E EDG rating shown in Tables 8.3.1-2 and 8.3.1-3 is based on the characteristics of each load and the combined bus load demand connected to each diesel generator during the worst-case operating condition. Trains A and B EDGs are rated at 9,100 kW continuous rating and 10,010 kW short-time rating (2 hours), and trains C and D EDGs are rated at 7,500 kW continuous rating and 8,250 kW short-time rating.”

The staff noticed that the EDG output values provided in DCD Section 8.3 are different from that of Technical Specification (TS) Section B3.8, namely, the continuous service rating of trains A and B EDGs is 8,700 kW, and the rating for trains C and D EDGs is 7,000 kW with 10% overload permissible for up to 2 hours in any 24-hour period.

Explain the differences of EDG ratings provided in DCD vs. TS and provide the correct continuous and short-time ratings for the EDGs.

Response

The continuous rating and short-time rating of each EDG specified in DCD Tier 2, Subsection 8.3.1.1.2.4 are consistent with the latest calculation result. However, the latest ratings are not properly reflected in the Technical Specification (TS) bases, Subsection B3.8.1. The sentence in TS Subsection B3.8.1 will be revised as follows to be consistent with the DCD Tier 2 Subsection:

“The continuous service rating of each EDG A and B is 9,100 kW and each EDG C and D is 7,500 kW with 10% overload permissible for up to 2 hours in any 24-hour period.”

Impact on DCD

Same as changes described in Impact on Technical Specifications section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

TS Subsection B 3.8.1 will be revised as shown in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

BASES

BACKGROUND (continued)

The onsite standby power source for each 4.16 kV ESF bus is a dedicated EDG. EDGs [1A, 1B, 1C, and 1D] are dedicated to ESF buses [SW1A, SW1B, SW1C, and SW1D], respectively. An EDG starts automatically on a safety injection (SI) signal (i.e., low pressurizer pressure or high containment pressure signals) or on an ESF bus degraded voltage or undervoltage signal. After the EDG has started, it will automatically tie to its respective bus after offsite power is tripped as a consequence of ESF bus undervoltage or degraded voltage, independent of or coincident with an SI signal. The EDGs will also start and operate in the standby mode without tying to the ESF bus on an SI signal alone. Following the trip of offsite power, a sequencer strips nonpermanent loads from the ESF bus. When the EDG is tied to the ESF bus, loads are then sequentially connected to its respective ESF bus by the automatic load sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the EDG by automatic load application.

In the event of a loss of preferred power, the ESF electrical loads are automatically connected to the EDGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a design basis accident (DBA), such as a loss-of-coolant accident (LOCA).

Certain required unit loads are returned to service in a predetermined sequence in order to prevent overloading the EDG in the process. Within 1 minute after the initiating signal is received, all loads needed to recover the unit or maintain it in a safe condition are returned to service.

Ratings for Trains A, B, C, and D EDGs satisfy the requirements of NRC RG 1.9 (Reference 3). The continuous service rating of each EDGs A and B are ~~8,700~~ 9,100 kW and EDGs C and D are ~~7,000~~ 7,500 kW with 10 % overload permissible for up to 2 hours in any 24-hour period. The ESF loads that are powered from the 4.16 kV ESF buses are listed in Reference 2.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in DCD Tier 2, Chapters 6 (Reference 4) and 15 (Reference 5), assume ESF systems are OPERABLE. The AC electrical power sources are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, reactor coolant system (RCS), and containment design limits are not exceeded.

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.:	**57-7965**
SRP Section:	**08.03.01 – AC Power Systems (Onsite)**
Application Section:	**8.3.1**
Date of RAI Issue:	**07/01/2015**

Question No. 08.03.01-3

GDC 17 states that “the onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure.”

DCD Tier 2, Section 8.3.1.1.4, describes the Class 1E electrical equipment (switchgear, EDG, battery & DC system equipment) layout in the auxiliary building and the EDG building.

However, in this section, the Class 1E system equipment layout in other areas (such as in reactor building, safeguards building, Turbine Island, Fuel building, Circulating Water and Essential Service Water building, Ultimate Heat Sink (Building/area), and Radwaste Building) are not discussed. The following needs to be provided:

1. Discuss the Class 1E equipment layout in other areas where Class 1E equipment items are to be located. Discuss how the independence and the physical separation for this equipment is achieved.

2. Discuss whether these Class 1E equipment pieces are interface and/or COL items.

3. Discuss the seismic category where each of the above pieces of equipment are located.

4. Revise the DCD with Class 1E equipment location information for other locations, as applicable.

Response

Other than the auxiliary building (AB) and the EDG building (EDGB), two geographically separated essential service water (ESW) buildings (Division I and Division II) are the only areas where Class 1E electrical equipment are located. The Class 1E Train A motor control center (MCC) is located in the Division I ESW Building and the Train B MCC is located in the Division II ESW Building. The term “Pump House” in Table 3.2-1 will be revised to reflect the appropriate nomenclature for the location.

As indicated in DCD Tier 2, Table 3.2-1 (2 of 86), the ESW buildings are Seismic Category I buildings.

Impact on DCD

DCD Tier 2, Table 3.2-1 (45 of 86) and Subsection 8.3.1.1.4 will be revised as shown in the Attachment.

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 Reports.

Table 3.2-1 (45 of 86)

Item No. / Principal SSCs	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
67. PG – 480V Class 1E Load Center							
a. 480V LCs and LC XFMRs	AB	SC-3	N/A	IEEE 308-2001, IEEE 323-2003, IEEE 344-2004, IEEE 420-2013	Yes	I	
68. PH – 480V Class 1E MCC and Low Voltage							
a. 480V MCCs 120/208V distribution panels and XFMRs	AB ~~Pump House~~ EDGB ESWB	SC-3	N/A	IEEE 308-2001, IEEE 323-2003, IEEE 344-2004, IEEE 420-2013	Yes	I	
69. PM – MCR							
a. Control console (RO, TO, EO, SS, STA)							
1) Frame	AB	SC-3	N/A	IEEE-323-2003 IEEE-344-2004 IEEE-420-2013 IEEE-603-1991	Yes	I	
2) Information FPD	AB	NNS	N/A	N/A	A	II	(3)(d)
3) ESF-CCS soft control module	AB	SC-3	N/A	IEEE-603-1991 IEEE-323-2003 IEEE-344-2004 IEEE-420-2013	Yes	I	

d. Class 1E EDGs and associated equipment are located in separate rooms of the auxiliary building and EDG building.

e. The Class 1E battery chargers, inverters, and dc buses associated with each of the independent trains are located in four separate rooms of the auxiliary building.

~~f.~~ g. Piping containing fluids is excluded from the Class 1E electrical distribution equipment rooms. Class 1E electrical distribution equipment rooms of different trains are separated from each other by concrete walls and floors. Any electrical or physical failure in one room has no effect on the redundant equipment in the other rooms.

f. In addition to the preceding, two Class 1E MCCs(Train A and Train B) are each located in geographically separated ESW buildings.

8.3.1.1.5 Design Criteria for Class 1E Equipment

Motor Size

The motor horsepower rating is selected to be equal or greater than maximum horsepower requirement of the driven load when operating at design condition.

Minimum Motor Accelerating Voltage

Class 1E motors are designed to accelerate with 75 percent rated voltage at the motor terminals throughout the starting period and are capable of accelerating their connected loads without overheating. All other motors are designed to accelerate to the rated speed with 80 percent rated voltage at the motor terminal throughout the starting period and are capable of accelerating their connected loads without exceeding the thermal limits.

Motor Starting Torque

The torque of 225 hp and smaller motors is designed in accordance with standard NEMA MG 1 (Reference 19). The torque of 250 hp and larger motors is designed in accordance with NEMA C50.41 (Reference 20), except that locked rotor torques and pull-up torques for normal torque type motors are not less than 80 percent of full-load torque. The motor starting torque at minimum specified voltage is adequate for starting and accelerating the

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.:	**57-7965**
SRP Section:	**08.03.01 – AC Power System (Onsite)**
Application Section:	**08.03.01**
Date of RAI Issue:	**07/01/2015**

Question No. 08.03.01-4

DCD, Tier 2, Section 8.3.1.1.7, states that “The heat tracing system is provided with non-Class 1E power to prevent freezing of fluid in pipes and equipment and to maintain the required temperature in critical process control systems. The heater is energized by a signal from the temperature sensor attached to each system. The heat tracing system is operated by an automatic control device in the heat tracing panel when the temperature is below the required setpoint.”

Identify Class 1E systems and processes that require heat tracing and freeze protection to maintain process temperatures. If there are Class 1E systems that need to be heat traced, justify why non-Class 1E power is used for the heat tracing circuits. Describe equipment associated with the heat tracing/freeze protection system.

RG 1.68, Appendix A-1.o, “Auxiliary and Miscellaneous Systems,” states that the applicant should conduct appropriate tests to demonstrate the operability of auxiliary and miscellaneous systems. Tests should be conducted, as appropriate, to verify redundancy and electrical independence. DCD Tier 2, Section 14.2.12.1.84, Heat Tracing System Test, does not specifically mention verification of redundancy and electrical independence as acceptance criteria for Heat Tracing System Test. Describe how the redundancy and electrical independence will be verified for Class 1E equipment/systems during initial testing phase.

Response

The heat tracing (HT) system mentioned in DCD Tier 2, Subsection 8.3.1.1.7 does not provide heat tracing or freeze protection for any safety- related piping or equipment. Accordingly, Class 1E power is not provided.

Apart from the heat tracing system mentioned above, there are sample lines for containment air monitors in the process and effluent radiological monitoring system (PERMS; refer to DCD Tier 2, Subsection 11.5.2.2), which are equipped with local heat tracing to which Class 1E power is supplied.

The local heat tracing provided as part of PERMS and the heat tracing test for the sample lines will be performed along with other supporting systems of PERMS. Redundancy and electrical independence of the local heat tracing for PERMS will be verified by reviewing the PERMS detailed design before the initial testing phase for PERMS.

In order to clearly identify the local heat tracing test required for PERMS, KHNP will revise DCD Tier 2, Subsection 14.2.12.1.106.

Impact on DCD

DCD Tier 2, Subsection 14.2.12.1.106 will be revised as shown in the Attachment.

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.

2.2 Process and effluent radiological monitoring system instrumentation has been calibrated.

,including heat tracing,

2.3 Support systems required for operation of the process and effluent radiological monitoring system are completed and operational.

2.4 Test instrumentation is available and calibrated.

2.5 Calibration check source is available.

3.0 TEST METHOD

3.1 Using the check source and external test equipment, verify calibration and operation of the monitor.

3.2 Check the self-testing feature of the monitor.

3.3 Where applicable, verify proper control actuation by the monitor and record the response time. Simulate a high-radiation signal to the appropriate radiation monitors to verify proper control actuations.

3.4 Verify proper alarm actuation in the main control room. Simulate a high-radiation signal to the radiation monitors to verify proper alarm actuations in the main control room or local control panel, as appropriate.

4.0 DATA REQUIRED

4.1 Monitor response to check source

4.2 Technical data associated with the source

4.3 Signal levels necessary to cause alarm actuation

4.4 Response time of the monitor to perform control functions