REVISED 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.:	**191-8210**
SRP Section:	**14.02 – Initial Plant Test Program – Design Certification and New License Applicants**
Application Section:	
Date of RAI Issue:	**09/01/2015**

Question No. 14.02-11

REQUIREMENTS

GDC 17 requires that onsite and offsite power systems provide sufficient capacity and capapbility and
GDC 18 requires the testing of electrical power systems

ISSUE AND INFORMATION NEEDED

DCD Tier 2, Section 8.4.1.3, “Alternate AC Power Source,” states that the 4.16kV non-Class 1E AAC GTG is provided as an AAC source to mitigate an SBO. Section 14.2.12.89 and 14.2.12.90 do not provide sufficient detail to demonstrate that the AAC GTG can obtain rated voltage and frequency within 2 minutes after the receipt of a starting signal. Please discuss the specific mechanical and electrical trips, indications, alarms, and number of starts required. Furthermore, discuss a) how adequate ventilation is assessed, b) how the continuous rating is verified, c) how the time requirements are verified for reaching required voltage and frequency, d) how these tests verify that upon a simulated station blackout that the GTG starts from standby to energize the buses, e) how these tests demonstrate the capability to reject a loss of the largest single load, and f) how these tests demonstrate the ability to synchronize the GTG with offsite power while loaded upon a simulated restoration of offsite power.

For the support systems, discuss how the adequacy and operation of the fuel systems is demonstrated. Similarly, discuss how the operation of the lube oil and cooling systems are demonstrated. The exhaust/intake system should be specifically demonstrated. Discuss why the exhaust/intake system, one of the EDG support systems is not specifically demonstrated, considering it is necessary for the EDG to complete the safety function.

Response

KHNP has reviewed the subject question and understands the staff's request. KHNP is in the process of upgrading the test plans presented in Section 14.2 of the DCD. This effort is focused on adding additional SSCs that are important to safety and risk significant as well as increasing the level of detail described in the DCD for test prerequisites, test methods and acceptance criteria for the various tests. It has been determined that the actions to be taken as a result of this question is within the scope of the upgrade effort. Therefore, KHNP will address the noted items in the upgrade effort, which is scheduled to be completed by February 1, 2016. A revised response to this question that incorporates the results of the upgrade effort will be submitted to the NRC after completion.

Response – (Rev. 1)

Subsections 14.2.12.1.89, "Alternate AC Source System Test" and 14.2.12.1.90, "Alternate AC Source Support Systems Test" will be revised to "Alternate AC Source Test (Mechanical)" and "Alternate AC Source Test (Electrical) and include the following information. Also, related information will be added to Subsection 8.4.1.

a) Adequate ventilation is assessed through the items 1.2, 3.8, 4.2, and 5.1 in the revised Subsection 14.2.12.1.89.

b) The continuous rating is verified through the items 1.1, 3.2, 4.2, 4.3, 5.1, and 5.6 in the revised Subsection 14.2.12.1.90.

c) The time requirements for reaching required voltage and frequency are verified through items 1.2, 3.1, 4.1, 5.1, and 5.3 in the revised Subsection 14.2.12.1.90.

d) To verify that upon a simulated station blackout that the GTG starts from standby to energize the buses, items 1.1, 1.2, 1.4, 3.1, 3.3, 3.4, 3.5, 4.1, 4.2, 5.1, 5.2, and 5.3 will be provided in the revised Subsection 14.2.12.1.90.

e) To demonstrate the capability to reject a loss of the largest single load, items 1.5, 3.2, 4.2, and 5.6 will be provided in the revised Subsection 14.2.12.1.90.

f) To demonstrate the ability to synchronize the GTG with offsite power while loaded upon a simulated restoration of offsite power, items 1.4, 3.4, 4.2, and 5.5 will be provided in the revised Subsection 14.2.12.1.90.

For the support systems,

g) To demonstrate the adequacy and operation of the fuel systems, items 1.2, 1.4, 3.1, 3.6, 3.7, 3.8, 3.9, 4.1, 4.2, 5.1, 5.4, and 5.5 will be provided in the revised Subsection 14.2.12.1.89.

h) To demonstrate the operation of the lube oil and cooling systems, items 1.2, 3.1, 3.6, 3.8, 4.1, 4.2, 5.1, and 5.4 will be provided in the revised Subsection 14.2.12.1.89.

i) KHNP understands that the phrase “one of the EDG support systems” in the question means “one of the AAC GTG support systems.” To demonstrate the operation of the exhaust/intake system, items 1.2, 3.8, 4.2, 5.1 will be provided in the revised Subsection 14.2.12.1.89, though the AAC GTG has no safety function.

Various monitoring and control devices are provided to provide the operator with control and operational status information for the AAC system. In general, the parameters described in this response and added to the DCD are used to verify proper operation of the AAC GTG and support systems. The specific brand and model AAC GTG is to be determined by the COL applicant. Therefore, COL Item 8.4(4) has been established for the COL applicant to specify the specific parameters for monitoring, providing alarms, the mechanical and electrical trips for testing, and the emergency trips.

Impact on DCD

The upgraded DCD Tier 2, Sections 14.2.12.1.89 and 14.2.1.12.2.90 submitted by KHNP in letter MKD/NW-16-0156L, dated February 24, 2016 will be revised as indicated in the attachment associated with this response.

DCD Tier 2, Tables 1.8-2, 14.2-1 and 14.2-7 will be revised along with Subsection 8.4.3 as indicated in the attachment. Section 8.4.1.3.1 will be added to DCD Tier 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.

5.4 The EDG engine lubrication system operates as described in Subsection 9.5.7.

14.2.12.1.89 Alternate AC Source System Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To verify the proper operation of the alternate ac (AAC) source system

2.0 PREREQUISITES

2.1 Construction activities on the AAC source system have been completed.

2.2 Support systems, including the AAC support systems and the 4,160V distribution system required for the operation of the AAC source system, are complete and operational.

2.3 AAC source system instrumentation has been calibrated.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify the system alarms, instrumentation, interlocks, and controls.

3.2 Verify the AAC source system provides rated power at the proper voltage and frequency.

3.3 Verify operation of the AAC source system from all its control stations.

3.4 Demonstrate the AAC source system can be connected in the design configuration to the dedicated train of the onsite 4,160 V Class 1E switchgear buses (train A or train B).

3.5 Verify AAC can carry design loads.

Replace with A

4.0 DATA REQUIRED

4.1 Setpoints at which alarms and interlocks occur

4.2 AAC source system operating data at designated loads including time to start and connect to the dedicated train of the onsite 4,160 V Class 1E switchgear buses (train A or train B)

5.0 ACCEPTANCE CRITERIA

5.1 The AAC source system operates as described in Subsection 8.4.1.

14.2.12.1.90 Alternate AC Source Support Systems Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 Demonstrate the proper operation of the AAC source system fuel, starting, cooling, and lubrication subsystems

2.0 PREREQUISITES

2.1 Construction activities on the AAC source support systems have been completed.

2.2 AAC source support system instrumentation has been calibrated.

2.3 Support systems required for operation of the AAC source support systems are complete and operational.

2.4 The AAC source system is available to be run.

3.0 TEST METHOD

3.1 Demonstrate the adequacy and operation of the AAC source fuel systems.

Replace with B

3.2 Demonstrate the operation of the AAC source starting system three consecutive times.

3.3 Demonstrate the operation of the AAC source lube oil system.

3.4 Demonstrate alarms, interlocks, and controls on the AAC source fuel systems, starting system, lube oil, and cooling system.

3.5 With the AAC source system in operation, verify the AAC source cooling system maintains design temperatures.

4.0 DATA REQUIRED

4.1 Setpoints of alarms, interlocks, and controls

4.2 Verification of starts from each AAC source starting system

4.3 AAC source cooling system temperature

4.4 Fuel consumption rate for required configurations

5.0 ACCEPTANCE CRITERIA

5.1 The AAC source support systems operate as described in Subsection 8.3.1.

14.2.12.1.91 Containment Polar Crane Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate the functional performance of the containment polar crane

Replacement A

14.2.12.1.89 Alternate AC Source System Test (Mechanical)

1.0 OBJECTIVES

1.1 To demonstrate that the Alternate AC Source (Gas Turbine Generator – GTG) set operates reliably.

1.2 To demonstrate the operation of the GTG supporting systems, namely, fuel oil storage & transfer system, starting system, lubrication system, combustion intake air and exhaust system, and ventilation system for GTG enclosure.

1.3 To demonstrate the capability of the starting system to provide five (5) GTG cycles (for starting), without being charged.

1.4 To determine that the fuel oil consumption of GTG while operating at continued load rating condition.

2.0 PRE-REQUESITES

2.1 The required construction activities is completed for the Gas Turbine Generator and its supporting systems

2.2 The GTG supporting systems, namely, fuel oil storage & transfer system, starting system, lubrication system, combustion intake air and exhaust system, and ventilation system for GTG enclosure are available and operational

2.3 GTG and its supporting system instrumentation is available, functional and calibrated for its operation / tests

2.4 Test instrumentation is available and calibrated

3.0 TEST METHOD

3.1 Demonstrate that the GTG and its supporting systems can be started in automatic and manual modes using Main Control Room (MCR) and local control station.

3.2 Demonstrate that the following mechanical trips are functional:

3.2.1 Engine over speed

3.2.2 Low lube oil pressure

3.2.3 Low lube oil level in lube oil tank or sump

3.2.4 High pressure in crank case

3.2.5 High-high lube oil temperature

3.2.6 Low fuel oil pressure

RAI 191-8210 - Question 14.02-11_Rev.1

Replacement A (Con't)

3.3 Demonstrate that the following parameters are monitored in the MCR and local control panel:

3.3.1 Lube oil temperature and pressure

3.3.2 Engine bearing temperatures

3.3.3 Engine speed

3.3.4 Air pressure (if air is used for starting)

3.4 Demonstrate the operation of following status indication:

3.4.1 Engine Over speed

3.4.2 Low oil pressures

3.4.3 Low air pressure (if air is used for starting)

3.5 Evaluate the ability of the starting system to allow cranking a cold GTG five (5) times, without re-charging the receiver / motor.

3.6 Verify that the system alarms, instrumentation, interlocks and controls

3.7 Fuel oil is transferred from the fuel oil storage tank to the fuel oil day tanks by means of transfer pumps; record the appropriate flow parameter.

3.8 Verify the operability of the GTG supporting systems (namely, fuel oil storage & transfer system, starting system, lubrication system, combustion intake air and exhaust system, and ventilation system for GTG enclosure).

3.9 Fuel oil consumption is monitored at continuous load rating condition.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms and interlocks occur

4.2 AAC source system and supporting system operating parameters at designated loads

4.3 GTG consecutive start data

4.4 GTG starting air volume parameters after consecutive starts (if air is used)

4.5 Battery capacity after consecutive starts (if motor is used)

5.0 ACCEPTANCE CRITERIA

5.1 Performance requirements of GTG and associated mechanical system (starting system, lubrication system, combustion intake air & exhaust system, and ventilation system for GTG enclosure) are within the design requirements.

RAI 191-8210 - Question 14.02-11_Rev.1

Replacement A (Con't)

5.2 Starting system is capable of providing five (5) starts, without being re-charged.

5.3 The required time for GTG to reach rated speed per DCD Chapter 8.4

5.4 The alarms, interlocks, controls and trips of the GTG system and supporting systems is in accordance with Subsection 8.4.1.

5.5 The fuel oil consumption by the GTG while operating at continuous load rating does not exceed the design requirements including fuel oil storage capacity as described in Subsection 9.5.9.

Replacement B

14.2.12.1.90 Alternate AC Source System Test (Electrical)

1.0 OBJECTIVES

1.1 To demonstrate that the Alternate AC Source (Gas Turbine Generator - GTG) can reliably supply power at continuous rated load, the short-time rated load, and design rated load.

1.2 To demonstrate that the GTG starts and verify that the required voltage and frequency are attained within the required time limits.

1.3 To demonstrate the ability of the GTG starting automatically on the event of LOOP and to synchronize with the offsite power system.

1.4 To demonstrate the capability of GTG breaker and associated interlocks.

1.5 To demonstrate GTG proper operation including a test of loss of the largest single load and complete loss of load.

2.0 PRE-REQUESITES

2.1 The required construction activities are completed for the GTG and its supporting systems

2.2 The GTG mechanical system test is completed (See 14.2.12.1.89)

2.3 GTG system instrumentation is available, functional and calibrated for its operation / tests

2.4 Test instrumentation is available and calibrated

2.5 GTG Enclosure ventilation system test is completed (See 14.2.12.1.89)

2.6 Required electrical power supplies and control circuits are available.

2.7 Electrical testing is complete as needed to allow the required buses to be energized.

3.0 TEST METHOD

3.1 Demonstrate that the GTG starts from standby conditions and reaches required voltage and frequency within acceptable limits and time requirements.

3.2 Demonstrate that the largest single load and complete load are shed with no tripping on over speed is verified.

3.3 Demonstrate by simulating a SBO event that: (a) non-essential loads are shed from the bus; (b) the GTG starts on auto-start signal from its standby conditions; (c) attains the required voltage and frequency within acceptable limits and time;

Replacement B (Con't)

(d) energizes the respective buses; and (e) can be manually connected with the respective buses within ten minutes.

3.4 Demonstrate the ability to synchronize the GTG with offsite power while loaded upon a simulated restoration of offsite power: (a) Parallel the SBO bus with offsite power, (b) transfer SBO GTG and open SBO GTG output circuit breaker; (c) Restore the SBO GTG to standby status.

3.5 Evaluate the operability of GTG breaker and associated interlocks.

3.6 Demonstrate that the following electrical trips are functional:

3.2.1 Generator differential protection

3.2.2 Generator electrical protection

3.3.3 Electronic governor failure

3.7 Demonstrate the operation of following status indication:

3.4.1 GTG output breaker position

3.4.2 Loss of control power

3.4.3 Generator fault

4.0 DATA REQUIRED

4.1 Test data for GTG output voltage, frequency and output circuit breaker closing data during start sequence

4.2 Running data for the parameters monitored during each of the required testing sequence

4.3 Verification of field data versus shop data

4.4 Periodic area temperature

5.0 ACCEPTANCE CRITERIA

5.1 SBO GTG electrical system meets the design requirements as described in Section 8.4

5.2 The controls, alarms, interlocks, and operation of the GTG breaker and support system are as described in Section 8.4.

5.3 GTG attains the required voltage and frequency within the required time limits

5.4 GTG starts automatically on receipt of an under-voltage signal from the 4.16 kV bus.

RAI 191-8210 - Question 14.02-11_Rev.1

Replacement B (Con't)

5.6 GTG is capable of being synchronized with offsite power and supplies the maximum expected load carrying capability.

5.7 Upon the loss of the largest single load and complete loss of load, GTG continues to operate without exceeding the over speed limit.

Table 14.2-1 (4 of 5)

Subsection	Test
14.2.12.1.82	Compressed air system test
14.2.12.1.83	Process sampling system test
14.2.12.1.84	Heat tracing system test
14.2.12.1.85	Fire protection system test
14.2.12.1.86	Emergency diesel generator mechanical system test
14.2.12.1.87	Emergency diesel generator electrical system test
14.2.12.1.88	Emergency diesel generator auxiliary systems test
14.2.12.1.89	~~Alternate AC source system test~~ Alternate AC source System Test (Mechanical)
14.2.12.1.90	~~Alternate AC source support systems test~~
14.2.12.1.91	Containment polar crane test Alternate AC source System Test (Electrical)
14.2.12.1.92	Fuel handling area cranes test
14.2.12.1.93	Reactor containment building HVAC system test
14.2.12.1.94	Reactor containment purge HVAC system test
14.2.12.1.95	Control room area HVAC system test
14.2.12.1.96	Turbine generator building HVAC system test
14.2.12.1.97	Emergency diesel generator area HVAC system test
14.2.12.1.98	Fuel handling HVAC system test
14.2.12.1.99	Compound building HVAC system test
14.2.12.1.100	Balance of control room HVAC system test
14.2.12.1.101	Hydrogen mitigation system test
14.2.12.1.102	Containment hydrogen recombiner system test
14.2.12.1.103	Liquid waste management system test
14.2.12.1.104	Solid waste management system test
14.2.12.1.105	Gaseous waste management system test
14.2.12.1.106	Process and effluent radiological monitoring system test
14.2.12.1.107	Airborne and area radiation monitoring system test

Table 14.2-7 (4 of 18)

RG 1.68 APP. A	Subsection #	Individual Test
1.e.8	14.2.12.1.69	Condensate system test
1.e.9	14.2.12.1.68	Feedwater system test
1.e.10	14.2.12.1.73	Heater drains system test
1.e.11	14.2.12.1.52 14.2.12.1.67 14.2.12.1.69	Pre-core reactor coolant and secondary water chemistry data Main condenser and condenser vacuum systems test Condensate system test
1.e.12	14.2.12.1.67	Main condenser and condenser vacuum systems test
1.f.1	14.2.12.1.71	Circulating water system test
1.f.2	-	Exception The COL applicant is to prepare the pre-operational test of cooling tower and associated auxiliaries.
1.f.3	-	Exception The COL applicant is to prepare the pre-operational test of raw water and service water cooling systems.
1.g.1	14.2.12.1.110 14.2.12.1.111 14.2.12.1.112 14.2.12.1.113 14.2.12.1.116	Unit main power system test 13,800 V normal auxiliary power system test 4,160 V normal auxiliary power system test 480 V normal auxiliary power system test Offsite power system test
1.g.2	14.2.12.1.108 14.2.12.1.109 14.2.12.1.81	4,160 V Class 1E auxiliary power system test 480 V Class 1E auxiliary power system test Emergency lighting system test
1.g.3	14.2.12.1.86 14.2.12.1.87 14.2.12.1.88 14.2.12.1.89 14.2.12.1.90	Emergency diesel generator mechanical system test Emergency diesel generator electrical system test Emergency diesel generator auxiliary systems test ~~Alternate AC source system test~~ Alternate AC source System Test (Mechanical) ~~Alternate AC source support systems test~~
1.g.4	14.2.12.1.81 14.2.12.1.114 14.2.12.1.115	Emergency lighting system test Alternate AC source System Test (Electrical) Non-Class 1E dc power systems test Class 1E dc power systems test
1.h.1.a	14.2.12.1.117 14.2.12.1.118	BOP piping thermal expansion measurement test BOP piping vibration measurement test

Table 1.8-2 (11 of 29)

Item No.	Description
COL 8.3(1)	The COL applicant is to provide and to design a mobile generator and its support equipment.
COL 8.3(2)	The COL applicant is to describe and provide detailed ground grid and lightning protection.
COL 8.3(3)	The COL applicant is to provide testing, inspection, and monitoring programs for detecting insulation degradation of underground and inaccessible power cables within the scope of 10 CFR 50.65.
COL 8.3(4)	The COL applicant is to provide protective device coordination.
COL 8.3(5)	The COL applicant is to provide insulation coordination of surge and lightning protection.
COL 8.3(6)	The COL applicant is to develop the maintenance program to optimize the life and performance of the batteries.
COL 8.3(7)	The COL applicant is to provide short circuit analysis of onsite dc power system with actual data.
COL 8.3(8)	The COL applicant is to describe any special features of the design that would permit online replacement of an individual cell, group of cells, or entire battery.
COL 8.4(1)	The COL applicant is to identify local power sources and transmission paths that could be made available to resupply power to the plant following the loss of a grid or the SBO.
COL 8.4(2)	The COL applicant is to develop detailed procedures for manually aligning the alternate AC power supply when two (Trains A and B) of the four diesel generators are unavailable during a loss of offsite power event.
COL 9.1(1)	The COL applicant is to provide operational procedures and maintenance program as related to leak detection and contamination control.
COL 9.1(2)	The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.
COL 9.1(3)	The COL applicant is to address the load-handling procedures. Load-handling procedures are established for component handling procedures and plant operating procedures in accordance with ASME B30.2. ASME B30.2 requires establishing component handling procedures that include (1) a safe load path for lifting heavy loads to perform special handling component inspections, (2) acceptance criteria prior to lift, and (3) use of steps and proper sequence in handling the load. ASME B30.2 requires plant operating procedure guidelines that include appropriate crane operator training and crane inspections. ASME B30.2 also requires that the load-handling procedures include preparing operating procedures for preoperational load testing and checkouts of interlocks, brakes, hoisting cables, control circuitry, and lubrication of OHLHS equipment.

COL 8.4(4) The COL applicant is to specify the specific parameters for monitoring, alarms, mechanical and electrical trip for testing, and emergency trips.

The AAC GTG is designed to attain rated voltage and frequency within 2 minutes after receipt of a starting signal. The loads required for plant safe shutdown are manually connected by the operator in the main control room (MCR) and remote shutdown room (RSR) in accordance with the emergency operating procedures (EOPs) described in Subsection 13.5.2. Normally, the AAC GTG is not directly connected to both the preferred offsite power sources and any onsite Class 1E 4.16 kV switchgear buses. The connection between the AAC power source and the onsite or offsite ac power systems meets the requirements of Criterion 1 for NRC RG 1.155, Position C.3.3.5. The AAC GTG is manually connected to the designated Class 1E 4.16 kV switchgears (train A or train B) by the operator within 10 minutes from the beginning of the SBO event. This operation meets the requirements of Criterion 3 for NRC RG 1.155, Position C.3.3.5. The isolation between the Class 1E and the non-Class 1E system is provided by two circuit breakers in series in accordance with the Appendix B requirements of NRC RG 1.155 and with NUMARC 87-00.

During a LOOP condition, the AAC GTG is manually aligned to power two permanent non-safety (PNS) 4.16 kV switchgears (divisions I and II) through two in-series, normally open circuit breakers.

To minimize the potential for common-cause failures with Class 1E EDGs, the AAC GTG is provided with a gas turbine engine with a diverse starting and cooling system. The AAC GTG, including the related auxiliary equipment, is installed in a separate building. Therefore, no single-point vulnerability exists in which a weather-related event or single active failure disables any portion of the onsite EAC sources or the offsite power sources and simultaneously fails the AAC source. The design factors for the AAC GTG meet the requirements of Criterion 2 for NRC RG 1.155, Position C.3.3.5.

The COL applicant is to identify local power sources and transmission paths that could be made available to resupply power to the plant following the loss of a grid or an SBO (COL 8.4(1)).

The power supply from the AAC GTG and the recovery from the SBO are described in Subsections 8.4.1.4 and 8.4.1.5.

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8.4.1.3.1 AAC Instrumentation and Control

Various monitoring and control devices are provided to provide the operator with control and operational status information for the AAC system. The COL applicant is to specify the specific parameters for monitoring, alarms, mechanical and electrical trip for testing, and emergency trips. (COL 8.4(4)). Generally, parameters described in this Subsection are used.

The following mechanical trips are provided to protect the AAC GTG during testing:

a. Low lube oil pressure
b. Low lube oil level in lube oil tank or sump
c. High pressure in crank case
d. High high lube oil temperature
e. low fuel oil pressure

These mechanical trips are bypassed during the operation of the AAC GTG in the emergency mode.

The following electrical trips are provided to protect the AAC GTG during testing:

a. Generator electrical protection
b. Electronic governor failure

All signals of the protective relay trip, except the trip signals listed below, are bypassed during the operation of the AAC GTG in the emergency mode.

a. Engine over speed
b. Generator differential protection
c. Manual trip

The following parameters are monitored in the MCR and local control panel.

a. Lube oil temperature and pressure
b. Engine bearing temperatures
c. Engine speed
d. Air pressure (if air is used for starting)

The following status indication are provided in local control panel.

a. Engine over speed
b. Low oil pressures
c. Low air pressure (if air is used for starting)
d. GTG output breaker position
e. Loss of control power
f. Generator fault

8.4.3 Combined License Information

COL 8.4(1) The COL applicant is to identify local power sources and transmission paths that could be made available to resupply power to the plant following the loss of a grid or the SBO.

COL 8.4(2) The COL applicant is to develop detailed procedures for manually aligning the alternate AC power supply when two (Trains A and B) of the four diesel generators are unavailable during a loss of offsite power event.

8.4.4 References

1. 10 CFR Part 50, Appendix A, General Design Criterion 17, "Electric Power Systems," U.S. Nuclear Regulatory Commission.

2. 10 CFR Part 50, Appendix A, General Design Criterion 18, "Inspection and Testing of Electric Power Systems," U.S. Nuclear Regulatory Commission.

3. Regulatory Guide 1.155, "Station Blackout," U.S. Nuclear Regulatory Commission, August 1988.

4. 10 CFR 50.63, "Loss of All Alternating Current Power," U.S. Nuclear Regulatory Commission.

5. Regulatory Guide 1.9, "Application and Testing of Safety-Related Diesel Generators in Nuclear Power Plants," Rev. 4, U.S. Nuclear Regulatory Commission, March 2007.

6. NSAC-108, "Reliability of Emergency Diesel Generators at U.S. Nuclear Power Plants," Electric Power Research Institute, September 1986.

7. NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," Rev. 1, Nuclear Energy Institute, August 1991.

COL 8.4(4) The COL applicant is to specify the specific parameters for monitoring, alarms, mechanical and electrical trip for testing, and emergency trips.