3/4.8 ELECTRICAL POWER SYSTEMS

3/4.8.1 A.C. SOURCES

OPERATING

LIMITING CONDITION FOR OPERATION

3.8.1.1 As a minimum, the following A.C. electrical power sources shall be OPERABLE:

a. Two physically independent circuits between the offsite transmission network and the onsite Class 1E Distribution System, and

b. Two separate and independent diesel generators, each with:

1) A separate day fuel tank containing a minimum fuel volume fraction of 3/8 (600 gallons),

2) A separate Fuel Storage System containing a minimum volume of 62,000 gallons of fuel,

3) A separate fuel transfer pump,

4) Lubricating oil storage containing a minimum total volume of 275 gallons of lubricating oil, and

5) Capability to transfer lubricating oil from storage to the diesel generator unit.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTION:

a. With an offsite circuit of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. source by performing Specification 4.8.1.1.1a. within 1 hour and at least once per 8 hours thereafter; restore at least two offsite circuits to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

3.8.1.1 (Continued)

ACTION:

b. With a diesel generator inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Specification 4.8.1.1.1a within 1 hour and at least once per 8 hours thereafter. Perform ACTION d. Demonstrate the OPERABILITY of the remaining diesel generator by performing Specification 4.8.1.1.2a.5) within 24 hours.* Restore at least two diesel generators to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

c. With one offsite circuit and one diesel generator of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. source by performing Specification 4.8.1.1.1a. within 1 hour and at least once per 8 hours thereafter. Perform ACTION d. Demonstrate the OPERABILITY of the remaining diesel generator by performing Specification 4.8.1.1.2a.5) within 8 hours.* Restore at least one of the inoperable sources to OPERABLE status within 12 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore at least two offsite circuits and two diesel generators to OPERABLE status within 72 hours from the time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

* The OPERABILITY of the remaining diesel generator need not be verified if it has been successfully operated within the last 24 hours, or if currently operating, or if the diesel generator became inoperable due to:

1. Preplanned preventive maintenance or testing,

2. An inoperable support system with no potential common mode failure for the remaining diesel generator, or

3. An independently testable component with no potential common mode failure for the remaining diesel generator.

LIMITING CONDITION FOR OPERATION

3.8.1.1 (Continued)

ACTION:

d. With one diesel generator inoperable in addition to ACTION b. or c. above, verify that:

   1. All required systems, subsystems, trains, components, and devices that depend on the remaining OPERABLE diesel generator as a source of emergency power are also OPERABLE, and

   2. When in MODE 1, 2, or 3, the steam-driven emergency feedwater pump is OPERABLE.

   If these conditions are not satisfied within 2 hours be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

e. With two of the above required offsite A.C. circuits inoperable; restore at least one of the inoperable offsite sources to OPERABLE status within 24 hours or be in at least HOT STANDBY within the next 6 hours. With only one offsite source restored, restore at least two offsite circuits to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

f. With two of the above required diesel generators inoperable, demonstrate the OPERABILITY of two offsite A.C. circuits by performing the requirements of Specification 4.8.1.1.1a. within 1 hour and at least once per 8 hours thereafter; restore at least one of the inoperable diesel generators to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore at least two diesel generators to OPERABLE status within 72 hours from time of initial loss or be in least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.8.1.1.1 Each of the above required independent circuits between the offsite transmission network and the Onsite Class 1E Distribution System shall be:

a. Determined OPERABLE at least once per 7 days by verifying correct breaker alignments, indicated power availability, and

b. Demonstrated OPERABLE at least once per 18 months by transferring (manually and automatically) unit power supply from the normal circuit to the alternate circuit.*

4.8.1.1.2 Each diesel generator shall be demonstrated OPERABLE:**

a. At least once per 31 days on a STAGGERED TEST BASIS by:

1) Verifying the fuel level in the day fuel tank;

2) Verifying the fuel level in the fuel storage tank;

3) Verifying the fuel transfer pump starts and transfers fuel from the storage system to the day tank;

4) Verifying the lubricating oil inventory in storage;

5) Verifying the diesel starts from standby conditions and attains a steady-state generator voltage and frequency of 4160 ± 420 volts and 60 ± 1.2 Hz.***

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* This surveillance requirement shall not be performed in Mode 1 or 2.

** All planned starts for the purpose of these surveillances may be preceded by an engine prelube period.

*** Performance of Specification 4.8.1.1.2a.6) must immediately follow this surveillance. Additionally, a modified start involving idling and gradual acceleration to synchronous speed may be used for this surveillance. When modified start procedures are not used, the time, voltage, and frequency tolerances of Specification 4.8.1.1.2e must be met.

4.8.1.1.2 (Continued)

6) Verifying the generator is synchronized, gradually loaded**** to greater than or equal to 5600 kW and less than or equal to 6100 kW, and operates within this load band for at least 60 minutes, and until stable engine operating temperature is attained; and

7) Verifying the diesel generator is aligned to provide standby power to the associated emergency busses.

b. At least once per 31 days by checking for and removing accumulated water from the day fuel tank;

c. At least once per 31 days by checking for and removing accumulated water from the fuel oil storage tanks;

d. By verifying fuel oil properties of new and stored fuel oil are tested in accordance with, and maintained within the limits of, the Diesel Fuel Oil Testing Program;

e. At least once every 184 days# by verifying the diesel starts from standby condition and achieves:

1) A generator voltage and frequency greater than or equal to 3740 volts and 58.8 Hz within 10 seconds after the start signal, and

2) A steady-state generator voltage and frequency of 4160 ± 420 volts and 60 ± 1.2 Hz.

**** Diesel generator loading may be in accordance with manufacturers recommendations, including a warmup period. Momentary transients outside the load range, due to changing bus conditions, do not invalidate the test. In addition, this surveillance shall be preceded by and immediately follow without shutdown a successful performance of Specification 4.8.1.1.2a.5) or 4.8.1.1.2e.

Performance of Specification 4.8.1.1.2a.6) must immediately follow this surveillance. Additionally, performance of Specification 4.8.1.1.2e satisfies Specification 4.8.1.1.2a.5).

4.8.1.1.2 (Continued)

f. At least once per 18 months, during shutdown[##], by:

1) (NOT USED)

2) Verifying the generator capability to reject a load of greater than or equal to 671 kW while maintaining voltage at 4160 ± 420 volts and frequency at 60 ± 4.0 Hz;

3) Verifying the generator capability to reject a load of 6083 kW without tripping. The generator voltage shall not exceed 4784 volts during and following the load rejection;

4) Simulating a loss-of-offsite power by itself, and:

a) Verifying deenergization of the emergency busses and load shedding from the emergency busses, and

b) Verifying the diesel starts from standby conditions[###] on the loss of offsite power signal, energizes the emergency busses with permanently connected loads within 12 seconds, energizes the auto-connected shutdown loads through the emergency power sequencer and operates for greater than or equal to 5 minutes while its generator is loaded with the shutdown loads. After energization, the steady-state voltage and frequency of the emergency busses shall be maintained at 4160 ± 420 volts and 60 ± 1.2 Hz during this test.

5) Verifying that on an SI actuation test signal, without loss-of-offsite power, the diesel generator starts from standby conditions[###] on the auto-start signal and operates on standby for greater than or equal to 5 minutes. The generator voltage and frequency shall be greater than or equal to 3740 volts and 58.8 Hz within 10 seconds after the auto-start signal; the steady-state generator voltage and frequency shall be maintained at 4160 ± 420 volts and 60 ± 1.2 Hz during this test;

Selected surveillance requirements, or portions thereof, may be performed during conditions or modes other than shutdown, provided an evaluation supports safe conduct of that surveillance in a condition or mode that is consistent with safe operation of the plant. (Ref. NRC GL 91-04)

Starting of the diesel for Specifications 4.8.1.1.2f.4) and 4.8.1.1.2f.5) may be performed with the engine at or near normal operating temperature.

4.8.1.1.2 (Continued)

6) Simulating a loss-of-offsite power in conjunction with an SI actuation test signal; and

   a) Verifying deenergization of the emergency busses and load shedding from the emergency busses;

   b) Verifying the diesel starts from standby conditions, on the auto-start signal, energizes the emergency busses with permanently connected loads within 10 seconds, energizes the auto-connected emergency (accident) loads through the emergency power sequencer and operates for greater than or equal to 5 minutes while its generator is loaded with the emergency loads. After energization, the steady-state voltage and frequency of the emergency busses shall be maintained at 4160 ± 420 volts and 60 ± 1.2 Hz during this test; and

   c) Verifying that all automatic diesel generator trips, except engine overspeed, low lube oil pressure, 4160-volt bus fault, and generator differential, are automatically bypassed upon loss of voltage on the emergency bus concurrent with a Safety Injection actuation signal.

7) Verifying full-load carrying capability of the diesel generator for an interval of not less than 24 hours:

   a) At a load greater than or equal to 5600 kW and less than or equal to 6100 kW,#### or

   b) Should auto-connected loads be equal to or greater than 6100 kW;

      1. Verify the diesel generator operates for an interval of not less than 2 hours at a load greater than or equal to 6363 kW and less than or equal to 6700 kW.#### For the remaining hours, at a load greater than or equal to 5600 kW and less than or equal to 6100 kW, and

      2. Verify that the auto-connected loads to each diesel generator do not exceed the short time rating of 6700 kW.

Diesel generator loading may be in accordance with manufacturers recommendations, including a warmup period. Momentary transients outside the load range, due to changing bus conditions, do not invalidate the test.

4.8.1.1.2 (Continued)

8) Within 5 minutes of shutting down the diesel generator, after the diesel generator has operated for an interval of not less than 2 hours at a load greater than or equal to 5600 kW and less than or equal to 6100 kW,+ by verifying the diesel starts and achieves:

   a) A generator voltage and frequency greater than or equal to 3740 volts and 58.8 Hz within 10 seconds after the start signal, and

   b) A steady-state generator voltage and frequency of 4160 ± 420 volts and 60 ± 1.2 Hz.

9) Verifying the diesel generator's capability to:

   a) Synchronize with the offsite power source while the generator is loaded with its emergency loads upon a simulated restoration of offsite power,

   b) Transfer its loads to the offsite power source, and

   c) Be restored to its standby status.

10) Verifying that with the diesel generator operating in a test mode, connected to its bus, a simulated Safety Injection signal overrides the test mode by: (1) returning the diesel generator to standby operation, and (2) automatically energizing the emergency loads with offsite power;

11) Verifying that the fuel transfer pump transfers fuel from each fuel storage tank to the day tank of each diesel via the installed cross-connection lines;

12) Verifying that the emergency power sequence timer is OPERABLE with the interval between each load block within ± 10% of its design interval;

13) NOT USED

+ Momentary transients outside the load range, due to changing bus conditions, do not invalidate the test.

4.8.1.1.2 (Continued)

14) Simulating a Tower Actuation (TA) signal while the diesel generator is loaded with the permanently connected loads and auto-connected emergency (accident) loads, and verifying that the service water pump automatically trips, and that the cooling tower pump automatically starts. After energization the steady state voltage and frequency of the emergency buses shall be maintained at 4160 ± 420 volts and 60 ± 1.2 Hz; and

15) While diesel generator 1A is loaded with the permanently connected loads and auto-connected emergency (accident) loads, manually connect the 1500 hp startup feedwater pump to 4160-volt bus E5. After energization the steady-state voltage and frequency of the emergency bus shall be maintained at 4160 ± 420 volts and 60 ± 1.2 Hz.

g. At least once per 10 years or after any modifications which could affect diesel generator interdependence by starting both diesel generators simultaneously from standby condition, during shutdown, and verifying that both diesel generators achieve:

1) A generator voltage and frequency greater than or equal to 3740 volts and 58.8 Hz within 10 seconds after the start signal, and

2) A steady-state generator voltage and frequency of 4160 ± 420 volts and 60 ± 1.2 Hz.

3/4.8.1 AC SOURCES

BACKGROUND

The Seabrook Station Class 1E AC Electrical Power Distribution System AC sources consist of the offsite power sources (preferred power sources, normal and alternate(s)), and the onsite standby power sources (Train A and Train B emergency diesel generators (EDGs)). As required by 10 CFR 50, Appendix A, GDC 17 (Ref 1), the design of the AC electrical power system provides independence and redundancy to ensure an available source of power to the Engineered Safety Feature (ESF) systems.

The onsite Class 1E AC Distribution System is divided into redundant load groups (trains) so that the loss of any one group does not prevent the minimum safety functions from being performed. Each train has connections to two preferred offsite power sources and a single EDG.

Offsite power is supplied to the unit switchyard from the transmission network by three transmission lines. From the switchyard, two electrically and physically separated circuits provide AC power, through the generator stepup transformer and/or step down station auxiliary transformers, to the 4.16 kV ESF buses. A detailed description of the offsite power network and the circuits to the Class 1E ESF buses is found in the UFSAR, Chapter 8 (Ref. 2).

An offsite circuit consists of breakers, transformers, switches, interrupting devices, cabling, and controls, required to transmit power from the offsite transmission network to the onsite Class 1E ESF buses.

The onsite standby power source for each 4.16 kV ESF bus is a dedicated EDG (DG-1A and DG-1B). DG-1A and DG-1B are dedicated to ESF buses E5 and E6, 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 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 coincident with an SI signal. The EDGs will also start and operate in the standby mode without tying to the ESF bus on a SI signal alone. Following the trip of offsite power, an undervoltage signal 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 emergency power sequencer timer. 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 108 seconds after the EDG

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* Seabrook Station is only committed to demonstrating the OPERABILITY of the diesel generators in accordance with the recommendations of Regulatory Guides 1.9, "Selection of Diesel Generator Set Capacity for Standby Power Supplies," Revision 2, December 1979; 1.108, "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," Revision 1, August 1977, Errata September 1977; and 1.137, "Fuel-Oil Systems for Standby Generators." Revision 1, October 1979. Exceptions to these Regulatory Guides are noted in the UFSAR.

** Seabrook Station is only committed to IEEE Std. 387-1972 and 1977.

3/4.8.1 AC SOURCES (Continued)

restores power to the bus, all loads needed to recover the unit or maintain it in a safe condition are returned to service.

Ratings for Train A and Train B EDGs satisfy the requirements of Regulatory Guide 1.9 (Ref. 3). The continuous service rating of each EDG is 6083 kW (rounded to 6100 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 the UFSAR, Chapter 6 (Ref. 4) and Chapter 15 (Ref. 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. A discussion of these limits may be found in the Bases for Section 3/4.2, Power Distribution Limits; Section 3/4.4, Reactor Coolant System; and Section 3/4.6, Containment Systems.

The OPERABILITY of the AC electrical power sources is consistent with the initial assumptions of the Accident analyses and is based upon meeting the design basis of the unit. This results in maintaining at least one train of the onsite or offsite AC sources OPERABLE during Accident conditions in the event of:

a. An assumed loss of all offsite power or all onsite AC power and

b. A worst case single failure.

The AC sources satisfy Criterion 3 of 10 CFR 50.36.

LIMITING CONDITION FOR OPERATION (LCO)

Two qualified circuits between the offsite transmission network and the onsite Class 1E Electrical Power System and separate and independent EDGs for each train ensure availability of the required power to shutdown the reactor and maintain it in a safe shutdown condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Qualified offsite circuits are those that are described in the UFSAR and are part of the licensing basis for the unit,

Each offsite circuit must be capable of maintaining rated frequency and voltage, and accepting required loads during an accident, while connected to the ESF buses.

The offsite circuits receive power from three 345,000 volt transmission lines which terminate in a common termination yard, which is then fed to the switchyard. The switchyard is arranged through circuit breakers and transformers to form the two qualified circuits. Each ESF bus is capable of being supplied by the offsite circuits either through the unit auxiliary transformer (UAT) or reserve auxiliary transformer (RAT). The RAT is normally the standby transformer when the UAT is unavailable.

Each EDG must be capable of starting, accelerating to rated speed and voltage, and connecting to its respective ESF bus on detection of bus undervoltage. This will be

3/4.8.1 AC SOURCES (Continued)

LCO (continued)

accomplished within 10 to 12 seconds, depending on the type of event (12 seconds for loss of power only event, and 10 seconds for events requiring safety injection). Each EDG must also be capable of accepting required loads within the assumed loading sequence intervals, and continue to operate until offsite power can be restored to the ESF buses. These capabilities are required to be met from a variety of initial conditions such as EDG in standby with the engine hot and EDG in standby with the engine at ambient (keep-warm temperature) conditions. Additional EDG capabilities must be demonstrated as well to other required surveillances, e.g., capability of the EDG to revert to standby status on an ECCS signal while operating in parallel test mode.

In addition, though not specifically mentioned in the LCO, one required emergency power sequencer timer per train must be OPERABLE as well. The sequencer is an essential support system to the EDG associated with a given ESF bus. Furthermore, the sequencer is on the primary success path for most major AC electrically powered safety systems powered from the associated ESF bus. Therefore, loss of an ESF bus sequencer affects every major ESF system in the train. Thus, the proper sequencing of loads, including tripping of nonessential loads is a required support function for EDG OPERABILITY.

The AC sources in one train must be separate and independent (to the extent possible) of the AC sources in the other train (Ref. 1). For the EDGs, separation and independence are complete.

For the offsite AC sources, separation and independence are to the extent practical. A circuit may be connected to more than one ESF bus, with fast transfer capability to the other circuit OPERABLE, and not violate separation criteria. A circuit that is not connected to an ESF bus is required to have OPERABLE fast transfer capability to at least one ESF bus to support OPERABILITY of that circuit. Both offsite power circuits are designed to be connected or available via fast transfer to both ESF buses. However, the minimum regulatory requirements are met and the two offsite power circuits can be considered OPERABLE with each offsite power circuit connected or available via fast transfer to only one ESF bus as long as the two offsite power circuits are connected or available via fast transfer to opposite ESF buses.

APPLICABILITY

The AC sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients and

b. Adequate core cooling is provided and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

The AC power requirements for MODES 5 and 6 are covered in LCO 3/4.8.2, "AC Sources – Shutdown."

ACTIONS

For all of the following ACTIONs, if the inoperable AC electric power sources cannot be restored to OPERABLE status within the required AOT, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least HOT

3/4.8.1 AC SOURCES (Continued)

LCO (continued)

STANDBY within 6 hours and to COLD SHUTDOWN within the following 30 hours.

The AOTs are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems.

The term, "verify," as used in this context means to administratively check by examining logs or other information to determine if certain components are out of service for maintenance or other reasons. It does not mean to perform the Surveillance Requirements needed to demonstrate the OPERABILITY of the component.

a. ACTION a. is to ensure a highly reliable power source remains with one offsite circuit inoperable, it is necessary to verify the OPERABILITY of the remaining required offsite circuit on a more frequent basis, i.e., within 1 hour of discovery and at least once every 8 hours thereafter. However, if a second required circuit fails Surveillance Requirement (SR) 4.8.1.1.1a, the second offsite circuit is inoperable, and ACTION e., for two offsite circuits inoperable, would have to be entered.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue with one offsite power source inoperable for a period that should not exceed 72 hours. With one offsite circuit inoperable, the reliability of the offsite system is degraded, and the potential for a loss of offsite power is increased, with attendant potential for a challenge to the unit safety systems. In this condition, however, the remaining OPERABLE offsite circuit and EDGs are adequate to supply electrical power to the onsite Class 1E Distribution System.

The 72-hour allowed outage time (AOT) takes into account the capacity and capability of the remaining AC sources, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

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b. When one EDG is inoperable it is necessary to verify the availability of the offsite circuits on a more frequent basis to ensure a highly reliable power source remains. Since the required ACTION only specifies "perform," a failure of SR 4.8.1.1.1a acceptance criteria does not result in a required ACTION being not met. However, if a circuit fails to pass SR 4.8.1.1.1a, it is inoperable. Upon offsite circuit inoperability, additional conditions and required ACTIONs must then be entered.

ACTION b. requires performance of ACTION d., which is intended to provide assurance that a loss of offsite power, during the period that a EDG is inoperable, does not result in a complete loss of safety function of critical features/systems. While in this condition (one EDG inoperable), the remaining OPERABLE EDG and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Refer to ACTION d. basis for further discussion.

ACTION b. also requires starting the remaining EDG per SR 4.8.1.1.2a.5) within 24 hours to demonstrate OPERABILITY. The associated * footnote provides an allowance to avoid unnecessary testing of the remaining EDG to verify OPERABLITY. If the inoperable EDG has been successfully operated within the last 24 hours, if currently operating or if it can be determined that the cause of the inoperable EDG does not exist on the OPERABLE EDG, SR 4.8.1.1.2a.5) does not have to be performed. If the cause of inoperability exists on the remaining EDG, the remaining EDG would be declared inoperable upon discovery and ACTION f. would be entered for two EDGs inoperable. Once the failure is repaired, the

3/4.8.1 AC SOURCES (Continued)

LCO (continued)

common cause failure no longer exists, and ACTION f. is satisfied. If the cause of the initial inoperable EDG cannot be confirmed not to exist on the remaining EDG(s), performance of SR 4.8.1.1.2a.5) suffices to provide assurance of continued OPERABILITY of the remaining EDG while the common cause possibility is evaluated under the corrective action program.

In the event the inoperable EDG is restored to OPERABLE status prior to completing the actions required in ACTION b., the plant corrective action program will continue to evaluate the common cause possibility. This continued evaluation, however, is no longer under the 24 hour constraint imposed while in ACTION b.

According to Generic Letter 84-15 (Ref. 7), 24 hours is a reasonable time to confirm that the OPERABLE EDG is not affected by the same problem as the inoperable EDG.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue with one onsite power source inoperable for a period that should not exceed 72 hours. The remaining OPERABLE EDG and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 72-hour AOT takes into account the capacity and capability of the remaining AC sources, a reasonable time for evaluation and repairs, and the low probability of a DBA occurring during this period.

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c. When in ACTION c., individual redundancy is lost in both the offsite electrical power system and the onsite AC electrical power system. Since power system redundancy is provided by two diverse sources of power, however, the reliability of the power systems in this condition may appear higher than the condition of ACTION e. (loss of both required offsite circuits). This difference in reliability is offset by the susceptibility of this power system configuration to a single bus or switching failure.

ACTION c. also directs the performance of ACTION d. and demonstration of the remaining OPERABLE offsite and onsite power sources, similar to the actions specified in ACTION b., however, demonstration of OPERABILITY for the remaining EDG must be performed in 8 hours. If one power source is restored within 12 hours, power operation continues in accordance with either ACTION a. or ACTION b.

According to Regulatory Guide 1.93 (Ref. 6), operation may continue while in ACTION c. for a period that should not exceed 12 hours. The 12-hour AOT takes into account the capacity and capability of the remaining AC sources, a reasonable time for evaluation and repairs, and the low probability of a DBA occurring during this period.

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d. ACTION d. is intended to provide assurance that a loss of offsite power condition does not result in a complete loss of safety function of critical features during the period when either an EDG is inoperable (condition addressed in ACTION b.) or when both an EDG and an offsite power source are inoperable (condition addressed in ACTION c.) at the same time. Critical features are designed with redundant safety related trains. Thus, it is necessary to verify OPERABILITY of redundant critical features in a timely manner. The term "verify," as used in this context means to administratively check by examining logs or other information to determine of certain components are out of service for maintenance or other reasons. It does not mean to perform the Surveillance Requirements needed to demonstrate OPERABILITY of the component.

In addition, when in MODE 1, 2, or 3, the turbine driven emergency feedwater pump

3/4.8.1 AC SOURCES (Continued)

LCO (continued)

must also be verified OPERABLE as well. This requirement ensures a diverse emergency feedwater supply to the steam generators should the remaining offsite and onsite power sources subsequently become inoperable.

Redundant required feature failures consist of inoperable features associated with a train, redundant to the train that has an inoperable EDG (i.e., all required systems, subsystems, trains, components and devices dependent on the remaining OPERABLE EDG must be verified OPERABLE as well). The emergency power supply for the required systems, subsystems, trains, components and devices may be used as the primary basis for determining the redundant features–train relationship. Features whose inoperability has been determined to impact both trains should be considered as Train A and Train B related. Manually operated features should use the same train designation as the electrically powered features in the same flowpath.

Discovering one required EDG inoperable coincident with one or more inoperable required support or supported features, or both, that are associated with the OPERABLE EDG, results in starting the AOT for ACTION d. The 2-hour AOT from the discovery of these events existing concurrently is acceptable because it minimizes risk while allowing time for restoration before subjecting the unit to transients associated with shutdown.

While in this condition, the remaining OPERABLE EDG and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Though, on a component basis, single failure protection for the required feature's function may have been lost, however, the safety function has not been lost.

The 2-hour AOT takes into account the OPERABILITY of the redundant counterpart to the inoperable required feature, the capacity and capability of the remaining AC sources, a reasonable time for evaluation and repairs, and the low probability of a DBA occurring during this period.

If at any time during the existence of this condition (one EDG inoperable), a required feature subsequently becomes inoperable, the 2-hour AOT would begin to be tracked.

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e. ACTION e., which applies when two offsite circuits are inoperable, is intended to provide assurance that an event with a coincident single failure will not result in a complete loss of redundant required safety functions

According to Regulatory Guide 1.93 (Ref. 6), operation may continue with two offsite AC power sources inoperable for a period that should not exceed 24 hours. This level of degradation means that the offsite electrical power system does not have the capability to effect a safe shutdown and to mitigate the effects of an accident; however, the onsite AC sources have not been degraded. This level of degradation generally corresponds to a total loss of the immediately accessible offsite power sources.

Because of the normally high availability of the offsite sources, this level of degradation may appear to be more severe than other combinations of two AC sources inoperable that involve one or more EDGs inoperable. However, two factors tend to decrease the severity of this level of degradation:

1. The configuration of the redundant AC electrical power system that remains available is

3/4.8.1 AC SOURCES (Continued)

LCO (continued)

not susceptible to a single bus or switching failure, and

2. The time required to detect and restore an unavailable off site power source is generally much less than that required to detect and restore an unavailable onsite AC source.

With both of the required offsite circuits inoperable, sufficient onsite AC sources are available to maintain the unit in a safe shutdown condition in the event of a DBA or transient. In fact, a simultaneous loss of offsite AC sources, a LOCA and a worst case single failure were postulated as a part of the design basis in the safety analysis. Thus, the 24-hour AOT provides a period of time to effect restoration of one of the offsite circuits commensurate with the importance of maintaining an AC electrical power system capable of meeting its design criteria.

According to Reference 6, with the available offsite AC sources, two less than required by the LCO, operation may continue for 24 hours. If two offsite sources are restored within 24 hours, unrestricted operation may continue. If only one offsite source is restored within 24 hours, power operation continues in accordance with ACTION a.

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f. With Train A and Train B EDGs inoperable, there are no remaining standby AC sources. Thus, with an assumed loss of offsite electrical power, insufficient standby AC sources are available to power the minimum required ESF functions. For this level of degradation, the offsite electrical power system is the only source of AC power available. The risk associated with continued operation for a very short time could be less than that associated with an immediate controlled shutdown (the immediate shutdown could cause grid instability and inadvertent generator trip, which could result in a total loss of AC power); however, the time allowed for continued operation is severely restricted. The intent here is to avoid the risk associated with an immediate controlled shutdown and to minimize the risk associated with this level of degradation.

According to Reference 6, with both EDGs inoperable, operation may continue for a period that should not exceed 2 hours. If one EDG is restored within 2 hours power operation may continue in accordance with ACTION b.

SURVEILLANCE REQUIREMENTS (SR)

The AC sources are designed to permit inspection and testing of important areas and features, especially those that have a standby function, in accordance with 10 CFR 50, Appendix A, GDC 18 (Ref 8). Periodic component tests are supplemented by extensive functional tests during refueling outages (under simulated accident conditions). The SRs for demonstrating the OPERABILITY of the EDGs are in accordance with the recommendations of Regulatory Guide 1.9 (Ref. 3), Regulatory Guide 1.108 (Ref. 9), and Regulatory Guide 1.137 (Ref. 10), as addressed in the UFSAR including exceptions thereto.

Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. The minimum steady state output voltage of 3740 Vac is 90% of the nominal 4160 Vac output voltage. This value, which is specified in ANSI C84.1 (Ref 11) allows for voltage drop to the terminals of 4000 V motors whose minimum operating voltage is specified as 90% or 3600 Vac. It also allows for voltage drops to motors and other equipment down through the 120

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

Vac level where minimum operating voltage is also usually specified as 90% of nameplate rating. The specified maximum steady state output voltage of 4580 Vac is equal to the nominal bus voltage plus 10%. The specified minimum and maximum frequencies of the EDG are 58.8 Hz and 61.2 Hz, respectively. These values are equal to ±2% of the 60 Hz nominal frequency and are derived from the recommendations given in Regulatory Guide 1.9 (Ref. 3).

SR 4.8.1.1.1a

This SR ensures proper circuit continuity for the offsite AC electrical power supply to the onsite distribution network and availability of offsite AC electrical power. The breaker alignment verifies that each breaker is in its correct position to ensure that distribution buses and loads are connected to their preferred power source, and that appropriate independence of offsite circuits is maintained. The 7-day frequency is adequate since breaker position is not likely to change without the operator being aware of it and because its status is displayed in the control room.

SR 4.1.1.1b

Transfer of each 4.16 kV ESF bus power supply from the normal offsite circuit to the alternate offsite circuit demonstrates the OPERABILITY of the alternate circuit distribution network to power the shutdown loads. The transfer circuit is only required to be OPERABLE when the offsite circuit to which it transfers is credited as being OPERABLE. The 18-month frequency of the Surveillance is based on engineering judgment, taking into consideration the unit conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths. Operating experience has shown that these components usually pass the SR when performed at the 18-month frequency. Therefore, the frequency was concluded to be acceptable from a reliability standpoint.

SR 4.8.1.1.1.b is modified by footnote * prohibiting performance during MODE 1 or 2. The reason for the Note is that, during operation with the reactor critical, performance of this SR could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, unit safety systems.

SR 4.8.1.1.2a through 2.g

These SRs help to ensure the availability of the standby electrical power supply to mitigate DBAs and transients and to maintain the unit in a safe shutdown condition.

SR 4.8.1.1.2 is modified by footnote ** to indicate that all planned EDG starts for the purposes of these surveillances may be preceded by an engine prelube period. This allowance is to minimize wear on moving parts since the EDG does not get lubricated when the engine is not running.

The term "standby condition" used throughout these SRs mean that the diesel engine coolant and oil are being continuously circulated and engine temperature is being maintained consistent with manufacturer recommendations at keep-warm values.

SR 4.8.1.1.2a

Activities to demonstrate EDG OPERABILITY under this SR are to be performed on a STAGGERED TEST BASIS at least once every 31 days. Performance of surveillances on a staggered test basis provides an added measure of assurance that the redundant onsite power sources are OPERABLE and any detected failure during surveillance testing is promptly

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

evaluated to determine if the failure has a common failure mode component to it.

SR 4.8.1.1.2a.1) provides verification that the level of fuel oil in the day tank is at or above the level at which fuel oil is automatically added. The level is expressed as an equivalent volume in gallons, and is selected to ensure adequate fuel oil for a minimum of 1 hour of EDG operation at full load plus 10%. The 31-day frequency is adequate to assure that a sufficient supply of fuel oil is available, since low level alarms are provided and facility operators would be aware of any large uses of fuel oil during this period.

SR 4.8.1.1.2a.2) provides verification that there is an adequate inventory of fuel oil in the storage tanks to support each EDG's operation for 7 days. The 7-day period is sufficient time to place the unit in a safe shutdown condition and to bring in replenishment fuel from an offsite location. The 31-day frequency is adequate to ensure that a sufficient supply of fuel oil is available, since low level alarms are provided and unit operators would be aware of any large uses of fuel oil during this period.

SR 4.8.1.1.2a.3) demonstrates that each required fuel oil transfer pump operates and transfers fuel oil from its associated storage tank to its associated day tank. This is required to support continuous operation of standby power sources. This Surveillance provides assurance that the fuel oil transfer pump is OPERABLE, the fuel oil piping system is intact, the fuel delivery piping is not obstructed, and the controls and control systems for **automatic** fuel transfer systems are OPERABLE. The 31-day frequency is appropriate since proper operation of fuel transfer systems is an inherent part of EDG OPERABILITY.

SR 4.8.1.1.2a.4) ensures that sufficient lube oil inventory is available to support at least 7 days of operation for each EDG. The 275 gal minimum requirement is based on the EDG manufacturer consumption values for the run time of the EDG. Implicit in this SR is the requirement to verify the capability to transfer the lube oil from its storage location to the EDG, when the EDG lube oil sump does not hold adequate inventory for 7 days of operation without the level reaching the manufacturer recommended minimum level. A 31-day frequency is adequate to ensure that a sufficient lube oil supply is onsite, since EDG starts and run time are closely monitored by the unit staff.

SR 4.8.1.1.2a.5) ensures that the EDG is capable of starting from standby conditions and attaining rated voltage and frequency. The SR is modified by footnote *** which requires the EDG to be gradually loaded per SR 4.8.1.1.2a.6) immediately following the performance of this SR. In addition, footnote *** allows a modified start procedure to be used in lieu of the 10-12 seconds "fast start" for the EDG. In order to reduce stress and wear on diesel engines, the manufacturer recommends a modified start in which the starting speed of the EDG is limited, warmup is limited to this lower speed, and the EDG is gradually accelerated to synchronous speed prior to loading. Use of the modified start method requires the diesel governor system to be capable of engine idling and gradual acceleration to synchronous speed. When the modified start is not used footnote *** requires that the time, voltage, and frequency tolerances of SR 4.8.1.1.2e) (10 second start) be met. The 31-day frequency for SR 4.8.1.1.2a.5) is consistent with Regulatory Guide 1.9 (Ref. 3), though Seabrook Station is not committed to Regulatory Guide 1.9.

SR 4.8.1.1.2a.6) verifies that the EDG is capable of synchronizing with the offsite electrical system and accepting loads greater than or equal to the equivalent of the maximum expected accident loads. A minimum run time of 60 minutes is required to stabilize engine temperatures, while minimizing the time that the EDG is connected to the offsite source.

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

To minimize mechanical stress and wear on the diesel engine SR 4.8.1.1.2a.6) is modified by footnote **** that allows EDG loading per the manufacturers recommendations, including a warmup period. In addition, footnote **** states that momentary transients outside the load range, due to changing bus conditions do not invalidate the test. Footnote **** also stipulates a prerequisite requirement for performance of this SR whereby this SR must be preceded by and immediately follow a successful EDG start per SR 4.8.1.1.2a.5) or SR 4.8.1.1.2e to credit satisfactory performance.

Note that although no power factor requirements are established by SR 4.8.1.1.2a.6), the EDG is normally operated at a power factor between 0.8 lagging and 1.0. The 0.8 value is the design rating of the machine, while the 1.0 is an operational limitation to ensure circulating currents are minimized. The load band is provided to avoid routine overloading of the EDG. Routine overloading may result in more frequent tear down inspections in accordance with vendor recommendations in order to maintain EDG OPERABILITY. Similarly, though not stated in footnote ****, momentary kvar transients above the limit do not invalidate the test.

The 31-day frequency for SR 4.8.1.1.2a.6) is consistent with Regulatory Guide 1.9 (Ref. 3).

SR 4.8.1.1.2a.7) ensures that following EDG testing per SR 4.8.1.1.2a.5) and SR 4.8.1.1.2a.6) that the EDG is returned to ready to standby status when offsite power is restored. It also ensures that the auto-start logic is reset to allow the EDG to reload if a subsequent loss of offsite power occurs. The EDG is considered to be in ready to load status when the EDG is at rated speed and voltage, the output breaker is open and can receive an autoclose signal on bus undervoltage, and the load sequence timers are reset.

SR 4.8.1.1.2b and SR 4.8.1.1.2c

Removal of water from the fuel oil day and storage tanks once every 31 days eliminates the necessary environment for bacterial survival. Microbiological fouling is a major cause of fuel oil degradation. There are numerous bacteria that can grow in fuel oil and cause fouling, but all must have a water environment in order to survive. Removal of water is the most effective means of controlling microbiological fouling. In addition, it eliminates the potential for water entrainment in the fuel oil during EDG operation. Water may come from any of several sources, including condensation, ground water, rain water, contaminated fuel oil, and breakdown of the fuel oil by bacteria. Frequent checking for and removal of accumulated water minimizes fouling and provides data regarding the watertight integrity of the fuel oil system. The Surveillance frequencies are established by Regulatory Guide 1.137 (Ref. 10). This SR is for preventative maintenance. The presence of water does not necessarily represent failure of this SR, provided the accumulated water is removed during the performance of this Surveillance.

SR 4.8.1.1.2d

For proper operation of the standby EDGs, it is necessary to ensure the proper quality of the fuel oil. Regulatory Guide 1.137 (Ref. 10) addresses the recommended fuel oil practices as supplemented by ANSI Standards. The SR refers to the Diesel Fuel Oil Testing Program (Specification 6.7.6i) for the verification of new and stored fuel oil properties. The fuel oil properties governed by Specification 6.7.6i are water and sediment content, kinematic viscosity, specific gravity (or API gravity), and impurity level. Technical Requirements Program (TRP) 5.1 implements the requirements of Specification 6.7.6i. The 31-day frequency is acceptable because the fuel oil properties of interest, even if they were not within stated limits, would not have an immediate effect on EDG operation. This Surveillance ensures the availability of high

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

quality fuel oil for the EDGs.

SR 4.8.1.1.2e

This surveillance requires that, at a 184-day frequency, the EDG starts from standby conditions and achieves required voltage and frequency within 10 seconds (a.k.a, "fast start"). The 10-second start requirement supports the assumptions of the design basis LOCA analysis in the UFSAR, Chapter 15 (Ref. 5).

Upper limits for voltage and frequency are not specified during the initial EDG start in order to account for potential overshoot in voltage and frequency because of governor control system characteristics when testing the EDG in an unloaded condition.

Since this SR requires a 10 second start, it is more restrictive than SR 4.8.1.1.2a.5), and it may be performed in lieu of SR 4.8.1.1.2a.5). Associated footnote # allows crediting of this SR for SR 4.8.1.1.2a.5). Additionally, footnote # stipulates that gradual loading per SR 4.8.1.1.2a.6) must immediately follow this surveillance.

In addition to the SR requirements, the time for the EDG to reach steady state operation, unless the modified EDG start method is employed, is periodically monitored and the trend evaluated to identify degradation of governor and voltage regulator performance.

This SR in combination with SR 4.8.1.1.2a.5) help to ensure the availability of the standby electrical power supply to mitigate DBAs and transients and to maintain the unit in a safe shutdown condition.

The 184-day frequency is consistent with Generic Letter 84-15 (Ref. 7) and provides adequate assurance of EDG OPERABILITY, while minimizing degradation resulting from testing.

SR 4.8.1.1.2f

Surveillances carried out under SR 4.8.1.1.2f are activities normally conducted during shutdown at a refueling frequency of every 18 months. The SR is modified by footnote ## which provides a dispensation from the 'during shutdown' requirement provided an evaluation supports the safe conduct of a particular surveillance in a condition or mode that is consistent with safe operation of the plant. This disposition is consistent with Generic Letter 91-04 (Ref. 13).

Note: SR 4.8.1.1.2f.1), SR 4.8.1.1.2f.2), and SR 4.8.1.1.2.2f.13) are Not Used.

SR 4.8.1.1.2f.2) demonstrates the EDG load response characteristics and capability to reject the largest single load without exceeding predetermined voltage and frequency limits. This surveillance may be accomplished by either:

a. Tripping the EDG output breaker with the EDG carrying greater than or equal to its associated single largest post-accident load while paralleled to offsite power, or while solely supplying the bus, or

b. Tripping its associated single largest post-accident load with the EDG solely supplying the bus.

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

If method a. is used the EDG power factor must be in the range of 0.9 which is representative of actual design basis inductive loading.

The voltage and frequency specified are consistent with the design range of the equipment powered by the EDG and are the steady state voltage and frequency values to which the system must recover following load rejection. The 18-month frequency is consistent with the recommendation of Regulatory Guide 1.108 (Ref. 9).

SR 4.8.1.1.2f.3) demonstrates the DG's capability to reject a full load without overspeed tripping or exceeding the predetermined voltage limits. The DG full load rejection may occur because of a system fault or inadvertent breaker tripping. This Surveillance ensures proper engine generator load response under the simulated test conditions. This test simulates the loss of the total connected load that the DG experiences following a full load rejection and verifies that the DG does not trip upon loss of the load. These acceptance criteria provide for DG damage protection. While the DG is not expected to experience this transient during an event and continues to be available, this response ensures that the DG is not degraded for future application, including reconnection to the bus if the trip initiator can be corrected or isolated.

As required by IEEE-387 (Ref. 12), the load rejection test is acceptable if the increase in diesel speed does not exceed 75% of the difference between synchronous speed and the overspeed trip setpoint, or 15% above synchronous speed, whichever is lower.

The 18 month frequency is consistent with the recommendation of Regulatory Guide 1.108 (Ref. 9) and is intended to be consistent with expected fuel cycle lengths.

SR 4.8.1.1.2f.4) demonstrates the as designed operation of the standby power sources during loss of the offsite source, as required by Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(1). This test verifies all actions encountered from the loss of offsite power, including shedding of the nonessential loads and energization of the emergency buses and respective loads from the EDG. It further demonstrates the capability of the EDG to automatically achieve the required voltage and frequency within the specified time.

The EDG auto-start time of 12 seconds is derived from requirements of the accident analysis to respond to a loss of offsite power event. The Surveillance must be continued for a minimum of 5 minutes in order to demonstrate that all starting transients have decayed and stability is achieved.

The requirement to verify the connection and power supply of permanent and auto-connected shutdown loads is intended to satisfactorily show the relationship of these loads to the EDG loading logic. In certain circumstances, many of these loads cannot actually be connected or loaded without undue hardship or potential for undesired operation. In lieu of actual demonstration of connection and loading of loads, testing and analysis that adequately show the capability of the EDG systems to perform these loading functions is acceptable. This testing may include any series of sequential, overlapping, or total steps so that the entire connection and loading sequence is verified. Similarly, pumps need not be operated at design basis flows since the purpose of the SR is only to verify correct loading sequence.

This SR is modified by footnote ### to allow starting of the diesel engine at or near normal operating temperature in lieu of standby conditions. The reason for the footnote is to minimize wear and tear on the EDGs during testing. Repeated fast starts with the diesel engine starting at a standby condition temperature still contribute to accelerated engine degradation. Starting

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

of the diesel generator from standby conditions, equivalent to the keep-warm systems temperature, would continue to be performed per SR 4.8.1.1.2f.6) (the loss-of-offsite power in conjunction with a SI actuation test signal) which would meet the spirit of Generic Letter 84-15 (Ref. 7). This allowance would also benefit outage planning and scheduling to shorten the length of the outage by not needing to wait for the engine to cool down before starting the next test. In addition, this capability would continue to be verified several times during the 18-month operating cycle when performing the 184-day fast start test per SR 4.8.1.1.2e.

The 18-month frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(1), takes into consideration unit conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths.

SR 4.8.1.1.2f.5) demonstrates that the EDG automatically starts and reaches the minimum voltage and frequency requirements within the specified time (10 seconds) from the design basis (LOCA) actuation signal (SI signal) without loss of offsite power, maintains steady-state voltage and frequency within prescribed limits, and operates on standby for at least 5 minutes. The 5-minute period provides sufficient time to demonstrate stability. Upper limits for voltage and frequency are not specified during the initial EDG start in order to account for potential overshoot in voltage and frequency because of governor control system characteristics when testing the EDG in an unloaded condition. The time, voltage and frequency for the EDG to reach steady state operation is periodically monitored and the trend evaluated to identify degradation of governor and voltage regulator performance.

The 18-month frequency takes into consideration unit conditions required to perform the Surveillance and is intended to be consistent with the expected fuel cycle lengths. Operating experience has shown that these components usually pass the SR when performed at the 18-month frequency. The frequency is also consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9) for other EDG surveillance requirements. Therefore, the frequency was concluded to be acceptable from a reliability standpoint.

This SR is modified by footnote ###, as described in SR 4.8.1.1.2f.4), to minimize wear and tear on the EDGs during testing.

SR 4.8.1.1.2f.6) demonstrates the EDG operation, as discussed in the Bases for SR 4.8.1.1.2f.4), during a loss of offsite power actuation test signal in conjunction with a SI actuation signal. In the event of a DBA coincident with a loss of offsite power, the EDGs are required to supply the necessary power to ESF systems so that the fuel, RCS, and containment design limits are not exceeded. The basis for the EDG auto-start is as discussed in the Bases for SR 4.8.1.1.2f.5). The basis for the EDG loading is as discussed in the Bases for SR 4.8.1.1.2f.4).

The surveillance must be continued for a minimum of 5 minutes in order to demonstrate that all starting transients have decayed and stability is achieved.

The SR is performed with the EDG initially at standby condition, i.e., equivalent to the keep-warm systems temperature. This requirement is consistent with Generic Letter 84-15 (Ref. 7) which notes that the design basis for the plant, i.e., large LOCA coincident with loss of offsite power requires the EDG to be capable of starting from ambient conditions (keep-warm system temperature).

The SR also demonstrates that all automatic protective trip functions (e.g., high jacket water temperature) except, engine overspeed, 4160 volt bus fault, generator differential current, and

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

low lube oil pressure, are bypassed on a loss of voltage signal concurrent with a SI actuation test signal. The noncritical trips are bypassed during DBAs and provide an alarm on an abnormal engine condition. This alarm provides the operator with sufficient time to react appropriately. The EDG availability to mitigate the DBA is more critical than protecting the engine against minor problems that are not immediately detrimental to emergency operation of the EDG.

The 18-month frequency takes into consideration unit conditions required to perform the Surveillance, is intended to be consistent with an expected fuel cycle length of 18 months, and is consistent with the frequency of SR 4.8.1.1.2f.4). Operating experience has shown that these components usually pass the SR when performed at the 18-month frequency. The frequency is also consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9) for other EDG surveillance requirements. Therefore, the frequency was concluded to be acceptable from a reliability standpoint.

SR 4.8.1.1.2f.7) demonstrates that the EDGs can start and run continuously at full load capability for an interval of not less than 24 hours at a load equivalent to 92 - 100 percent of the continuous duty rating of the EDG. The EDG starts for this SR can be performed either from standby or hot conditions. The load band is provided to avoid routine overloading of the EDG. Routine overloading may result in more frequent tear down inspections in accordance with vendor recommendations in order to maintain EDG OPERABILITY.

Should auto-connected loads be added in the future such that the load on the bus reach or exceed the EDG continuous load rating, the EDG must run for a minimum of 2 hours at a load equivalent to 105 – 110 percent the continuous duty rating of the EDG. The remaining hours of the 24-hour run are to be at 92 – 100 percent full load. In addition, the SR requires verification that the auto-connected loads do not exceed the short term rating of the EDG.

Note that although no power factor requirements are established by SR 4.8.1.1.2f.7), the EDG is normally operated at a power factor between 0.8 lagging and 1.0. The 0.8 value is the design rating of the machine, while the 1.0 is an operational limitation to ensure circulating currents are minimized. The load band is provided to avoid routine overloading of the EDG. Routine overloading may result in more frequent tear down inspections in accordance with vendor recommendations in order to maintain EDG OPERABILITY.

To minimize mechanical stress and wear on the diesel engine SR 4.8.1.1.2f.7) is modified by footnote ### that allows EDG loading per the manufacturers recommendations, including a warmup period. In addition, the footnote states that momentary transients outside the load range, due to changing bus conditions do not invalidate the test. Similarly, though not stated in footnote ###, momentary kvar transients above the limit do not invalidate the test.

The 18-month frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref 9), paragraph 2.a.(3), takes into consideration unit conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths.

SR 4.8.1.1.2f.8) demonstrates that the diesel engine can restart within 5 minutes from a hot condition, such as subsequent to shutdown from normal surveillances, and achieve the minimum required voltage and frequency within 10 seconds and steady-state conditions thereafter. The time, voltage and frequency for the EDG to reach steady state operation is periodically monitored and the trend evaluated to identify degradation of governor and voltage regulator performance.

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

The requirement that the diesel has operated for at least 2 hours at sufficiently loaded conditions prior to performance of this Surveillance is based on manufacturer recommendations for achieving hot conditions. The load band is provided to avoid routine overloading of the EDG.

The SR is modified by footnote + noting that momentary transients outside the load range, due to changing bus loads, do not invalidate the test.

The 18-month frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(5).

SR 4.8.1.1.2f.9) ensures, as recommended by Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(6), that the manual synchronization and load transfer (emergency loads) from the EDG to the offsite source can be made and the EDG can be returned to standby status when offsite power is restored. It also ensures that the auto-start logic is reset to allow the EDG to reload if a subsequent loss of offsite power occurs. The EDG is considered to be in standby status when the EDG is aligned for auto-start, the EDG circuit breaker is available for automatic closure, and the emergency power sequencer timer(s) are reset and available for automatic operation.

The three sub-steps do not need to be performed sequentially. It is acceptable to delay performance of sub-step c) to support optimum scheduling of maintenance and surveillance activities so long as the requisite test criteria are met when it is performed.

The 18-month frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(6), and takes into consideration unit conditions required to perform the Surveillance.

SR 4.8.1.1.2f.10) is a demonstration of the test mode override which ensures that EDG availability under accident conditions will not be compromised as a result of testing the EDG while connected to its bus. The EDG is verified to return to standby operation and the emergency loads are automatically energized with offsite power if a SI actuation signal is received during operation in the test mode. Ready to load operation is defined as the EDG running at rated speed and voltage with the EDG output breaker open.

The requirement to automatically energize the emergency loads with offsite power is intended to show that the emergency loading was not affected by the EDG operation in test mode. In certain circumstances, many of these loads cannot actually be connected or loaded without undue hardship or potential for undesired operation. For instance, ECCS injection valves are not desired to be stroked open, or high pressure injection systems are not capable of being operated at full flow, or RHR systems performing a decay heat removal function are not desired to be realigned to the ECCS mode of operation. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the emergency loads to perform these functions is acceptable. This testing may include any series of sequential, overlapping, or total steps so that the entire connection and loading sequence is verified.

The 18-month frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(8), takes into consideration unit conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths.

SR 4.8.1.1.2f.11) demonstrates that each required fuel oil transfer pump operates and transfers fuel oil from each storage tank to each EDG day tank via the installed cross-connection lines. This is required to support continuous operation of standby power sources. This Surveillance provides assurance that the fuel oil transfer pump is OPERABLE, the fuel oil

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

piping system is intact, the fuel delivery piping is not obstructed, and the controls and control systems for fuel transfer systems are OPERABLE.

The 18-month frequency for this SR is appropriate to verify this capability since both EDG and associated fuel oil trains are independent and are normally not cross-connected. The cross-connect provision is an installed feature for an enhanced defense-in-depth capability should, in the unlikely event, it become necessary to cross-connect the fuel oil trains.

SR 4.8.1.1.2f.12) ensures that under loss of offsite power conditions, with or without an accident, loads are sequentially connected to the bus by the emergency power sequencer timer. The sequencing logic controls the permissive and starting signals to motor and other load breakers to prevent overloading of the EDGs due to high inrush starting currents. The 10% load sequence time interval tolerance ensures that sufficient time exists for the EDG to restore frequency and voltage prior to applying the next load and that safety analysis assumptions regarding ESF equipment time delays are not violated. Reference 2 provides a summary of the automatic loading of ESF buses.

The 18-month frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(2), takes into consideration unit conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths.

SR 4.8.1.1.2f.14) demonstrates that when a Tower Actuation (TA) signal is generated, while the EDG is loaded with its permanently connected loads and auto-connected emergency accident loads, the associated operating service water pump automatically trips and the corresponding cooling tower pump starts and after energization that voltage and frequency of the emergency bus remains within steady-state limits.

The 18-month frequency takes into consideration unit conditions required to perform the Surveillance and is intended to be consistent with the expected fuel cycle lengths. Operating experience has shown that these components usually pass the SR when performed at the 18-month frequency. The frequency is also consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9) for other EDG surveillance requirements. Therefore, the frequency was concluded to be acceptable from a reliability standpoint.

SR 4.8.1.1.2f.15) demonstrates that while EDG 1A is loaded with its permanently connected loads and auto-connected emergency loads, that emergency bus E5 voltage and frequency remain within steady-state limits after manual energization of the 1500 hp startup feedwater pump (the largest manually-connected load).

The 18-month frequency takes into consideration unit conditions required to perform the Surveillance and is intended to be consistent with the expected fuel cycle lengths. Operating experience has shown that these components usually pass the SR when performed at the 18-month frequency. The frequency is also consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9) for other EDG surveillance requirements. Therefore, the frequency was concluded to be acceptable from a reliability standpoint.

SR 4.8.1.1.2g

This surveillance demonstrates that the EDG starting independence has not been compromised. Also, this Surveillance demonstrates that each engine can achieve proper voltage and frequency within 10 seconds then steady-state condition when the EDGs are started simultaneously. The time, voltage and frequency for the EDG to reach steady state operation is monitored and the trend evaluated to identify degradation of governor and voltage

3/4.8.1 AC SOURCES (Continued)

SURVEILLANCE REQUIREMENTS (SR) (continued)

regulator performance.

The SR also requires that the EDGs must be started from standby conditions, that is, with the engine coolant and oil continuously circulated and temperature maintained consistent with manufacturer recommendations at keep-warm values.

The 10-year frequency is consistent with the recommendations of RG 1.108 (Ref. 9).

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. UFSAR, Chapter 8.
3. Regulatory Guide 1.9, Rev. 3*.
4. UFSAR, Chapter 6.
5. UFSAR, Chapter 15.
6. Regulatory Guide 1.93, Rev. 0, December 1974.
7. Generic Letter 84-15, "Proposed Staff ACTIONs to Improve and Maintain Diesel Generator Reliability," July 2, 1984.
8. 10 CFR 50, Appendix A, GDC 18.
9. Regulatory Guide 1.108, Rev. 1, August 1977.*
10. Regulatory Guide 1.137, Rev. 1, October 1979.*
11. ANSI Std. C84.1
12. IEEE Std. 387-1984**
13. Generic Letter 91-04, April 1991.

* Seabrook Station is only committed to demonstrating the OPERABILITY of the diesel generators in accordance with the recommendations of Regulatory Guides 1.9, "Selection of Diesel Generator Set Capacity for Standby Power Supplies," Revision 2, December 1979; 1.108, "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," Revision 1, August 1977, Errata September 1977; and 1.137, "Fuel-Oil Systems for Standby Generators." Revision 1, October 1979. Exceptions to these Regulatory Guides are noted in the UFSAR.

** Seabrook Station is only committed to IEEE Std. 387-1972 and 1977.

3/4.8.2 and 3/4.8.3 DC SOURCES and ONSITE POWER DISTRIBUTION (Continued)

The OPERABILITY of the minimum specified A.C. and D.C. power sources and associated distribution systems during shutdown and refueling ensures that: (1) the facility can be maintained in the shutdown or refueling condition for extended time periods and (2) sufficient instrumentation and control capability is available for monitoring and maintaining the unit status.

The Surveillance Requirement for demonstrating the OPERABILITY of the station batteries are based on the recommendations of Regulatory Guide 1.129, "Maintenance Testing and Replacement of Large Lead Storage Batteries for Nuclear Power Plants," February 1978, and IEEE Std. 450-1980, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations."

Verifying average electrolyte temperature above the minimum for which the battery was sized, total battery terminal voltage on float charge, connection resistance values, and the performance of battery service and discharge tests ensures the effectiveness of the charging system, the ability to handle high discharge rates, and compares the battery capacity at that time with the rated capacity.

Table 4.8-2 specifies the normal limits for each designated pilot cell and each connected cell for electrolyte level, float voltage, and specific gravity. The limits for the designated pilot cells float voltage and specific gravity, greater than 2.13 volts and 0.015 below the manufacturer's full charge specific gravity or a battery charger current that had stabilized at a low value, is characteristic of a charged cell with adequate capacity. The normal limits for each connected cell for float voltage and specific gravity, greater than 2.13 volts and not more than 0.020 below the manufacturer's full charge specific gravity with an average specific gravity of all the connected cells not more than 0.010 below the manufacturer's full charge specific gravity, ensures the OPERABILITY and capability of the battery.

Operation with a battery cell's parameter outside the normal limit but within the allowable value specified in Table 4.8-2 is permitted for up to 7 days. During this 7-day period: (1) the allowable values for electrolyte level ensures no physical damage to the plates with an adequate electron transfer capability; (2) the allowable value for the average specific gravity of all the cells, not more than 0.020 below the manufacturer's recommended full charge specific gravity, ensures that the decrease in rating will be less than the safety margin provided in sizing; (3) the allowable value for an individual cell's specific gravity, ensures that an individual cell's specific gravity will not be more than 0.040 below the manufacturer's full charge specific gravity and that the overall capability of the battery will be maintained within an acceptable limit; and (4) the allowable value for an individual cell's float voltage, greater than 2.07 volts, ensures the battery's capability to perform its design function.

3/4.8.4 ELECTRICAL EQUIPMENT PROTECTIVE DEVICES

Containment electrical penetrations and penetration conductors are protected by either deenergizing circuits not required during reactor operation or by demonstrating the OPERABILITY of primary and backup overcurrent protection circuit breakers during periodic surveillance.

The Surveillance Requirements applicable to lower voltage circuit breakers provide assurance of breaker reliability by testing at least one representative sample of each manufacturer's brand of circuit breaker. Each manufacturer's air circuit breakers, molded case circuit breakers, and overload devices are grouped into representative samples which are then tested on a rotating basis to ensure that all breakers are tested. If a wide variety exists within

3/4.8.2 and 3/4.8.3 DC SOURCES and ONSITE POWER DISTRIBUTION (Continued)

any manufacturer's brand of circuit breakers, it is necessary to divide that manufacturer's breakers into groups and treat each group as a separate type of breaker for surveillance purposes.

The OPERABILITY of the motor-operated valves thermal overload protection ensures that the thermal overload protection will not prevent safety-related valves from performing their function. The Surveillance Requirements for demonstrating the OPERABILITY of the thermal overload protection are in accordance with Regulatory Guide 1.106, "Thermal Overload Protection for Electric Motors on Motor Operated Valves," Revision 1, March 1977.