B 3.7 PLANT SYSTEMS

B 3.7.12 AUXILIARY BUILDING VENTILATION SYSTEM (ABVS)

BASES

BACKGROUND

The ABVS filters air from the area of the active ECCS components during the recirculation phase of a loss of coolant accident (LOCA). The ABVS, in conjunction with other normally operating systems, also provides environmental control of temperature and humidity in the ECCS pump room area, if one of the pumps is operating, and the auxiliary building.

The ABVS consists of two trains. Each train is powered by a separate vital bus and consists of a supply fan and an exhaust fan. A single roughing and HEPA filter is common to both trains for normal operations and a single roughing filter, HEPA filter, and charcoal adsorber bank and a single manually initiated heater are common to both trains for emergency operations. Ductwork, valves or dampers, and instrumentation also form part of the system,

The ABVS has several modes of operation. These modes include: (1) Building Only; (2) Building and Safeguards; and (3) Safeguards only. In the Building Only mode of operation, the ABVS provides ventilation flow to all parts of the auxiliary building except for the ECCS pump rooms, but does take suction from the ECCS rooms. If any ECCS pump is started, the ABVS will automatically re-align to the Building and Safeguards mode of operation. In the Building and Safeguards mode of operation, ventilation is provided to the entire auxiliary building, including the ECCS pump rooms. In the Safeguards Only mode of operation, only the ECCS pump rooms and the lower reaches of the auxiliary building are provided with ventilation. If a SI signal is generated, the system will automatically realign such that all exhaust flow from the ECCS pump rooms passes through the common HEPA filter/charcoal adsorber bank prior to being exhausted to atmosphere. Whenever an SI signal is generated, the operator must manually energize the heater from the control room.

The ABVS is discussed in the FSAR, Sections 9.4 2, and 15.5 (Refs. 1, and 2, respectively) since it may be used for normal, as well as post accident, ventilation and atmospheric cleanup functions. The primary purpose of the single manually initiated heater is to maintain the relative humidity at an acceptable level, consistent with iodine removal efficiencies per ASTM D 3803-1989 (Ref. 3). There is no redundant heater since the failure of the charcoal adsorber and heater train would constitute a second failure in addition to the RHR pump seal failure assumed in conjunction with a LOCA (Ref.7).

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

The design basis of the ABVS is established by the large break LOCA. The system evaluation assumes a passive failure of the ECCS outside containment, such as an RHR pump seal failure, during the recirculation mode. In such a case, the system limits radioactive release to within the 10 CFR 100 (Ref. 5) limits. The analysis of the effects and consequences of a large break LOCA is presented in Reference 2. The ABVS also functions, following a LOCA, in those cases where the ECCS goes into the recirculation mode of long term cooling, to clean up releases of smaller leaks, such as from valve stem packing.

The ventilation flow is also required to maintain the temperatures of the operating ECCS motors within allowable limits. The ventilation function has been designed for single failure and the system will continue to function to provide its ECCS motor cooling function.

Two types of system failures are considered in the accident analysis for radiation release: complete loss of function, and excessive LEAKAGE. Either type of failure may result in a lower efficiency of removal for any gaseous and particulate activity released to the ECCS pump rooms following a LOCA.

The ABVS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two trains of the ABVS are required to be OPERABLE to ensure that at least one is available, assuming that a single failure disables the other train coincident with loss of offsite power. Total system failure could result in the atmospheric release from the ECCS pump room exceeding 10 CFR 100 limits in the event of a Design Basis Accident (DBA).

ABVS is considered OPERABLE when the individual components necessary to maintain the ECCS pump room filtration and temperature are OPERABLE in both trains.

An ABVS train is considered OPERABLE when its associated:

a. Supply and exhaust fans are OPERABLE;

b. The common roughing filter, HEPA filter and charcoal adsorber are not excessively restricting flow, and are capable of performing their filtration functions; and

c. The single, manually initiated heater, ductwork, valves, and dampers are OPERABLE and air circulation can be maintained.

(continued)

BASES (continued)

APPLICABILITY

In MODES 1, 2, 3, and 4, the ABVS is required to be OPERABLE consistent with the OPERABILITY requirements of the ECCS.

In MODE 5 or 6, the ABVS is not required to be OPERABLE since the ECCS is not required to be OPERABLE.

ACTIONS

A.1

With the common HEPA filter and charcoal adsorber bank or manually initiated heater inoperable, the cooling function of the ABVS for ECCS motors is maintained; however, the filtration system function is lost. Since the entire function of the system is not lost, a 24 hour completion time is provided to restore the filters.

The 24 hour completion time is acceptable because it is a common filter system and the Completion Time is shorter than the ECCS Completion Time. The 24 hour Completion Time is based on the low probability of a DBA occurring during this time period.

B.1

With one ABVS train inoperable, action must be taken to restore OPERABLE status within 7 days. During this time, the remaining OPERABLE train is adequate to perform the ABVS function.

The 7 day Completion Time is appropriate because the risk contribution is less than that for the ECCS (72 hour Completion Time). The 7 day Completion Time is based on the low probability of a DBA occurring during this time period, and ability of the remaining train to provide the required capability.

Concurrent failure of two ABVS trains would result in the loss of both filtration and cooling capability; therefore, LCO 3.0.3 must be entered immediately.

C.1 and C.2

If the ABVS train cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.7.12.1

Each ABVS train should be checked periodically to ensure that it functions properly. As the environment and normal operating conditions on this system are not severe, testing each train with flow through both the HEPA filter and charcoal adsorber bank once a month provides an adequate check on this system. Monthly manual heater operations dry out any moisture that may have accumulated in the charcoal from humidity in the ambient air and ensures that the manually initiated heater emergency function is available. Systems with heaters must be operated ≥ 10 continuous hours with the heaters energized and operating automatically (filter temperature control). Since the ABVS has only one common charcoal filter, one train needs to be operated for ≥ 10 hours to dry out the filter and the other train only needs to be operated long enough (≥ 15 minutes) to verify all components are operating correctly. Monthly verification of the separate OPERABLE vital power supplies for the exhaust fans assures system redundancy. The 31 day Frequency is based on the known reliability of equipment and the two train redundancy available.

SR 3.7.12.2

This SR verifies that the required ABVS testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The ABVS filter tests are in accordance with References 3 and 4. The VFTP includes testing HEPA filter performance, charcoal adsorber efficiency, minimum system flow rate, and the physical properties of the activated charcoal (general use and following specific operations). Specific test Frequencies and additional information are discussed in detail in the VFTP.

SR 3.7.12.3

This SR verifies that each ABVS train actuates an actual or simulated actuation signal by verifying that the system aligns to exhaust through the common HEPA filter and charcoal adsorber and that flow is established through the HEPA and charcoal adsorber (Ref. 3 and 4). The 24 month Frequency is based upon the maintenance and operating history (Ref. 8).

SR 3.7.12.4

Not Used.

SR 3.7.12.5

Not Used.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.12.6

This SR verifies the leak tightness of dampers that isolate flow to the normally operating filter train. This SR assures that the flow from the auxiliary building passes through the HEPA filter and charcoal adsorber unit when the ABVS Buildings and Safeguards or Safeguards Only modes have been actuated coincident with an SI. The 24 month Frequency is based upon the maintenance and operating history (Ref. 8).

REFERENCES

1. FSAR, Section 9.4.2.
2. FSAR, Section 15.5.
3. ASTM D 3803-1989
4. ANSI N510-1980
5. 10 CFR 100.11.
6. NUREG-0800, Section 6.5.1, Rev. 2, July 1981.
7. DCM S-23B, "Main Auxiliary Building Heating and Ventilation System".
8. LA 119/117, Revision to Technical Specifications to Support Extended Fuel Cycles to 24 Months, April 14, 1997.

B 3.7 PLANT SYSTEMS

B 3.7.13 Fuel Handling Building Ventilation System (FHBVS)

BASES

BACKGROUND

The FHBVS filters airborne radioactive particulates and radioactive iodine from the area of the fuel pool following a fuel handling accident. The FHBVS provides environmental control of temperature and humidity in the fuel pool area and for the AFW pump motors. The ventilation for the AFW pump motors is to provide cooling flow for EQ considerations, i.e., motor longevity. The ventilation is not required to function during an accident or for the few hours required to reach RHR conditions during a natural circulation cooldown.

The FHBVS consists of two independent and redundant trains. Each train consists of, an exhaust prefilter, high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section for removal of gaseous activity (principally iodines), and an exhaust fan. A third non-vital exhaust fan is used for normal operation and has only a prefilter and a HEPA filter. Ductwork, valves or dampers, and instrumentation also form part of the system. The system initiates filtered ventilation of the fuel handling building following receipt of a high radiation signal or loss of the normal exhaust fan E-4.

The FHBVS is a standby system, parts of which may also be operated during normal plant operations. Upon receipt of the actuating signal, normal air discharge from the fuel handling building is isolated and the normal exhaust fan shuts down and the vital exhaust fans start and the stream of ventilation air discharges through the system filter trains. The prefilter removes any large particles in the air, to prevent excessive loading of the HEPA filter and charcoal adsorber.

The FHBVS is discussed in the FSAR, Sections 9.4.4 and 15.5 (Refs. 1, and 2, respectively) because it may be used for normal, as well as post (fuel handling) accident, atmospheric cleanup functions.

APPLICABLE SAFETY ANALYSES

The FHBVS design basis is established by the consequences of the limiting Design Basis Accident (DBA), which is a fuel handling accident. The analysis of the fuel handling accident, given in Reference 2, assumes that all fuel rods in an assembly are damaged. The DBA analysis of the fuel handling accident assumes that only one train of the FHBVS is functional due to a single failure that disables the other train. The accident analysis accounts for the reduction in airborne radioactive material provided by the one remaining train of this filtration system. The amount of fission products available for release from the fuel handling building is determined for a fuel handling accident. In accordance with assumptions made in the fuel handling accident

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

analysis, loss of offsite power is not considered concurrent with a fuel handling accident. However, loss of power is enveloped by the fuel handling accident analysis. To maximize FHBVS capability to mitigate the consequences of a fuel handling accident, at least one of the FHBVS trains must be capable of being supplied from an operable emergency diesel generator at all times whenever fuel movement is taking place in the spent fuel pool. These assumptions and the analysis follow the guidance provided in Regulatory Guide 1.25 (Ref. 3).

The FHBVS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two independent and redundant trains of the FHBVS are required to be OPERABLE to ensure that at least one train is available, assuming a single failure that disables the other train. In accordance with assumptions made in the fuel handling accident analysis, loss of offsite power is not considered concurrent with a fuel handling accident. However, loss of power is enveloped by the fuel handling accident analysis. This requires that when two trains of the FHBVS are OPERABLE, at least one train of the FHBVS must be capable of being powered from an OPERABLE diesel generator that is directly associated with the bus which energizes the FHBVS train. When only one train is OPERABLE, an OPERABLE diesel generator must be directly associated with the bus which energizes that one OPERABLE FHBVS train. Total system failure could result in the atmospheric release from the fuel handling building exceeding the 10 CFR 100 (Ref. 4) limits in the event of a fuel handling accident.

The FHBVS is considered OPERABLE when the individual components necessary to control releases from fuel handling building are OPERABLE in both trains. An FHBVS train is considered OPERABLE when its associated:

a. Exhaust fan is OPERABLE;

b. HEPA filter and charcoal adsorber are not excessively restricting flow, and are capable of performing their filtration function; and

c. Ductwork, valves, and dampers are OPERABLE, and air circulation can be maintained.

(continued)

BASES (continued)

APPLICABILITY

In MODE 1, 2, 3, 4, 5 or 6, the FHBVS is not required to be OPERABLE since it provides no safety function associated with these MODES of operation.

During movement of irradiated fuel in the fuel handling building, the FHBVS is required to be OPERABLE to alleviate the consequences of a fuel handling accident.

ACTIONS

The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply.

If moving irradiated fuel assemblies in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODES 1, 2, 3, and 4, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.

A.1

With one FHBVS train inoperable, action must be taken to restore OPERABLE status immediately.

B.1 and B.2

When Required Action A.1 cannot be completed within the required Completion Time, during movement of irradiated fuel assemblies in the fuel building, the OPERABLE FBACS train must be started immediately and verify that it has an OPERABLE emergency power source and is discharging through its HEPA filter and charcoal adsorber. Or suspend movement of irradiated fuel assemblies in the fuel handling building. The suspension of movement of fuel assemblies does not preclude movement of assemblies to a safe position. This action ensures that the remaining train is OPERABLE, that no undetected failures preventing system operation will occur, and that any active failure will be readily detected.

If the system is not placed in operation, this action requires suspension of fuel movement, which precludes a fuel handling accident. This does not preclude the movement of fuel assemblies to a safe position.

C.1

When two trains of the FHBVS are inoperable during movement of irradiated fuel assemblies in the fuel handling building, suspend movement of irradiated fuel assemblies in the fuel handling building. This does not preclude the movement of fuel assemblies to a safe position.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Once actuated due to a fuel handling accident the FHBVS must be protected against a single failure coincident with a loss of offsite power. Protection against a loss of power, although not required for immediate accident response, is assured by requiring that a backup power supply be provided as described above in the LCO section. This back up is assured via the performance of non-TS surveillances.

SR 3.7.13.1

Standby systems should be checked periodically to ensure that they function properly. As the environmental and normal operating conditions on this system are not severe, testing each train once every month provides an adequate check on this system. This testing requires establishing air flow through both the HEPA filters and charcoal adsorbers.

Systems without heaters need only be operated for ≥ 15 minutes to demonstrate the function of the system. The 31 day Frequency is based on the known reliability of the equipment and the two train redundancy available.

SR 3.7.13.2

This SR verifies that the required FHBVS testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The FHBVS filter tests are in accordance with References 5 and 6. The VFTP includes testing HEPA filter performance, charcoal adsorber efficiency, minimum system flow rate, and the physical properties of the activated charcoal (general use and following specific operations). Specific test frequencies and additional information are discussed in detail in the VFTP.

SR 3.7.13.3

This SR verifies that each FHBVS train starts and operates on an actual or simulated actuation signal and directs its exhaust flow through the HEPA Filters and charcoal adsorber banks. The 24 month Frequency is consistent with Reference 9.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.13.4

This SR verifies the integrity of the fuel handling building enclosure. The ability of the fuel handling building to maintain negative pressure with respect to potentially uncontaminated adjacent areas is periodically tested to verify proper function of the FHBVS. During the post accident mode of operation, the FHBVS is designed to maintain a slight negative pressure in the fuel handling building, to prevent unfiltered LEAKAGE. The FHBVS is designed to maintain the building pressure $\leq$ -0.125 inches water gauge with respect to atmospheric pressure. The 24 month Frequency (on a STAGGERED TEST BASIS) is based upon the maintenance and operating history (Ref. 9).

SR 3.7.13.5

Operation of damper M-29 is necessary to ensure that the system functions properly. The operability of damper M-29 is verified if it can be closed. The 24 month Frequency is consistent with Reference 9.

REFERENCES

1. FSAR, Section 9.4.4.
2. FSAR, Section 15.5.
3. Regulatory Guide 1.25.
4. 10 CFR 100.
5. ASTM D 3802-1989
6. ANSI N510-1980.
7. NUREG-0800, Section 6.5.1, Rev. 2, July 1981.
8. DCM S-23D, "Fuel handling Building HVAC System."
9. LA 119/117, Revision to Technical Specification to Support Extended Fuel Cycles to 24 Months, April 14, 1997.

B 3.7 PLANT SYSTEMS

B 3.7.14 Not Used

B 3.7 PLANT SYSTEMS

B 3.7.15 Spent Fuel Storage Pool Water Level

BASES

BACKGROUND	The minimum water level in the spent fuel pool meets the assumptions of iodine decontamination factors following a fuel handling accident. The specified water level shields and minimizes the general area dose when the storage racks are filled to their maximum capacity. The water also provides shielding during the movement of spent fuel. A general description of the spent fuel pool design is given in the FSAR, Section 9.1.2 (Ref. 1). A description of the Spent Fuel Pool Cooling and Cleanup System is given in the FSAR, Section 9.1.3 (Ref. 2). The assumptions of the fuel handling accident are given in the FSAR, Section 9.1.4.3.4, 15.4.5 and 15.5.22 (Ref. 3).
APPLICABLE SAFETY ANALYSES	The minimum water level in the spent fuel pool meets the assumptions of the fuel handling accident described in Regulatory Guide 1.25 (Ref. 4). The resultant 2 hour thyroid dose per person at the exclusion area boundary is a small fraction of the 10 CFR 100 (Ref. 5) limits. According to Reference 4, there is 23 ft of water between the top of the damaged fuel rods and the fuel pool surface during a fuel handling accident. With 23 ft of water, the assumptions of Reference 4 can be used directly. Although there are other spent fuel pool elevations where fuel handling accidents can occur, the design basis fuel handling accident, which uses the conservative assumptions of RG 1.25, is expected to be bounding. To add conservatism, the analysis assumes that all fuel rods of the damaged fuel assembly fail. In practice, the water level maintained for fuel handling provides more than 23 feet of water over the top of irradiated fuel assemblies seated in the storage racks. FSAR Section 9.1.4.3.4 requires the water level to be at or above 137 feet 8 inches during fuel handling to assure 8 feet of water shielding. This water level corresponds to 24 feet 6 inches above the top of the fuel assemblies in the racks and to 23 feet above a fuel assembly lying horizontally on top of the racks. The spent fuel pool water level satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).
LCO	The spent fuel pool water level is required to be ≥ 23 ft over the top of irradiated fuel assemblies seated in the storage racks. The specified water level preserves the assumptions of the fuel handling accident analysis (Ref. 3). As such, it is the minimum required for fuel storage and movement within the fuel storage pool.

(continued)

BASES (continued)

APPLICABILITY	This LCO applies during movement of irradiated fuel assemblies in the spent fuel pool, since the potential for a release of fission products exists.
ACTIONS	A.1 Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply. When the initial conditions for prevention of an accident cannot be met, steps should be taken to preclude the accident from occurring. When the spent fuel pool water level is lower than the required level, the movement of irradiated fuel assembly in the spent fuel pool is immediately suspended. This does not preclude movement of a fuel assembly to a safe position. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODES 1, 2, 3, and 4, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.
SURVEILLANCE REQUIREMENTS	SR 3.7.15.1 This SR is done during the movement of irradiated fuel assemblies as stated in the Applicability. This SR verifies sufficient fuel storage pool water is available in the event of a fuel handling accident. The water level in the spent fuel pool must be checked periodically. The 7 day Frequency is appropriate because the volume in the pool is normally stable. Water level changes are controlled by plant procedures and are acceptable based on operating experience. During refueling operations, the level in the spent fuel pool is in equilibrium with the refueling canal, and the level in the refueling canal is checked daily in accordance with SR 3.9.7.1.
REFERENCES	1. FSAR, Section 9.1.2. 2. FSAR, Section 9.1.3. 3. FSAR, Section 9.1.4.3.4, 15.4.5 and 15.5.22. 4. Regulatory Guide 1.25, Rev. 0. 5. 10 CFR 100.11.

B 3.7 PLANT SYSTEMS

B 3.7.16 Spent Fuel Pool Boron Concentration

BASES

BACKGROUND

The spent fuel pool is divided into two separate and distinct regions which, for the purpose of criticality considerations, are considered as separate pools. Region 1, with 290 storage positions, has been analyzed for the storage of fuel assemblies which meet the requirements of LCO 3.7.17.1. Region 2, with 1034 storage positions, has been analyzed for the storage of fuel assemblies which meet the requirements of LCO 3.7.17.2.

The water in the spent fuel pool normally contains soluble boron, which results in large subcriticality margins under actual operating conditions. However, the NRC guidelines, based upon the accident condition in which all soluble poison is assumed to have been lost, require that the limiting k_{eff} of the fuel configuration is at or below the limit of 0.95 in the absence of soluble boron. Hence, the analysis of both regions is based on the use of unborated water, which maintains each region in a subcritical condition during normal operation with the regions fully loaded. The double contingency principle discussed in ANSI N16.1-1975 and the April 1978 NRC letter (Ref. 1) allows credit for soluble boron under other abnormal or accident conditions, since only a single accident need be considered at one time.

APPLICABLE SAFETY ANALYSES

Most accident conditions result in negligible reactivity effect for either of the two regions (Ref. 2 and 3). However, scenarios can be postulated that could have more than a negligible positive reactivity effect. One such scenario is associated with placing a fuel assembly which is required to be stored in Region 1, in Region 2. This could potentially increase the k_{eff} of Region 2 above 0.95. Thus, to compensate for reductions in the subcriticality margin from postulated accident conditions, the spent fuel pool contains 2000 ppm soluble boron. The negative reactivity effect of the soluble boron more than compensates for the increased reactivity caused by the postulated accident scenarios. The accident analyses is provided in the FSAR, Section 15.5.22 (Ref. 4).

The concentration of dissolved boron in the spent fuel pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

(continued)

BASES (continued)

LCO	The spent fuel pool boron concentration is required to be ≥ 2000 ppm. The specified concentration of dissolved boron in the fuel storage pool preserves the assumptions used in the analyses of the potential criticality accident scenarios as described in Reference 2, 3, and 4. This concentration of dissolved boron is the minimum required concentration for fuel assembly storage and movement within the spent fuel pool.
APPLICABILITY	This LCO applies whenever fuel assemblies are stored in the spent fuel pool.
ACTIONS	A.1 and A.2 The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply. When the concentration of boron in the spent fuel storage pool is less than required, immediate action must be taken to preclude the occurrence of an accident or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately suspending the movement of fuel assemblies and immediately taking actions to restore the spent fuel pool boron concentration to greater than or equal to 2000 ppm. This suspension of fuel movement does not preclude movement of fuel assembly to a safe position. If the LCO is not met while moving fuel assemblies LCO 3.0.3 would not be applicable since the inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.
SURVEILLANCE REQUIREMENTS	SR 3.7.16.1 This SR verifies by chemical analysis that the concentration of boron in the spent fuel pool is at or above the required limit. As long as this SR is met, the analyzed accidents are fully addressed. The 31 day Frequency is appropriate because no major replenishment of pool water is expected to take place.
REFERENCES	1. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A). 2. "Criticality Safety Evaluation of Region 1 of the Diablo Canyon Spent Fuel Storage Racks with 5.0 % Enrichment," S.E.Turner, October 1993, Holtec Report HI-931076.

(continued)

BASES

REFERENCES (continued)

3. "Criticality Safety Evaluation of Region 2 of the Diablo Canyon Spent Fuel Storage Racks with 5.0 % Enrichment," S.E.Turner, October 1993, Holtec Report HI-931077.

4. FSAR, Section 9.1 and 15.2.22.

B 3.7 PLANT SYSTEMS

B 3.7.17 Spent Fuel Assembly Storage

BASES

BACKGROUND	The spent fuel storage pool is divided into two separate and distinct regions which, for the purpose of criticality considerations, are considered as separate pools. Region 1, with 290 storage positions, has been analyzed for the storage of fuel assemblies which meet the requirements of LCO 3.7.17.1. Region 2, with 1034 storage positions, has been analyzed for the storage of fuel assemblies which meet the requirements of LCO 3.7.17.2. The water in the spent fuel pool normally contains soluble boron, which results in large subcriticality margins under actual operating conditions. However, the NRC guidelines, based upon the accident condition in which all soluble poison is assumed to have been lost, require that the limiting k_{eff} of the fuel configuration is at or below the limit of 0.95 in the absence of soluble boron. Hence, the analysis of both regions is based on the use of unborated water, which maintains each region in a subcritical condition during normal operation with the regions fully loaded. The double contingency principle discussed in ANSI N16.1-1975 and the April 1978 NRC letter (Ref. 1) allows credit for soluble boron under other abnormal or accident conditions, since only a single accident need be considered at one time. Prior to movement of an assembly, it is necessary to verify that SR 3.7.16.1 is current.
APPLICABLE SAFETY ANALYSES	The analyzed accidents that could have significant reactivity effects are the misplacement of a fuel assembly, a significant increase in spent fuel pool temperature above the design basis temperature of 150°F, or a cask drop accident (Ref. 2, 3, and 4). For these accident occurrences, the presence of soluble boron in the spent fuel storage pool (controlled by LCO 3.7.16, "Spent Fuel Pool Boron Concentration") ensures that k_{eff} will remain at or below 0.95. The configuration of fuel assemblies in the fuel storage pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).
LCO	The restrictions on the placement of fuel assemblies within the spent fuel pool, in accordance with LCO 3.7.17.1 and 3.7.17.2, ensures the k_{eff} of the spent fuel storage pool will always remain $\leq$ 0.95, assuming the pool to be flooded with unborated water at a temperature of $\leq$ 150°F.

(continued)

BASES (continued)

APPLICABILITY	These LCOs apply whenever any fuel assembly is stored in the spent fuel pool.
ACTIONS	A.1 The Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply since the inability to move fuel assemblies is not sufficient reason to require a reactor shutdown. When the configuration of fuel assemblies stored in the spent fuel pool is not in accordance with LCO 3.7.17.1 and 3.7.17.2, the immediate action is to initiate action to make the necessary fuel assembly movement(s) to bring the configuration into compliance with LCO 3.7.17.1 and 3.7.17.2 which will return the fuel pool to an analyzed condition.
SURVEILLANCE REQUIREMENTS	SR 3.7.17.1.1 and SR 3.7.17.2.1 These SRs verify by administrative means that the each fuel assembly and its expected storage location are in accordance with the applicable LCO (3.7.17.1 or 3.7.17.2), prior to each fuel assembly move when the assembly is to be stored in Region 1 or 2 of the spent fuel pool. A complete record of initial enrichment, initial integral boron content (Region 1), fuel pellet diameter (Region 2), and the commulative burnup analysis shall be maintained for the time period that each fuel assembly remains in Region 1 or 2 of the spent fuel pool.
REFERENCES	1. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A). 2. FSAR, Section 15.5.22.3. 3. "Criticality Safety Evaluation of Region 1 of the Diablo Canyon Spent Fuel Storage Racks with 5.0 % Enrichment," S.E.Turner, October 1993, Holtec Report HI-931076. 4. "Criticality Safety Evaluation of Region 2 of the Diablo Canyon Spent Fuel Storage Racks with 5.0 % Enrichment," S.E.Turner, October 1993, Holtec Report HI-931076.

B 3.7 PLANT SYSTEMS

B 3.7.18 Secondary Specific Activity

BASES

BACKGROUND	Activity in the secondary coolant results from steam generator tube outleakage from the Reactor Coolant System (RCS). Under steady state conditions, the activity is primarily iodines with relatively short half lives and, thus, indicates current conditions. During transients, I-131 spikes have been observed as well as increased releases of some noble gases. Other fission product isotopes, as well as activated corrosion products in lesser amounts, may also be found in the secondary coolant. A limit on secondary coolant specific activity during power operation minimizes releases to the environment because of normal operation, anticipated operational occurrences, and accidents. This limit is lower than the activity value that might be expected from a 1 gpm tube leak (LCO 3.4.13, "RCS Operational LEAKAGE") of primary coolant at the limit of 1.0 μCi/gm (LCO 3.4.16, "RCS Specific Activity"). The steam line failure is assumed to result in the release of the noble gas and iodine activity contained in the steam generator inventory, the feedwater, and the reactor coolant LEAKAGE. Most of the iodine isotopes have short half lives, (i.e., < 20 hours). Operating at or below 0.1 μCi/gm ensures that in the event of a DBA, offsite doses will be less than 10 CFR 100 requirements.
APPLICABLE SAFETY ANALYSES	The accident analysis of the main steam line break (MSLB), as discussed in the FSAR, Chapter 15 (Ref. 2) assumes the initial secondary coolant specific activity to have a radioactive isotope concentration of 0.10 μCi/gm DOSE EQUIVALENT I-131. This assumption is used in the analysis for determining the radiological consequences of the postulated accident. The accident analysis, based on this and other assumptions, shows that the radiological consequences of an MSLB do not exceed 10 CFR 100 limits (Ref. 1) for whole body and thyroid dose rates. With the loss of offsite power, the remaining steam generators are available for core decay heat dissipation by venting steam to the atmosphere through the MSSVs and steam generator atmospheric dump valves (ADVs). The Auxiliary Feedwater System supplies the necessary makeup to the steam generators. Venting continues until the reactor coolant temperature and pressure have decreased sufficiently for the Residual Heat Removal System to complete the cooldown.

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BASES

APPLICABLE SAFETY ANALYSES (continued)

In the evaluation of the radiological consequences of this accident, the activity released from the steam generator connected to the failed steam line is assumed to be released directly to the environment. The unaffected steam generators are assumed to discharge steam and any entrained activity through the MSSVs and ADVs during the event. The quantity of radioactivity released to the environment, due to an SGTR, depends upon primary and secondary coolant activity, iodine spiking effects, primary to secondary break flow flashing fractions, attenuation of iodine carried by the flashed portion of the break flow, partitioning of iodine between the liquid and steam phases, the mass of fluid released from the steam generator, and liquid-vapor partitioning in the condenser hotwell. All of these parameters were conservatively evaluated in a manner consistent with the recommendations of Standard Review Plan Section 15.6.3 and the resultant radiological consequences represent a conservative estimate of the potential integrated dose due to the postulated steam line failure.

Secondary specific activity limits satisfy Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

As indicated in the Applicable Safety Analyses, the specific activity of the secondary coolant is required to be $\leq$ 0.10 μCi/gm DOSE EQUIVALENT I-131 to limit the radiological consequences of a Design Basis Accident (DBA) to a small fraction of the required limit (Ref. 1).

Monitoring the specific activity of the secondary coolant ensures that when secondary specific activity limits are exceeded, appropriate actions are taken in a timely manner to place the unit in an operational MODE that would minimize the radiological consequences of a DBA.

APPLICABILITY

In MODES 1, 2, 3, and 4, the limits on secondary specific activity apply due to the potential for secondary steam releases to the atmosphere.

In MODES 5 and 6, the steam generators are not being used for heat removal. Both the RCS and steam generators are depressurized, and primary to secondary LEAKAGE is minimal. Therefore, monitoring of secondary specific activity is not required.

ACTIONS

A.1 and A.2

DOSE EQUIVALENT I-131 exceeding the allowable value in the secondary coolant, is an indication of a problem in the RCS and contributes to increased post accident doses. If the secondary specific activity cannot be restored to within limits within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at

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BASES

ACTIONS	A.1 and A.2 (continued) least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.
SURVEILLANCE REQUIREMENTS	SR 3.7.18.1 This SR verifies that the secondary specific activity is within the limits of the accident analysis. A gamma isotopic analysis of the secondary coolant, which determines DOSE EQUIVALENT I-131, confirms the validity of the safety analysis assumptions as to the source terms in post accident releases. It also serves to identify and trend any unusual isotopic concentrations that might indicate changes in reactor coolant activity or LEAKAGE. The 31 day Frequency is based on the detection of increasing trends of the level of DOSE EQUIVALENT I-131, and allows for appropriate action to be taken to maintain levels below the LCO limit.
REFERENCES	1. 10 CFR 100.11. 2. FSAR, Chapter 15.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.1 AC Sources - Operating

BASES

BACKGROUND

The unit Class 1E AC Electrical Power Distribution System AC sources consist of offsite power sources (normal and alternate), and the onsite standby power sources (three diesel generators (DGs) for each unit). 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 for each unit is divided into three load groups so that the loss of any one group does not prevent the minimum safety functions from being performed. Each load group has connections to two offsite power sources and a single DG.

Offsite power is supplied to the 230 kV and 500 kV switchyards from the transmission network by two 230 kV transmission lines and three 500 kV transmission lines. These two electrically and physically separated circuits provide AC power, through auxiliary and standby startup transformers, to the 4.16 kV ESF buses. A detailed description of the offsite power network and the circuits to the Class 1E buses is found in the FSAR, Chapter 8 (Ref. 2).

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

Certain required unit loads are returned to service in a predetermined sequence in order to prevent overloading the transformer supplying offsite power to the onsite Class 1E Distribution System. Within 1 minute after the initiating signal is received, all automatic and permanently connected loads needed to recover the unit or maintain it in a safe, condition are returned to service via the load sequencer timers (auto transfer timers). Each individual timer connects a single ESF component.

The onsite standby power source for each 4.16 kV ESF bus is a dedicated DG. For Unit 1, DGs 1-1, 1-2, and 1-3 are dedicated to ESF buses H, G, and F, respectively. For Unit 2, DGs 2-1, 2-2, and 2-3 are dedicated to ESF buses G, H, and F. A DG starts automatically on a safety injection (SI) signal (e.g., low pressurizer pressure or high containment pressure signals), undervoltage on the offsite standby startup source, or on an ESF bus degraded voltage or undervoltage signal (refer to LCO 3.3.5, "Loss of Power (LOP) Diesel Generator

(continued)

BASES

BACKGROUND (continued)

(DG) Start Instrumentation"). After the DG has started, it will automatically tie to its respective bus after offsite power is tripped as a consequence of ESF bus undervoltage or degraded voltage, independent of or coincident with an SI signal. The DGs will also start and operate in the standby mode without tying to the ESF bus on an SI signal alone. Following the trip of offsite power, an undervoltage signal strips nonpermanent loads from the ESF bus. When the DG is tied to the ESF bus, loads are then sequentially connected to their respective ESF bus by the load sequencing timers (ESF timers). The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG. Each ESF component is provided with its own load sequencing timer.

In the event of a loss of preferred power, the ESF electrical loads are automatically connected to the DGs 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 DG in the process. Within 1 minute after the initiating signal is received, all loads needed to recover the unit or maintain it in a safe condition are returned to service.

Ratings for the six DGs satisfy the requirements of Regulatory Guide 1.9 (Ref.3). The continuous service rating of each DG is 2600 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.

Fuel oil is transferred from the storage tanks via the diesel fuel oil storage and transfer system to replenish the day tanks as required. The design incorporates sufficient redundancy so that a malfunction of either an active or a passive component will not impair the ability of the system to supply fuel oil. Two redundant fuel oil transfer pumps supply fuel oil to DG day tanks from either storage tank. One pump is adequate to supply the six DGs operating at full load. Each DG tank has two separate, redundant transfer pump start-stop level switches. Each level switch automatically starts a transfer pump and opens the supply header solenoid valve corresponding to the respective transfer pump, 0-1 or 0-2.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in the FSAR, 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

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BASES

APPLICABLE SAFETY ANALYSES (continued)

availability of necessary power to ESF systems so that the fuel, Reactor Coolant System (RCS), and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, 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 ESF systems powered by 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(c)(2)(ii).

LCO

Two qualified circuits between the offsite transmission network and the onsite Class 1E Electrical Power System and separate and independent DGs for each Class 1E ESF bus ensure availability of the required power to shut down 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 FSAR 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 Unit 1 Offsite Circuit #1 consists of Startup Transformer 1-1 supplied from the immediate access 230 kV Switchyard power source, which feeds Startup Transformer 1-2 through series supply breakers 52VU12 and 52VU14. Startup Transformer 1-2 then supplies power through breaker 52HG15 to each vital bus feeder breaker (Bus F - 52HF14, Bus G - 52HG14, Bus H - 52HH14). The Unit 1 Offsite Circuit #2 is the delayed access 500 kV circuit which becomes available only after opening the motor operated disconnect to the main generator. This circuit consists of Auxiliary Transformer 1-2 supplied from the 500 kV Switchyard through the main bank transformers. Auxiliary Transformer 1-2 supplies power directly to each of the vital bus feeder breakers (Bus F - 52HF13, Bus G - 52HG13, Bus H - 52HH13).

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BASES

LCO (continued)

The Unit 2 Offsite Circuit #1 consists of Startup Transformer 2-1 supplied from the immediate access 230 kV Switchyard power source, which feeds Startup Transformer 2-2 through series supply breakers 52VU23 and 52VU24. Startup Transformer 2-2 then supplies power through breaker 52HG15 to each vital bus feeder breaker (Bus F - 52HF14, Bus G - 52HG14, Bus H - 52HH14). The Unit 2 Offsite Circuit #2 is a delayed access circuit which only becomes available after opening the motor operated disconnect to the main generator. This circuit consists of Auxiliary Transformer 2-2 supplied from the 500 kV Switchyard through the main bank transformers. Auxiliary Transformer 2-2 supplies power directly to each of the vital bus feeder breakers (Bus F - 52HF13, Bus G - 52HG13, Bus H - 52HH13).

Each DG 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 accomplished within 10 seconds. Each DG 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 DG in standby with the engine hot and DG in standby with the engine pre-lubed and pre-warmed. Additional DG capabilities must be demonstrated to meet required Surveillance, e.g., capability of the DG to automatically sequence the emergency loads onto the DG, following opening of the auxiliary breaker, on an ESF actuation signal while operating in parallel test mode.

The AC sources must be separate and independent (to the extent possible). For the DGs, separation and independence are complete.

For the offsite AC sources, separation and independence are to the extent practical. The delayed access circuit (500 kV Auxiliary) is normally connected to all three ESF Buses during power operation. If this circuit is not connected to an ESF Bus, it is provided with a manual transfer mechanism (Delayed Access) to support circuit OPERABILITY. The immediate access circuit (230 kV Startup) is not normally connected to an ESF Bus but is provided with an OPERABLE automatic transfer interlock mechanism initiated by bus undervoltage to support circuit OPERABILITY.

The two redundant diesel fuel oil supply trains supply fuel oil to DG day tanks from either storage tank. One pump supply train is adequate to supply the six DGs operating at full load.

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BASES

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 3.8.2, "AC Sources - Shutdown."

ACTIONS

A.1

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. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 acceptance criteria does not result in a Required Action not met. However, if a second required circuit fails SR 3.8.1.1, the second offsite circuit is inoperable, and Condition C, for two offsite circuits inoperable, is entered.

The 230 kV system should be considered inoperable when the DCPP Shift Supervisor has been notified of system inoperability by the Diablo Canyon Switching Center, Grid Operations Scheduling, or Grid Shift Supervisor, in accordance with Transmission Operating Procedure O-23, "Operating Instructions for Reliable Transmission Service for Diablo Canyon P.P."

A.2

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition A 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 DGs are adequate to supply electrical power to the onsite Class 1E Distribution System.

The 72 hour Completion Time 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.

(continued)

BASES

ACTIONS

A.2 (continued)

The second Completion Time for Required Action A.2 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition A is entered while, for instance, a DG is inoperable and that DG is subsequently returned OPERABLE, the LCO may already have been not met for up to 7 days. This could lead to a total of 10 days, since initial failure to meet the LCO, to restore the offsite circuit. At this time, a DG could again become inoperable, the circuit restored OPERABLE, and an additional 7 days (for a total of 17 days) allowed prior to complete restoration of the LCO. The 10 day Completion Time provides a limit on the time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between 72 hour and 10 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

The Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition A was entered.

B.1

To ensure a highly reliable power source remains with an inoperable DG, it is necessary to verify the availability of the offsite circuits on a more frequent basis. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 acceptance criteria does not result in a Required Action being not met. However, if a circuit fails to pass SR 3.8.1.1, it is inoperable. Upon offsite circuit inoperability, additional Conditions and Required Actions must then be entered.

B.2

Required Action B.2 is intended to provide assurance that a loss of offsite power, during the period that a DG is inoperable, does not result in a complete loss of safety function of critical systems. These features are powered from the three AC electrical power distribution subsystems (buses). Required features are redundant safety-related systems, subsystems, trains, components, and devices that depend on the diesel generators as a source of emergency power. Redundant required feature failures consist of inoperable features associated with one of the other Class 1E AC electrical power distribution subsystems, redundant to the subsystem associated with the inoperable DG. An example, if DG 1-1 (Bus H) were declared inoperable with safety

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BASES

ACTIONS

B.2 (continued)

injection pump 1-1 (Bus F) already inoperable. SIP 1-2 (Bus H) would then be required to be declared inoperable within 4 hours, and TS 3.0.3 entered. A Note has been added to point out that during operation in MODES 1, 2, and 3, two auxiliary feedwater pumps are required to meet the redundant features requirement to mitigate a feedwater line break. If both of the available AFW pumps are motor driven, neither of the two may be supplied by the DG which is inoperable. For example, declaring DG 1-1 (Bus H) inoperable would require maintaining the turbine driven AFW pump and motor driven AFW pump 1-3 OPERABLE, while declaring DG 1-2 (Bus G) inoperable would not impact redundant required features since no AFW pumps are associated with Bus G.

The Completion Time for Required Action B.2 is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." In this Required Action, the Completion Time only begins on discovery that both:

a. An inoperable DG exists; and

b. A required feature, redundant to a required feature associated with the inoperable DG on one of the other Class 1E AC electrical power distribution subsystems, is inoperable.

If at any time during the existence of this Condition (one DG inoperable) a required feature subsequently becomes inoperable, this Completion Time would begin to be tracked.

Discovering one required DG inoperable coincident with one or more inoperable redundant required features associated with one of the OPERABLE DGs, results in starting the Completion Time for the Required Action. Four hours 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.

In this Condition, the remaining two OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Thus, on a component basis, single failure protection for the required feature's function may have been lost; however, function has not been lost. The 4 hour Completion Time takes into account the OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the 4 hour Completion Time 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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BASES

ACTIONS (continued)

B.3.1 and B.3.2

Required Action B.3.1 provides an allowance to avoid unnecessary testing of OPERABLE DGs. If it can be determined that the cause of the inoperable DG does not exist on the OPERABLE DGs, SR 3.8.1.2 does not have to be performed. If the cause of inoperability exists on other DGs, the other DGs would be declared inoperable upon discovery and Condition E of LCO 3.8.1 would be entered. Once the failure is repaired, the common cause failure no longer exists, and Required Action B.3.1 is satisfied. If the cause of the initial inoperable DG cannot be confirmed not to exist on the remaining DGs, performance of SR 3.8.1.2 suffices to provide assurance of continued OPERABILITY of those DGs. If a DG has already started and loaded on a bus, it is not necessary to shutdown the DG and perform SR 3.8.1.2. The DG is verified OPERABLE since it is performing its intended function.

In the event the inoperable DG is restored to OPERABLE status prior to completing either B.3.1 or B.3.2, 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 Condition B.

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

B.4

Operation may continue in Condition B for a period that should not exceed 7 days. This AOT was revised from 72 hours to 7 days by License Amendment (LA) 44 for Unit 1 and LA 43 for Unit 2.

In Condition B, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 7 day Completion Time 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.

The second Completion Time for Required Action B.4 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition B is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently restored OPERABLE, the LCO may already have been not met for up to 72 hours. This could lead to a total of 10 days, since initial failure to meet the LCO, to restore the DG. At this time, an offsite circuit could again become inoperable, the DG restored OPERABLE,

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BASES

ACTIONS

B.4 (continued)

and an additional 72 hours (for a total of 13 days) allowed prior to complete restoration of the LCO. The 10 day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between the 7 day and 10 day Completion Times means that both Completion Times apply simultaneously, and the more restrictive Completion Time must be met.

As in Required Action B.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed time "clock." This will result in establishing the "time zero" at the time that the LCO was initially not met, instead of at the time Condition B was entered.

C.1 and C.2

Required Action C.1, 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. The rationale for the reduction to 12 hours for Required Action C.1 is that Regulatory Guide 1.93 (Ref. 6) allows a Completion Time of 24 hours for two required offsite circuits inoperable, based upon the assumption that two complete safety trains are OPERABLE. When a concurrent redundant required feature failure exists, this assumption is not valid, and a shorter Completion Time of 12 hours is appropriate. Required features are redundant safety-related systems, subsystems, trains, components, and devices that depend on the DGs as a source of emergency power. These features are powered from the three Class 1E AC electrical power distribution subsystems. Examples of required features would include, but are not limited to, auxiliary saltwater pumps, centrifugal charging pumps, or motor-driven auxiliary feedwater pumps.

The Completion Time for Required Action C.1 is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." In this Required Action the Completion Time only begins on discovery that both:

a. All required offsite circuits are inoperable; and

b. A required feature is inoperable.

If at any time during the existence of Condition C (two offsite circuits inoperable) a required feature becomes inoperable, this Completion Time begins to be tracked.

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BASES

ACTIONS

C.1 and C.2 (continued)

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition C 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 DGs inoperable. However, two factors tend to decrease the severity of this level of degradation:

a. The configuration of the Class 1E AC electrical power system that remains available is not susceptible to a single bus or switching failure; and

b. The time required to detect and restore an unavailable offsite 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 DBA, and a worst case single failure were postulated as a part of the design basis in the safety analysis. Thus, the 24 hour Completion Time 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 Condition A.

D.1 and D.2

According to Regulatory Guide 1.93 (Ref. 6), operation may continue in Condition D for a period that should not exceed 12 hours.

In Condition D, individual redundancy is lost in the offsite electrical power system and may be lost in 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

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BASES

ACTIONS

D.1 and D.2 (continued)

Condition may appear higher than that in Condition C (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. The 12 hour Completion Time 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.

E.1

With two or more DGs inoperable, the remaining onsite AC sources are inadequate. Thus, with an assumed loss of offsite electrical power, insufficient standby AC sources are available to power the minimum required ESF functions. Since the offsite electrical power system may be the only source of AC power for this level of degradation, 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, which could result in a total loss of AC power). Since any inadvertent generator trip could also result in a total loss of offsite AC power, 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 two or more DGS inoperable, operation may continue for a period that should not exceed 2 hours.

F.1

Condition F corresponds to a level of degradation in which one train of the DFO transfer system is inoperable. The onsite AC electrical power systems are redundant and available to support ESF loads. However, one subsystem required for the onsite AC electrical system operability has lost its redundancy (DFO supply to the DGs).

The 72 hour Completion Time 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.

G.1

With both trains of DFO inoperable, the onsite AC sources are inadequate (loss of DFO supply to all DGs). With an assumed loss of offsite electrical power, insufficient AC sources are available to power the minimum required ESF functions. Since the offsite electrical power system is the only source for AC power for this level of degradation, the risk associated with continued operation for a very short time could

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BASES

ACTIONS

G.1 (continued)

be less than that associated with an immediate controlled shutdown (the immediate shutdown could cause grid instability, which could result in a total loss of AC power). Since any inadvertent generator trip could also result in a total loss of offsite AC power, 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.

H.1 and H.2

If the inoperable AC electric power sources cannot be restored to OPERABLE status within the required Completion Time, 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 MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times 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.

I.1

Condition I corresponds to a level of degradation in which all redundancy in the AC electrical power supplies has been lost. At this severely degraded level, further loss of the remaining offsite circuit will cause a loss of function. Therefore, no additional time is justified for continued operation. The unit is required by LCO 3.0.3 to commence a controlled shutdown.

J.1

Condition J corresponds to a level of degradation in which all redundancy in the AC electrical power supplies has been lost. At this severely degraded level, further loss of a remaining DG will cause a loss of function. Therefore, no additional time is justified for continued operation. The unit is required by LCO 3.0.3 to commence a controlled shutdown.

SURVEILLANCE REQUIREMENTS

The AC sources are designed to permit inspection and testing of all 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 DGS 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 FSAR.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. The minimum steady state output voltage of 3785 V is consistent with the second level undervoltage relay allowable values. This is the minimum steady state voltage needed on the 4160 volt vital buses to ensure adequate 4160 volt, 480 volt and 120 volt levels. The specified maximum steady state output voltage of 4400 V is equal to the maximum operating voltage for 4000 V motors specified in ANSI C84.1. The maximum steady state output voltage of 4400 V ensures that for a lightly loaded distribution system, the voltage at the terminals of 4000 V motors is no more than the maximum rated operating voltages. The specified minimum and maximum frequencies of the DG 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 3.8.1.1

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 3.8.1.2 and SR 3.8.1.7

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.

To minimize the wear on moving parts that do not get lubricated when the engine is not running, these SRs are modified by a Note (Note 2 for SR 3.8.1.2) to indicate that all DG starts for these Surveillances may be preceded by an engine prelube period and, for SR 3.8.1.2, followed by a warmup period prior to loading.

For the purposes of SR 3.8.1.2 and SR 3.8.1.7 testing, the DGS are started from standby conditions. Standby conditions for a DG means that the diesel engine coolant and oil temperature is being maintained consistent with manufacturer recommendations of equal to or greater than 90°F but less than 175°F. For the purposes of this SR, the diesel generator start will be initiated using one of the following signals: 1) manual, 2) simulated loss of offsite power, and 3) safety injection actuation test signal.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.2 and SR 3.8.1.7 (continued)

SR 3.8.1.7 requires that, at a 184 day Frequency, the DG starts from standby conditions and achieves required speed within 10 seconds and required voltage and frequency within 13 seconds. The 10 second start requirement reflects the point during the DG's acceleration at which the DG is assumed to be able to accept load. The 13 second start requirement reflects the point at which the DG is assumed to have reached stable operation. These stability points represent the recovery of the DG and the power distribution system following a transient. This assures the ability of the system to undergo further transients. Actual steady state operation is expected to achieve a level of stability closer to the nominal 60 Hz value. The 10 and 13 second start requirements support the assumptions of the design basis LOCA analysis in the FSAR, Chapter 15 (Ref. 5).

Since SR 3.8.1.7 requires a timed start, it is more restrictive than SR 3.8.1.2, and it may be performed in lieu of SR 3.8.1.2. This is the intent of Note 1 of SR 3.8.1.2.

The 31 day Frequency for SR 3.8.1.2 is consistent with Generic Letter 94-01 (Ref. 12). The 184 day Frequency for SR 3.8.1.7 is a reduction in cold testing consistent with Generic Letter 84-15 (Ref. 7). These Frequencies provide adequate assurance of DG OPERABILITY, while minimizing degradation resulting from testing.

SR 3.8.1.3

This Surveillance verifies that the DGs are 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 DG is connected to the offsite source.

Although no power factor requirements are established by this SR, the DG 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 DG. OPERATION within the load range of 90% to 100% of rated full load without anomalies will provide adequate assurance of the machine's ability to carry 100% of rated full load if required.

The 31 day Frequency for this Surveillance is consistent with Regulatory Guide 1.9 (Ref. 3).

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.3 (continued)

This SR is modified by four Notes. Note 1 indicates that diesel engine runs for this Surveillance may include gradual loading, as recommended by the manufacturer, so that mechanical stress and wear on the diesel engine are minimized. Note 2 states that momentary transients, because of changing bus loads, do not invalidate this test. Similarly, momentary power factor transients above the limit do not invalidate the test. Note 3 indicates that this Surveillance should be conducted on only one DG at a time per unit in order to avoid common cause failures that might result from offsite circuit or grid perturbations. Note 4 stipulates a prerequisite requirement for performance of this SR. A successful DG start must precede this test to credit satisfactory performance.

SR 3.8.1.4

This SR provides verification that the level of fuel oil in the day tank is a contained quantity sufficient for DG operation at full load for a nominal one-hour period. One hour is adequate time for an operator to take corrective action to restore the fuel oil supply to the affected day tank. The level is expressed as an equivalent volume in gallons.

The 31 day Frequency is adequate to assure that a sufficient supply of fuel oil is available, since the transfer pumps auto-starts are at a level above the minimum contained volume. Therefore, normal DG operation will not result in day tank level below the minimum required volume. Additional assurance of sufficient day tank contained volume is provided by a low level alarm.

SR 3.8.1.5

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 from the fuel oil day tanks once every 31 days eliminates the necessary environment for bacterial survival. This is the most effective means of controlling microbiological fouling. In addition, it eliminates the potential for water entrainment in the fuel oil during DG 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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.6

This Surveillance demonstrates that each required fuel oil transfer pump operates and transfers fuel oil from the fuel oil storage tanks to each 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 that controls are configured such that each unit will preferentially receive fuel from a different storage tank while using the other unit's preferred storage as its backup storage.

The Frequency of 31 days is adequate to verify proper operation of the fuel oil transfer pumps and day tank supply valves to maintain the required volume of fuel oil in the day tanks. The frequency has been proven acceptable through operating experience.

SR 3.8.1.7

See SR 3.8.1.2.

SR 3.8.1.8

Transfer of each 4.16 kV ESF bus power supply from the normal offsite circuit to the alternate offsite circuit, which is the immediate access 230 kV, demonstrates the OPERABILITY of the alternate circuit distribution network to power the shutdown loads. Transfer of each 4.16 kV ESF bus power supply from the alternate offsite circuit (immediate access 230 kV) to the delayed access circuit (500 kV circuit) demonstrates the ability of the delayed access circuit. The 24 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 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

This SR is modified by a Note. The reason for the Note is that, during operation with the reactor critical, performance of this SR for automatic bus transfers could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, unit safety systems. The restriction applies only to automatic bus transfers where a unit trip and reactor trip will occur. This restriction does not apply to manual bus transfers which are a normal action required during a plant startup or shutdown.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 3, 4, 5, or 6.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.9

Each DG is provided with an engine overspeed trip to prevent damage to the engine. Recovery from the transient caused by the loss of a large load could cause diesel engine overspeed, which, if excessive, might result in a trip of the engine. This Surveillance demonstrates the DG load response characteristics and capability to reject the largest single load without exceeding predetermined voltage and frequency and while maintaining a specified margin to the overspeed trip. The single largest DG load is a centrifugal charging pump (CCP), which is rated at 600 hp. The CCP has a maximum demand, based on the maximum expected horsepower input and motor efficiency, of 515 kW. This Surveillance may be accomplished by:

a. Tripping the DG output breaker with the DG 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 DG solely supplying the bus.

c. Simultaneously tripping a combination of loads equal to or greater than the DG's associated single largest post-accident load with the DG solely supplying the bus.

The time, voltage, and frequency tolerances specified in this SR are derived from Regulatory Guide 1.9 (Ref. 3) recommendations for response during load sequence intervals. The 2.4 seconds specified is equal to 60% of a typical 4 second load sequence interval associated with sequencing of the largest load. The voltage and frequency specified are consistent with the design range of the equipment powered by the DG. SR 3.8.1.9.a corresponds to the maximum frequency excursion, while SR 3.8.1.9.b and SR 3.8.1.9.c are steady state voltage and frequency values to which the system must recover following load rejection. The 24 month Frequency is consistent with the intent of Regulatory Guide 1.108 (Ref. 9). DC 3.8-ED1: added "in that the SR is performed on a Refueling Outage Frequency."

This SR is modified by two Notes. The reason for Note 1 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.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 3, 4, 5, or 6.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.9 (continued)

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, Note 2 requires that, if synchronized to offsite power, testing must be performed using a power factor ≤ 0.9 lagging. This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience.

SR 3.8.1.10

This Surveillance 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 would experience 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 continue 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.

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, testing must be performed using a power factor ≤ 0.87 lagging. This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience.

The 24 month Frequency is consistent with the intent of Regulatory Guide 1.108 (Ref. 9) and is intended to be consistent with expected fuel cycle lengths.

This SR has been modified by a Note. The reason for the Note is that during operation with the reactor critical, performance of this SR could cause perturbation to the electrical distribution systems that could challenge continued steady state operation and, as a result, unit safety systems. This risk is compared to the risk associated with a shutdown of the unit without the availability of a required DG. The result is that this SR shall not be performed in MODE 1 or 2 unless required to demonstrate OPERABILITY following unplanned maintenance (Ref. 13).

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 3, 4, 5, or 6.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.11

As required by Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(1), this Surveillance demonstrates the as designed operation of the standby power sources during loss of the offsite source. 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 DG. It further demonstrates the capability of the DG to automatically achieve the required voltage and frequency within the specified time.

The DG autostart time of 10 seconds is derived from requirements of the accident analysis to respond to a design basis accident. The 10 second requirement reflects the assumption of the accident analysis that the DG has reached the point in its acceleration where the DG is able to accept load. The Surveillance should be continued for a minimum of 5 minutes in order to demonstrate that all starting transients have decayed and stability is achieved. After energization of the loads, steady state voltage and frequency are required to be within their limits.

The requirement to verify the connection and power supply of permanent and autoconnected loads is intended to satisfactorily show the relationship of these loads to the DG loading logic. The permanently connected loads are the Class 1E 480 VAC buses. The permanently connected loads do not receive a load shed signal. In addition, the containment fan cooler units do not receive a load shed signal but are de-energized when their motor contactors drop out on undervoltage. The permanently connected loads are re-energized when the DG breaker closes to energize the bus. The auto-connected loads are those loads that are energized via their respective sequencing timer. 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 that adequately shows the capability of the DG systems 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 Frequency of 24 months is consistent with the intent 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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.11 (continued)

This SR is modified by two Notes. The reason for Note 1 is to minimize wear and tear on the DGS during testing. For the purpose of this testing, the DGS must be started from standby conditions, that is, with the engine coolant and oil temperature maintained consistent with manufacturer recommendations of equal to or greater than 90°F but less than 175°F. The reason for Note 2 is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 5 or 6.

SR 3.8.1.12

This Surveillance demonstrates that the DG automatically starts and achieves stability by reaching the required voltage and frequency within the specified time (13 seconds) from the Safety Injection actuation signal and operates for ≥ 5 minutes. The 5 minute period provides sufficient time to demonstrate stability. SR 3.8.1.12.d and SR 3.8.1.12.e ensure that permanently connected loads and emergency loads are energized from the offsite electrical power system on a Safety Injection signal without loss of offsite power. The emergency loads are the ESF loads.

The requirement to verify the connection of permanent and autoconnected loads to the immediate access 230 kV offsite power system is intended to satisfactorily show the relationship of these loads to the DG loading logic. For a description of the permanent and auto-connected loads, see SR 3.8.1.11 Bases. 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 that adequately shows the capability of the DG system 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 Frequency of 24 months 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 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.12 (continued)

This SR is modified by two Notes. The reason for Note 1 is to minimize wear and tear on the DGS during testing. For the purpose of this testing, the DGS must be started from standby conditions, that is, with the engine coolant and oil temperature maintained consistent with manufacturer recommendations of equal to or greater than 90°F but less than 175°F. The reason for Note 2 is that during operation with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, unit safety systems.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 3, 4, 5, or 6.

SR 3.8.1.13

This Surveillance demonstrates that DG noncritical protective functions are bypassed when the diesel engine trip cutout switch is in the cutout position and the DG is aligned for automatic operation. The noncritical trips include directional power, loss of field, breaker overcurrent, high jacket water temperature, and diesel overcrank. These 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 DG 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 DG.

The 24 month Frequency is based on engineering judgment, taking into consideration 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 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

The SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DG from service.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 3, 4, 5, or 6.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.14

The refueling outage intent of Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(3), requires demonstration once per 24 months that the DGs can start and run continuously at full load capability for an interval of not less than 24 hours, ≥ 2 hours of which is at a load equivalent to 110% of the continuous duty rating and the remainder of the time at a load equivalent to the continuous duty rating of the DG. The DG starts for this Surveillance can be performed either from standby or hot conditions. The provisions for prelubricating and warmup, discussed in SR 3.8.1.2, and for gradual loading, discussed in SR 3.8.1.3, are applicable to this SR.

In order to ensure that the DG is tested under load conditions that are as close to design conditions as possible, testing must be performed using a power factor of ≤ 0.87 lagging. This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience. The load band is provided to avoid routine overloading of the DG. Routine overloading may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY.

The 24 month Frequency is consistent with the intent 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.

This Surveillance is modified by two Notes. Note 1 states that momentary transients due to changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the power factor limit will not invalidate the test. The reason for Note 2 is that during operation with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, unit safety systems. This risk compared to the risk associated with a shutdown of the unit without the availability of a required DG. The result is that this SR shall not be performed in MODE 1 or 2 unless required to demonstrate OPERABILITY following unplanned maintenance (Ref. 13).

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 3, 4, 5, or 6.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.15

This Surveillance demonstrates that the diesel engine can restart from a hot condition, such as subsequent to shutdown from normal Surveillances, and achieve stability by reaching the required voltage and frequency within 13 seconds. The 13 second time is derived from the requirements of the accident analysis to respond to a design basis accident. The acceptance criteria represents the recovery of the DG and the power distribution system following a start and load transient. This assures the ability of the system to undergo further transients. Actual steady state operation is expected to achieve a level of stability closer to the nominal 60 Hz value. The 24 month Frequency is consistent with the intent of Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(5).

This SR is modified by two Notes. Note 1 ensures that the test is performed with the diesel sufficiently hot. The load band is provided to avoid routine overloading of the DG. Routine overloads may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY. The requirement that the diesel has operated for at least 2 hours at full load conditions prior to performance of this Surveillance is based on test data and manufacturer recommendations for achieving hot conditions. Momentary transients due to changing bus loads do not invalidate this test. Note 2 allows all DG starts to be preceded by an engine prelube period to minimize wear and tear on the diesel during testing.

SR 3.8.1.16

As required by Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(6), this Surveillance ensures that the manual synchronization and load transfer from the DG to the offsite source can be made and the DG can be returned to ready to load status when offsite power is restored. It also ensures that the autostart logic is reset to allow the DG to reload if a subsequent loss of offsite power occurs. The DG is considered to be in ready to load status when the DG is at rated speed and voltage, the output breaker is open and can receive an auto close signal on bus undervoltage, and the load sequencing timers are reset.

The Frequency of 24 months is consistent with the intent of Regulatory Guide 1.108 (Ref. 9), paragraph 2.a.(6), and takes into consideration unit conditions required to perform the Surveillance.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.16 (continued)

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 5 or 6.

SR 3.8.1.17

Demonstration of the test mode override ensures that the DG availability under accident conditions will not be compromised as the result of testing. A Safety Injection signal, received while the DG is operating in a test mode, results in the auxiliary breaker opening and the emergency loads automatically sequencing onto the DG.

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 24 month Frequency is consistent with the intent 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.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 5 or 6.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.18

Under accident and loss of offsite power conditions, loads are sequentially connected to the bus by load sequencer timers. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading of the DGs due to high motor starting currents. The load sequence time interval tolerances ensure that sufficient time exists for the DG to restore frequency and voltage prior to applying the next load and that safety analysis assumptions regarding ESF equipment time delays are not violated. The timing limits for the load sequence timers are found in table B3.8.1-1 (ESF Timers) and table B3.8.1-2 (Auto transfer Timers).

With an ESF timer found to be outside the range of acceptable settings, the corresponding DG shall be declared inoperable in MODES 1, 2, 3, and 4, and the corresponding CONDITION followed. With an Auto Transfer timer found to be outside the range of acceptable settings, the corresponding DG shall be declared inoperable for all MODES. This action is necessary only for that time required to open the breaker on the affected load.

The Frequency of 24 months is consistent with the intent 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.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 5 or 6.

SR 3.8.1.19

In the event of a DBA coincident with a loss of offsite power, the DGs are required to supply the necessary power to ESF systems so that the fuel, RCS, and containment design limits are not exceeded.

This Surveillance demonstrates the DG operation, as discussed in the Bases for SR 3.8.1.11, during a loss of offsite power actuation test signal in conjunction with a Safety Injection signal. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the DG system 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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.19 (continued)

The Frequency of 24 months takes into consideration unit conditions required to perform the Surveillance and is intended to be consistent with an expected fuel cycle length of 24 months.

This SR is modified by two Notes. The reason for Note 1 is to minimize wear and tear on the DGs during testing. For the purpose of this testing, the DGs must be started from standby conditions, that is, with the engine coolant and oil temperature maintained consistent with manufacturer recommendations for DGs of equal to or greater than 90°F but less than 175°F. The reason for Note 2 is that the performance of the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems.

Preplanned maintenance that would require the performance of this SR to demonstrate operability following the maintenance shall only be performed in Modes 5 or 6.

SR 3.8.1.20

This Surveillance demonstrates that the DG starting independence has not been compromised. Also, this Surveillance demonstrates that each engine can achieve proper speed within the specified time when the DGs are started simultaneously.

The 10 year Frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 9).

This SR is modified by a Note. The reason for the Note is to minimize wear on the DG during testing. For the purpose of this testing, the DGs must be started from standby conditions, that is, with the engine coolant and oil temperature maintained consistent with manufacturer recommendations of equal to or greater than 90°F but less than 175°F.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. FSAR, Chapter 8.
3. Regulatory Guide 1.9, Rev. 3, July 1993.
4. FSAR, Chapter 6.
5. FSAR, Chapter 15.

(continued)

BASES

REFERENCES (continued)

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, Oct 1979.

11. ASME, Boiler and Pressure Vessel Code, Section XI.

12. Generic Letter 94-01, "Removal of Accelerated Testing and Special Reporting Requirements for Emergency Diesel Generators," May 31, 1994.

13. Diesel Generator Allowed Outage Time Study, LA 44/43, October 4, 1989

TABLE B 3.8.1-1
LOAD SEQUENCING TIMERS
ESF TIMERS

		COMPONENT	TIMER SETTINGS (sec) MINIMUM	NOMINAL	MAXIMUM
1.	Bus F	Centrifugal Charging Pump No. 1	1.5	2	3
		Safety Injection Pump No. 1	5	6	7
		Containment Fan Cooler Unit No. 2	9	10	11
		Containment Fan Cooler Unit No. 1	13	14	15
		Component Cooling Water Pump No. 1	17	18	19.5
		Auxiliary Saltwater Pump No. 1	20.8	22	23.2
		Auxiliary Feedwater Pump No. 3	24.5	26	28
2.	Bus G	Centrifugal Charging Power No. 2	1.5	2	3
		Residual Heat Removal Pump No. 1	5	6	7.5
		Containment Fan Cooler Unit No. 3	9	10	11.5
		Containment Fan Cooler Unit No. 5	13	14	15
		Component Cooling Water Pump No. 2	17	18	19
		Auxiliary Saltwater Pump No. 2	20.8	22	23.2
		Containment Spray Pump No. 1	24.5	26	28
3.	Bus H	Safety Injection Pump No. 2	1	2	3
		Residual Heat Removal Pump No. 2	5	6	7
		Containment Fan Cooler Unit No. 4	9	10	11
		Component Cooling Water Pump No. 3	12.5	14	15
		Auxiliary Feedwater Pump No. 2	17	18	19.5
		Containment Spray Pump No. 2	20.8	22	23.2

TABLE B 3.8.1-2
LOAD SEQUENCING TIMERS
AUTO TRANSFER TIMERS

		COMPONENT	TIMER SETTINGS (sec) MINIMUM	NOMINAL	MAXIMUM
1.	Bus F	Component Cooling Water Pump No. 1	4	5	6
		Auxiliary Saltwater Pump No. 1	9	10	11
		Auxiliary Feedwater Pump No. 3	13	14	15
		Centrifugal Charging Pump No. 1	18.5	20	21.5
		Containment Fan Cooler Unit No. 1	23.5	25	27
		Containment Fan Cooler Unit No. 2	23.5	25	27
2.	Bus G	Component Cooling Water Pump No. 2	4	5	6
		Auxiliary Saltwater Pump No. 2	9	10	11
		Centrifugal Charging Pump No. 2	18.5	20	21.5
		Containment Fan Cooler Unit No. 3	23.5	25	27
		Containment Fan Cooler Unit No. 5	23.5	25	27
3.	Bus H	Component Cooling Water Pump No. 3	4	5	6
		Auxiliary Feedwater Pump No. 2	13	14	15
		Containment Fan Cooler Unit No. 4	22	25	27

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.2 AC Sources—Shutdown

BASES

BACKGROUND	A description of the AC sources is provided in the Bases for LCO 3.8.1, "AC Sources — Operating."
APPLICABLE SAFETY ANALYSES	The OPERABILITY of the minimum AC sources during MODES 5 and 6 and during movement of irradiated fuel assemblies ensures that: a. The unit can be maintained in the shutdown or refueling condition for extended periods; b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and c. Adequate AC electrical power is provided to mitigate events postulated during shutdown, such as a fuel handling accident. In general, when the unit is shut down, the Technical Specifications requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite power is not required. The rationale for this is based on the fact that many Design Basis Accidents (DBAs) that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6. Worst case bounding events are deemed not credible in MODES 5 and 6 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems. During MODES 1, 2, 3, and 4, various deviations from the analysis assumptions and design requirements are allowed within the Required Actions. This allowance is in recognition that certain testing and maintenance activities must be conducted, provided an acceptable level of risk is not exceeded. During MODES 5 and 6, performance of a significant number of required testing and maintenance activities is also required. In MODES 5 and 6, the activities are generally planned and administratively controlled. Relaxations from MODE 1, 2, 3, and 4 LCO requirements are acceptable during shutdown modes based on: a. The fact that time in an outage is limited. This is a risk prudent goal as well as a utility economic consideration.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

b. Requiring appropriate compensatory measures for certain conditions. These may include administrative controls, reliance on systems that do not necessarily meet typical design requirements applied to systems credited in operating MODE analyses, or both.

c. Prudent utility consideration of the risk associated with multiple activities that could affect multiple systems.

d. Maintaining, to the extent practical, the ability to perform required functions (even if not meeting MODE 1, 2, 3, and 4 OPERABILITY requirements) with systems assumed to function during an event.

In the event of an accident during shutdown, this LCO ensures the capability to support systems necessary to avoid immediate difficulty, assuming either a loss of all offsite power or a loss of all onsite diesel generator (DG) power.

The AC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

One offsite circuit capable of supplying the onsite Class 1E power distribution subsystem(s) of LCO 3.8.10, "Distribution Systems — Shutdown," ensures that all required loads are powered from offsite power. An OPERABLE DG, associated with the Class 1E AC electrical power distribution subsystem required to be OPERABLE by LCO 3.8.10, ensures a diverse power source is available to provide electrical power support, assuming a loss of the offsite circuit. Together, OPERABILITY of the required offsite circuit and DG ensures the availability of sufficient AC sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

The qualified offsite circuit must be capable of maintaining rated frequency and voltage, and accepting required loads during an accident, while connected to the Engineered Safety Feature (ESF) bus(es). Qualified offsite circuits are those that are described in the FSAR and are part of the licensing basis for the unit.

The Unit 1 Offsite Circuit #1 consists of Startup Transformer 1-1 supplied from the immediate access 230 kV Switchyard power source, which feeds Startup Transformer 1-2 through series supply breakers 52VU12 and 52VU14. Startup Transformer 1-2 then supplies power through breaker 52HG15 to each vital bus feeder breaker (Bus F - 52HF14, Bus G - 52HG14, Bus H - 52HH14). The Unit 1 Offsite Circuit #2 is the delayed access 500 kV circuit which becomes available only after opening the motor operated disconnect to the main

(continued)

BASES

LCO (continued)

generator. This circuit consists of Auxiliary Transformer 1-2 supplied from the 500 kV Switchyard through the main bank transformers. Auxiliary Transformer 1-2 supplies power directly to each of the vital bus feeder breakers (Bus F - 52HF13, Bus G - 52HG13, Bus H - 52HH13).

The Unit 2 Offsite Circuit #1 consists of Startup Transformer 2-1 supplied from the immediate access 230 kV Switchyard power source, which feeds Startup Transformer 2-2 through series supply breakers 52VU23 and 52VU24. Startup Transformer 2-2 then supplies power through breaker 52HG15 to each vital bus feeder breaker (Bus F - 52HF14, Bus G - 52HG14, Bus H - 52HH14). The Unit 2 Offsite Circuit #2 is a delayed access circuit which only becomes available after opening the motor operated disconnect to the main generator. This circuit consists of Auxiliary Transformer 2-2 supplied from the 500 kV Switchyard through the main bank transformers. Auxiliary Transformer 2-2 supplies power directly to each of the vital bus feeder breakers (Bus F - 52HF13, Bus G - 52HG13, Bus H -3 52HH13).

The DG must be capable of starting, accelerating to rated speed and voltage, and connecting to its respective ESF bus on detection of bus undervoltage. This sequence must be accomplished within 10 seconds. The DG must 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.

With administrative controls in place, it is acceptable for Class 1E AC electrical power distribution subsystems to be cross tied during shutdown conditions, allowing a single offsite power circuit or a single DG to supply the required Class 1E AC electrical power distribution subsystems.

The two redundant diesel fuel oil transfer pumps supply fuel oil to DG day tanks from either storage tank. One pump is adequate to supply the six DGs operating at full load. Only one train is required to be OPERABLE in MODES 5 or 6.

APPLICABILITY

The AC sources required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

(continued)

BASES

APPLICABILITY (continued)

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

The AC power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.1.

ACTIONS

A.1

An offsite circuit would be considered inoperable if it were not available to the required Class 1E bus(es). If two Class 1E AC electrical power distribution subsystems are required by LCO 3.8.10, and one Class 1E AC electrical power distribution subsystem has offsite power available, the remaining Class 1E AC electrical power distribution subsystem may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare required features inoperable, with no offsite power available, appropriate restrictions will be implemented in accordance with the affected required features LCO's ACTIONS.

A.2.1, A.2.2, A.2.3, A.2.4, B.1, B.2, B.3, and B.4

With the offsite circuit not available to all required AC electrical power distribution subsystems , the option would still exist to declare all required features inoperable. Since this option may involve undesired administrative efforts, the allowance for sufficiently conservative actions is made. With the required DG inoperable, the minimum required diversity of AC power sources is not available. It is, therefore, required to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions. The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory provided the required SDM is maintained.

Suspension of these activities does not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability or the occurrence of postulated events. It is further required to immediately initiate action to restore the required AC sources and to continue this action until restoration is accomplished in order to provide the necessary AC power to the unit safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required AC electrical power sources should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

(continued)

BASES

ACTIONS

A.2.1, A.2.2, A.2.3, A.2.4, B.1, B.2, B.3, and B.4 (continued)

Pursuant to LCO 3.0.6, the Distribution System's ACTIONS would not be entered even if all AC sources to it are inoperable, resulting in de-energization. Therefore, the Required Actions of Condition A are modified by a Note to indicate that when Condition A is entered with no AC power to any required ESF bus, the ACTIONS for LCO 3.8.10 must be immediately entered. This Note allows Condition A to provide requirements for the loss of the offsite circuit, whether or not an AC electrical power distribution subsystem is de-energized. LCO 3.8.10 would provide the appropriate restrictions for the situation involving a de-energized AC electrical power distribution subsystem.

SURVEILLANCE REQUIREMENTS

SR 3.8.2.1

SR 3.8.2.1 lists the SRs from LCO 3.8.1 that are applicable for ensuring the OPERABILITY of the AC sources in other than MODES 1, 2, 3, and 4. SR 3.8.1.8 is not required to be met since only one offsite circuit is required to be OPERABLE. SR 3.8.1.17 is not required to be met because the required OPERABLE DG is not required to undergo periods of being synchronized to the offsite circuit. SR 3.8.1.20 is excepted because starting independence is not required with the DG that is not required to be operable. SR 3.8.1.12, SR 3.8.1.13, SR 3.8.1.18 (for ESF timers), and SR 3.8.1.19 are excepted because SI response functions are not required to be OPERABLE.

This SR is modified by a Note listing the applicable SRs from LCO 3.8.1 that are not required to be performed. The reason for the Note is to preclude requiring the OPERABLE DG from being paralleled with the offsite power network or otherwise rendered inoperable during performance of an SR. The note would also preclude deenergizing a required 4160 V ESF bus or disconnecting a required offsite circuit for performance of an SR. With limited AC sources available, a single event could compromise both the required circuit and the DG. The note does not except the requirement for the DG, 4160 V ESF bus, or offsite circuit to be capable of performing the particular function, just that the capability of need not be demonstrated while that source of power is being relied on to support meeting the LCO.

Refer to the corresponding Bases for LCO 3.8.1 for a discussion of each SR.

REFERENCES

None.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Diesel Fuel Oil, Lube Oil, Starting Air, and Turbocharger Air Assist

BASES

BACKGROUND

The diesel fuel oil storage system consists of two common tanks with a nominal capacity of 50,000 gallons each. The TS-required fuel oil quantity is based on the calculated fuel oil consumption necessary to support the operation of the DGs to power the minimum engineered safety feature (ESF) systems required to mitigate a design basis accident (LOCA) in one unit and those minimum required systems for a concurrent non-LOCA safe shutdown in the remaining unit (both units initially in MODE 1 operation). The fuel oil consumption is calculated for a period of 7 days operation of minimum ESF systems. This requirement provides a sufficient operating period within which offsite power can be restored and/or additional fuel can be delivered to the site.

Fuel oil is transferred from the storage tanks via the diesel fuel oil storage and transfer system to replenish the day tanks as required. The design incorporates sufficient redundancy so that a malfunction of either an active or a passive component will not impair the ability of the system to supply fuel oil. Two redundant fuel oil transfer pumps supply fuel oil to DG day tanks from either storage tank. One pump is adequate to supply the six DGs operating at full load. Each DG tank has two separate, redundant transfer pump start-stop level switches. Each level switch automatically starts a transfer pump and opens the supply header solenoid valve corresponding to the respective transfer pump, 0-1 or 0-2. In addition, high and low level alarms are provided on each day tank and activate alarms both locally and in the control room.

The diesel lube oil storage requirement is based upon a conservative usage factor of 1% of fuel oil consumption. The storage system used to meet this requirement is that located in the warehouse where 650 gallons of lube oil is stored in drums. This storage is augmented by a second storage location within the diesel engine itself. The lube oil level on each engine's dip stick is maintained 5 inches above the engine's operability limit. This provides approximately 120 gallons of usable lube oil within each of the 6 diesel engines.

For proper operation of the standby DGs, it is necessary to ensure the proper quality of the fuel oil. Regulatory Guide 1.137 (Ref. 2) addresses the recommended fuel oil practices as supplemented by ANSI N195 (Ref. 3). The fuel oil properties governed by these SRs are the water and sediment content, the kinematic viscosity, specific gravity (or API gravity), and impurity level.

(continued)

BASES

BACKGROUND (continued)	The DG fuel oil consumption is calculated for a period of 7 days operation of minimum ESF systems. This requirement provides a sufficient operating period within which offsite power can be restored and/or additional fuel can be delivered to the site. The DG lubrication system is designed to provide sufficient lubrication to permit proper operation of its associated DG under all loading conditions. The system is required to circulate the lube oil to the diesel engine working surfaces and to remove excess heat generated by friction during operation. The total engine oil sump inventory (all engines) is capable of supporting a minimum of 7 days of operation at minimum ESF loads. The onsite storage inventory (warehouse) is in addition to the engine oil sump and is also sufficient to ensure 7 days of continuous operation. These supplies are sufficient to allow the operators to replenish lube oil from outside sources as a third resource. Each DG has two redundant 100% capacity air start systems and a turbocharger air assist system with adequate capacity for three successive start attempts each on the DG without recharging the air start receivers or the turbocharger air assist air receiver.
APPLICABLE SAFETY ANALYSIS	The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 4), and in the FSAR, Chapter 15 (Ref. 5), assume Engineered Safety Feature (ESF) systems are OPERABLE. The DGs are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that fuel, Reactor Coolant System and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems. Since diesel fuel oil, lube oil, air start, and turbocharger air assist subsystems support the operation of the standby AC power sources, they satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	Stored diesel fuel oil is required to have sufficient supply for 7 days of minimum ESF systems operation. The required combined stored diesel fuel oil is a contained quantity with different storage requirements for unit operation in MODE 1, 2, 3, and 4 and for MODE 5 and 6. With both units operating in MODE 1, 2, 3, and 4, the required level is ≥ 65,000 gallons. With one unit operating in MODE 1, 2, 3, or 4, and the other unit in MODE 5 or 6, the required fuel oil level is 33,000 gallons plus 26,000 gallons, for a total of 59,000 gallons combined storage. With both units in MODE 5 or 6, the required fuel oil level is 52,000 gallons. The required combined stored fuel oil was revised by License Amendment 74 for Unit 1 and 73 for Unit 2.

(continued)

BASES

LCO (continued)

The Note permits diesel fuel oil storage tank cleaning to be performed. Each tank is required to be cleaned on a 10-year frequency. Conducting the cleaning requires the tank to be taken out of service. For this infrequent event, the inventory in the remaining tank is sufficient to support operation of the DGs to power the minimum required loads to maintain safe conditions for a period of 4 days, considering one unit in MODE 1, 2, 3, 4, 5, or 6 and one unit in MODE 6 with 23 feet of water above the reactor vessel flange or with the reactor vessel defueled. The requirements for diesel fuel oil tank cleaning were approved by License Amendment 74 for Unit 1 and 73 for Unit 2.

The fuel oil is also required to meet specific standards for quality. Additionally, sufficient lubricating oil supply must be available to ensure the capability to operate at full load for 7 days. This requirement, in conjunction with an ability to obtain replacement supplies within 7 days, supports the availability of DGs required to shut down the reactor and to maintain it in a safe condition for an anticipated operational occurrence (AOO) or a postulated DBA with loss of offsite power. DG day tank fuel requirements, as well as transfer capability from the storage tank to the day tank, are addressed in LCO 3.8.1, "AC Sources - Operating," and LCO 3.8.2, "AC Sources-Shutdown."

The starting air system and turbocharger air assist system are required to have a minimum capacity for three successive DG start attempts without recharging the air start receivers or the turbocharger air assist air receiver.

APPLICABILITY

The AC sources (LCO 3.8.1 and LCO 3.8.2) are required to ensure the availability of the required power to shut down the reactor and maintain it in a safe shutdown condition after an AOO or a postulated DBA. Since stored diesel fuel oil, lube oil, starting air, and turbocharger air assist subsystems support LCO 3.8.1 and LCO 3.8.2, stored diesel fuel oil, lube oil, starting air, and turbocharger air assist are required to be within limits when the associated DGs are required to be OPERABLE.

ACTIONS

The ACTIONS Table is modified by a Note indicating that separate Condition entry is allowed for each DG or diesel fuel oil storage tank, except for Condition A. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each inoperable DG subsystem. Complying with the Required Actions for one inoperable DG subsystem may allow for continued operation, and subsequent inoperable DG subsystem(s) are governed by separate Condition entry and application of associated Required Actions.

(continued)

BASES

ACTIONS (continued)

Condition A is excepted from this allowance for diesel fuel oil storage tanks, since the requirement is for a combined storage quantity contained in both storage tanks. However, the Note would still allow separate Condition entry into a DG subsystem's Required Action coincident with Condition A.

A.1 and A.2

In this Condition, the 7 day fuel oil supply for the DGs is not available. However, the Condition is restricted to fuel oil level reductions that maintain at least a 6 day supply. These circumstances may be caused by events, such as full load operation required after an inadvertent start while at minimum required level, or feed and bleed operations, which may be necessitated by increasing particulate levels or any number of other oil quality degradations. This restriction allows sufficient time for obtaining the requisite replacement volume and performing the analyses required prior to addition of fuel oil to the tank. A period of 48 hours is considered sufficient to complete restoration of the required level prior to declaring the associated DGs inoperable. This period is acceptable based on the remaining capacity (> 6 days), the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period. Should the specified 6 day fuel oil supply for both units not be available, but the available supply is still greater than that required to support operation of one unit, then that available supply can be allocated to a selected unit, and the DGs declared inoperable under Action H need only be the ones associated with the unit that has the inadequate supply.

B.1

With diesel engine lube oil stored inventory < 650 gal, sufficient lubricating oil is available to support 7 days of continuous DG operation based on minimum 7 day ESF systems loading at 1% of fuel oil consumption. However, the Condition is restricted to lube oil volume reductions that maintain at least a 6 day supply of 610 gallons. This ACTION should be entered based upon warehouse inventory of less then 650 gallons with both units in MODES 1, 2, 3 or 4 and less then 590 gallons with one unit in MODES 1, 2, 3, or 4 and the other in MODES 5 or 6. This restriction allows sufficient time to obtain the requisite replacement volume. A period of 48 hours is considered sufficient to complete restoration of the required volume prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (> 6 days), the low rate of usage, the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

(continued)

BASES

ACTIONS (continued)

C.1

This Condition is entered as a result of a failure to meet the acceptance criterion of SR 3.8.3.3. Normally, trending of particulate levels allows sufficient time to correct high particulate levels prior to reaching the limit of acceptability. Poor sample procedures (bottom sampling), contaminated sampling equipment, and errors in laboratory analysis can produce failures that do not follow a trend. Since the presence of particulates does not mean failure of the fuel oil to burn properly in the diesel engine, and particulate concentration is unlikely to change significantly between Surveillance Frequency intervals, and proper engine performance has been recently demonstrated (within 31 days), it is prudent to allow a brief period prior to declaring the associated DGs inoperable. The 7 day Completion Time allows for further evaluation, re-sampling and re-analysis of the DG fuel oil.

D.1

With the new fuel oil properties defined in the Bases for SR 3.8.3.3 not within the required limits, a period of 30 days is allowed for restoring the stored fuel oil properties. This period provides sufficient time to test the stored fuel oil to determine that the new fuel oil, when mixed with previously stored fuel oil, remains acceptable, or to restore the stored fuel oil properties. This restoration may involve feed and bleed procedures, filtering, or combinations of these procedures. Even if a DG start and load was required during this time interval and the fuel oil properties were outside limits, there is a high likelihood that the DG would still be capable of performing its intended function.

E.1

With both starting air receiver pressures < 180 psig, sufficient capacity for three successive DG start attempts does not exist. However, as long as one receiver pressure is > 150 psig, there is adequate capacity for at least one start attempt, and the DG can be considered OPERABLE while one air receiver pressure is restored to the required limit. A period of 48 hours is considered sufficient to complete restoration to the required pressure prior to declaring the DG inoperable. This period is acceptable based on the remaining air start capacity, the fact that most DG starts are accomplished on the first attempt, and the low probability of an event during this brief period.

F.1

With turbocharger air assist air receiver pressure < 180 psig, sufficient capacity for three successive DG start attempts does not exist. However, as long as the receiver pressure is > 150 psig, there is

(continued)

BASES

ACTIONS

F.1 (continued)

adequate capacity for at least one start attempt, and the DG can be considered OPERABLE while the turbo air assist air receiver pressure is restored to the required limit. A period of 48 hours is considered sufficient to complete restoration to the required pressure prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity, the fact that most DG starts are accomplished on the first attempt, and the low probability of an event during this brief period.

G.1

With a Required Action and associated Completion Time or Conditions E or F not met, or one or more DG's starting air, or turbocharger air assist subsystem not within limits for reasons other than addressed by Conditions E or F, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable.

H.1, H.2, and H.3

With a Required Action and associated Completion Time not met, or the fuel oil storage tanks not within limits for reasons other than addressed by Conditions A, B, C, or D, the fuel oil storage tanks may be incapable of supporting the DGs in performing their intended function. This condition requires declaring inoperable, all the DGs on the unit(s) associated with either the inadequate fuel oil inventory, the fuel storage tank(s) having particulate outside the limit, and/or the fuel storage tank(s) having properties outside limits; and shutting down to MODE 3 in 6 hours and MODE 5 in 36 hours any associated unit(s) operating in MODE 1,2,3,or 4.

SURVEILLANCE REQUIREMENTS

SR 3.8.3.1

This SR provides verification that there is an adequate inventory of fuel oil in the storage tanks to support DG operation for 7 days based on a realistic (minimum) ESF systems loading profile. 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 3.8.3.2

This Surveillance ensures that sufficient lube oil inventory is available to support at least 7 days of operation for each DG at minimum ESF systems loading. The 650 gal requirement is based on the DG

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.3.2 (continued)

manufacturer consumption values for the run time of the DG at 1% of fuel oil consumption. The storage system used to meet this requirement is that located within the warehouse where 650 gallons of lube oil is stored in drums.

A 31 day Frequency is adequate to ensure that a sufficient lube oil supply is onsite, since DG starts and run time are closely monitored by the unit staff.

SR 3.8.3.3

The tests listed below are a means of determining whether new fuel oil is of the appropriate grade and has not been contaminated with substances that would have an immediate, detrimental impact on diesel engine combustion. If results from these tests are within acceptable limits, the fuel oil may be added to the storage tanks without concern for contaminating the entire volume of fuel oil in the storage tanks. These tests are to be conducted prior to adding the new fuel to the storage tanks. The tests, limits, and applicable ASTM Standards are as follows:

a. Sample the new fuel oil in accordance with ASTM D4057-81 (Ref. 6);

b. Verify in accordance with the tests specified in ASTM D975-81 (Ref. 6) that the sample has an absolute specific gravity at 60/60°F of ≥ 0.83 and ≤ 0.89 or an API gravity at 60°F of ≥ 27° and ≤ 39°, a kinematic viscosity at 40°C of ≥ 1.9 centistokes and ≤ 4.1 centistokes, and a flash point of ≥ 125°F; and

c. Verify that the new fuel oil has a clear and bright appearance with proper color when tested in accordance with ASTM D4176 or a water and sediment content of ≤ 0.05 volume percent when tested in accordance with ASTM D-1796-83 (Ref. 6).

Failure to meet any of the above limits is cause for rejecting the new fuel oil, but does not represent a failure to meet the LCO concern since the fuel oil is not added to the storage tanks.

Within 31 days following the initial new fuel oil sample, the fuel oil is analyzed to establish that the other properties specified in Table 1 of ASTM D975-81 (Ref. 7) are met for new fuel oil when tested in accordance with ASTM D975-81 (Ref. 6), except that the analysis for sulfur may be performed in accordance with ASTM D1552-79 (Ref. 6) or ASTM D2622-82 (Ref. 6). The 31 day period is acceptable because the fuel oil properties of interest, even if they were not within stated limits, would not have an immediate effect on DG operation. This Surveillance ensures the availability of high quality fuel oil for the DGs.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.3.3 (continued)

If the analysis of the new fuel oil sample indicates that one or more of the other properties specified in Table 1 of ASTM D975-81 are not within limits, then Required Action D.1 shall be entered, allowing 31 days to restore fuel oil properties to within limits.

Fuel oil degradation during long term storage shows up as an increase in particulates, due mostly to oxidation. The presence of particulates does not mean the fuel oil will not burn properly in a diesel engine. The particulates can cause fouling of filters and fuel oil injection equipment, however, which can cause engine failure.

Particulate concentrations should be determined in accordance with ASTM D2276-78, Method A (Ref. 6). This method involves a gravimetric determination of total particulate concentration in the fuel oil and has a limit of 10 mg/l. It is acceptable to obtain a field sample for subsequent laboratory testing in lieu of field testing. Each tank must be considered and tested separately.

ASTM D 2276-78 was written specifically for aviation fuel. However, it is used in this SR to evaluate diesel fuel oil. Therefore, it may be necessary to perform this test as a modified method. For example, a 500 ml sample may be analyzed rather than a one gallon sample.

The Frequency of this test takes into consideration fuel oil degradation trends that indicate that particulate concentration is unlikely to change significantly between Frequency intervals.

SR 3.8.3.4

This Surveillance ensures that, without the aid of the refill compressor, sufficient air start capacity for each DG is available. The system design requirements provide for a minimum of three engine start cycles without recharging. Each start cycle is 15 seconds of cranking. The pressure specified in this SR is intended to reflect the lowest value at which three starts can be accomplished.

The 31 day Frequency takes into account the capacity, capability, redundancy, and diversity of the AC sources and other indications available in the control room, including alarms, to alert the operator to below normal air start pressure.

SR 3.8.3.5

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 from the fuel storage tanks once every 31 days eliminates the necessary environment for bacterial survival. This is the most effective

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.3.5 (continued)

means of controlling microbiological fouling. In addition, it eliminates the potential for water entrainment in the fuel oil during DG operation. Water may come from any of several sources, including condensation, ground water, rain water, contaminated fuel oil, or from 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. 2). This SR is for preventive maintenance. The presence of water does not necessarily represent failure of this SR, provided the accumulated water is removed during performance of the Surveillance.

SR 3.8.3.6

This Surveillance ensures that, without the aid of the refill compressor, sufficient turbocharger air assist air receiver capacity for each DG is available. The system design requirements provide for a minimum of three engine start cycles without recharging. Each start cycle is 15 seconds of cranking. The pressure specified in this SR is intended to reflect the lowest value at which three starts can be accomplished.

The 31 day Frequency takes into account the capacity, capability, redundancy, and diversity of the AC sources and other indications available in the control room, including alarms, to alert the operator to below normal turbocharger air assist air receiver pressure.

REFERENCES

1. FSAR, Section 9.5.4.2.
2. Regulatory Guide 1.137.
3. ANSI N195-1976, Appendix B.
4. FSAR, Chapter 6.
5. FSAR, Chapter 15.
6. ASTM Standards: D4057-81; D975-81; D4176-82; D1796-83; D1552-79; D2622-82; D2276-78, Method A.
7. ASTM Standards, D975, Table 1.
8. ASME, Boiler and Presser Vessel Code, Section XI.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources-Operating

BASES

BACKGROUND

The Class 1E DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment and backup 120 VAC vital bus power (via inverters). As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 1), the Class 1E DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The 125 VDC electrical power system consists of three independent safety related Class 1E DC electrical power subsystems. Each subsystem consists of one 60-cell 125 VDC battery (Batteries 11(21), 12 (22), and 13 (23)), the dedicated battery charger and backup charger for each battery, and all the associated switchgear, control equipment, and interconnecting cabling.

There are two backup chargers for the three Class 1E DC subsystems. One backup charger is shared between two Class 1E DC subsystems. The other backup charger is dedicated to the third Class 1E DC subsystem. The backup chargers provide backup service in the event that the preferred battery charger is out of service. If the backup battery charger is substituted for one of the preferred battery chargers, then the requirements of independence and redundancy between subsystems are not maintained, and operation is this condition is limited to 14 days by Condition B.

During normal operation, the 125 VDC load is powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC load is automatically powered from the station batteries.

The DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, 4.16 kV switchgear, and 480V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn are backup sources to power the 120 VAC vital buses.

The DC power distribution system is described in more detail in Bases for LCO 3.8.9, "Distribution System-Operating," and LCO 3.8.10, "Distribution Systems-Shutdown."

(continued)

BASES

BACKGROUND (continued)

Each battery has adequate storage capacity to carry the required load continuously for at least 2 hours as discussed in the FSAR, Chapter 8 (Ref. 4).

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystem to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem.

The batteries for the three DC electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 128 V per battery. The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5).

Each DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 12 hours while supplying normal steady state loads discussed in the FSAR, Chapter 8 (Ref. 4).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 6), and in the FSAR, Chapter 15 (Ref. 7), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining the DC sources OPERABLE during accident conditions in the event of:

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

b. A worst case single failure.

The DC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

(continued)

BASES (continued)

LCO

The DC electrical power subsystems, each subsystem consisting of one battery, battery charger for each battery and the corresponding control equipment and interconnecting cabling supplying power to the associated bus are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any one DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4).

An OPERABLE DC electrical power subsystem requires the battery and its normal or backup charger to be operating and connected to the associated DC bus.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe unit operation and 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 integrity and other vital functions are maintained in the event of a postulated DBA.

The DC electrical power requirements for MODES 5 and 6 are addressed in the Bases for LCO 3.8.5, "DC Sources - Shutdown."

ACTIONS

A.1

Condition A represents one Class 1E DC electrical power subsystem and associated ESF equipment with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected subsystem. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution subsystem.

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger(s), or inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure would, however, result in the loss of one of the two remaining 125 VDC electrical power subsystems with attendant loss of ESF functions, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide

(continued)

BASES

ACTIONS

A.1 (continued)

1.93 (Ref. 8) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

B.1

The design of the 125 VDC electrical power distribution system is such that a battery can have associated with it a full capacity charger powered from its associated 480 VAC vital bus or an alternate full capacity charger powered from another 480 VAC vital bus. However, operation in the latter condition or, with two chargers powered by the same vital bus is limited to 14 days.

C.1 and C.2

If the inoperable DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, 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 MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times 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 Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 8).

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 9).

SR 3.8.4.2

Visual inspection to detect corrosion of the battery cells and connections, or measurement of the resistance of each intercell, interrack, and terminal connection, provides an indication of physical

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.2 (continued)

damage or abnormal deterioration that could potentially degrade battery performance. The resistance of cell-to-cell connecting cables does not have to be included in measurement of connection resistance.

The Surveillance Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is considered acceptable based on operating experience related to detecting corrosion trends.

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical deterioration does not necessarily represent a failure of this SR, provided an evaluation determines that the physical damage or deterioration does not affect the OPERABILITY of the battery (its ability to perform its design function).

The 24 month Frequency for this SR is based on operational experience related to battery integrity and physical degradation.

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of intercell, interrack, and terminal connections provide an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anticorrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection. The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR provided visible corrosion is removed during performance of SR 3.8.4.4. The resistance of cell-to-cell connecting cables does not have to be included in measurement of connection resistance for SR 3.8.4.5.

The Surveillance Frequencies of 24 months are based on operational experience related to corrosion and connection resistance trends.

SR 3.8.4.6

This SR requires that each battery charger be capable of supplying 400 amps at ≥ 130 V for ≥ 4 hours. These requirements are based on the design capacity of the chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 10), the battery charger supply is required to be

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.6 (continued)

based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 24 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

SR 3.8.4.7

A battery service test is a special test of battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements.

The Surveillance Frequency of 24 months is consistent with the intent of Regulatory Guide 1.32 (Ref. 10) and Regulatory Guide 1.129 (Ref. 11), which state that the battery service test should be performed during refueling operations or at some other outage.

This SR is modified by two Notes. Note 1 allows the performance of a modified performance discharge test in lieu of a service test.

The modified performance discharge test is a simulated duty cycle consisting of just two rates; the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Since the ampere-hours removed by a rated one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.

A modified discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will often confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test. The modified performance discharge test and service test should be performed in accordance with IEEE-450 (Ref. 9).

The reason for Note 2 is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems.

SR 3.8.4.8

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

A battery modified performance discharge test is described in the Bases for SR 3.8.4.7. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 9) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 24 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is < 90% of the manufacturer's rating. The Surveillance Frequency basis is consistent with IEEE-450 (Ref. 9), except if accelerated testing is required, it will be performed at an 24-month frequency to coincide with a refueling outage.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems.

(continued)

BASES (continued)

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-1971.
4. FSAR, Chapter 8.
5. IEEE-485-1978, June 1983.
6. FSAR, Chapter 6.
7. FSAR, Chapter 15.
8. Regulatory Guide 1.93, December 1974.
9. IEEE-450-1995.
10. Regulatory Guide 1.32, February 1977.
11. Regulatory Guide 1.129, December 1974.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources-Shutdown

BASES

BACKGROUND	A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources-Operating."
APPLICABLE SAFETY ANALYSES	The initial conditions of Design Basis Accident and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY. The OPERABILITY of the minimum DC electrical power sources during MODES 5 and 6 and during movement of irradiated fuel assemblies ensures that: a. The unit can be maintained in the shutdown or refueling condition for extended periods; b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as a fuel handling accident. The DC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	The DC electrical power subsystems, each subsystem consisting of one battery, one battery charger per battery, and the corresponding control equipment and interconnecting class 1E cabling within the subsystem, are required to be OPERABLE to support required trains of the distribution systems required OPERABLE by LCO 3.8.10, "Distribution Systems-Shutdown." An OPERABLE subsystem consists of a DC bus connected to a battery with an OPERABLE battery charger which is fed from an OPERABLE AC vital bus (Ref B.3.8.10).

(continued)

BASES

LCO (continued)

With administrative controls in place, DC buses may be cross-tied when a battery is taken out for maintenance provided that the battery and the Class 1E cross-tie has sufficient capacity and protection for its own loads and the cross-tie loads. The resulting circuit is not required to be single failure resistant. This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g. fuel handling accidents).

APPLICABILITY

The DC electrical power sources required to be OPERABLE in MODES 5 and 6, and during movement of irradiated fuel assemblies, provide assurance that:

a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core;

b. Required features needed to mitigate a fuel handling accident are available;

c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

The DC electrical power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.4.

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, and A.2.4

One or more required DC electrical power subsystems may be inoperable provided that the remaining OPERABLE DC electrical power subsystem(s) support the DC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution Systems - Shutdown," and are capable of supporting sufficient systems to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare affected required features inoperable with the associated DC power source(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCO ACTIONS. A required feature is not affected if sufficient power is provided by the associated DC power source such that the feature is capable of performing its specified safety function(s). An engineering evaluation may be required to determine if a required feature is affected. For

(continued)

BASES

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, and A.2.4 (continued)

example, see references 3 and 4. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions). The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained. Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required DC electrical power subsystems and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the unit safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required DC electrical power subsystems should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.8. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged below their capability to provide the required power supply or otherwise rendered inoperable during the performance of an SR. This note does not except the requirement for the battery to be capable of performing the particular function, just that the capability need not be demonstrated while that source of power is being relied on to meet the LCO.

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. DCM S-67, "125V/250V Direct Current System, Section 4.3.1."
4. AR A0456369

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

BACKGROUND	This LCO delineates the limits on electrolyte temperature, level, float voltage, and specific gravity for the DC power source batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources - Operating," and LCO 3.8.5, "DC Sources - Shutdown."
APPLICABLE SAFETY ANALYSES	The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining the required DC electrical power subsystem(s) OPERABLE during accident conditions, in the event of: a. An assumed loss of all offsite AC power or all onsite AC power; and b. A worst case single failure. Battery cell parameters satisfy the Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Electrolyte limits are conservatively established, allowing continued DC electrical system function even with Category A and B limits not met.
APPLICABILITY	The battery cell parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery OPERABILITY is only required when the DC power source is required to be OPERABLE. Refer to the Applicability discussion in Bases for LCO 3.8.4 and LCO 3.8.5.

(continued)

BASES (continued)

ACTIONS

A.1, A.2, and A.3

With one or more cells in one or more batteries not within limits (i.e., Category A limits not met, Category B limits not met, or Category A and B limits not met) but within the Category C limits specified in Table 3.8.6-1 in the accompanying LCO, the battery is degraded but there is still sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of Category A or B limits not met and operation is permitted for a limited period.

The pilot cell electrolyte level and float voltage are required to be verified to meet the Category C limits within 1 hour (Required Action A.1). This check will provide a quick indication of the status of the remainder of the battery cells. One hour provides time to verify the electrolyte level and to confirm the float voltage of the pilot cells. One hour is considered a reasonable amount of time to perform the required verification.

Verification that the Category C limits are met (Required Action A.2) provides assurance that during the time needed to restore the parameters to the Category A and B limits, the battery is still capable of performing its intended function. A period of 24 hours is allowed to complete the initial verification because specific gravity measurements must be obtained for each connected cell. Taking into consideration both the time required to perform the required verification and the assurance that the battery cell parameters are not severely degraded, this time is considered reasonable. The verification is repeated at 7 day intervals until the parameters are restored to Category A or B limits. This periodic verification is consistent with the normal Frequency of pilot cell Surveillances.

Continued operation is only permitted for 31 days before battery cell parameters must be restored to within Category A and B limits. With the consideration that, while battery capacity is degraded, sufficient capacity exists to perform the intended function and to allow time to fully restore the battery cell parameters to normal limits, this time is acceptable prior to declaring the battery inoperable.

B.1

With one or more batteries with one or more battery cell parameters outside the Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required

(continued)

BASES

ACTIONS

B.1 (continued)

Completion Time or average electrolyte temperature of representative cells less than 60°F, are also cause for immediately declaring the associated DC electrical power subsystem inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

This SR verifies that Category A battery cell parameters on a 7 day frequency are consistent with IEEE-450 (Ref. 3), which recommends regular battery inspections (at least one per month) including voltage, specific gravity, and electrolyte temperature of pilot cells.

SR 3.8.6.2

The quarterly inspection of specific gravity is more conservative than IEEE-450 (Ref. 3), which requires a yearly frequency. In addition, within 7 days of a battery discharge < 118 V or a battery overcharge > 145 V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to 118 V, do not constitute a battery discharge provided the battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.

SR 3.8.6.3

This Surveillance verification that the average temperature of representative cells is ≥ 60°F, is consistent with a recommendation of IEEE-450 (Ref. 3), that states that the temperature of electrolytes in 10 connected cells should be determined on a quarterly basis.

Lower than normal temperatures act to inhibit or reduce battery capacity. This SR ensures that the operating temperatures remain within an acceptable operating range. This limit is based on battery sizing calculations.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

Table 3.8.6-1

This table delineates the limits on electrolyte level, float voltage, and specific gravity for three different categories. The meaning of each category is discussed below.

Category A defines the normal parameter limit for the designated pilot cell in each battery. The cell selected as the pilot cell is that whose temperature, voltage, and electrolyte specific gravity approximate the state of charge of the entire battery.

The Category A limits specified for electrolyte level are based on manufacturer recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra 1/4 inch allowance above the high water level indication for operating margin to account for temperatures and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 3) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

The Category A limit specified for float voltage is ≥ 2.13 V per cell. This value is based on the recommendations of IEEE-450 (Ref. 3), which states that prolonged operation of cells < 2.13 V can reduce the life expectancy of cells.

The Category A limit specified for specific gravity for each pilot cell is ≥ 1.195 (0.015 below the manufacturer minimum fully charged specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. The correction factors are provided by the battery manufacturer. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation.

Category B defines the minimum normal parameter limits for each connected cell. The term "connected cell" excludes any battery cell that may be jumpered out.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit is corrected for average electrolyte temperature. The Category B limit specified for specific gravity for each connected cell is ≥ 1.190 (0.020 below the manufacturer minimum fully charged specific gravity) with the average of all connected cells > 1.200 (0.010 below the manufacturer minimum fully charged specific gravity). These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell will not mask overall degradation of the battery.

Category C defines the minimum allowable limits for each connected cell. These values, although reduced, provide assurance that sufficient capacity exists to perform the intended function and maintain a margin of safety. When any battery parameter is outside the Category C limits, the assurance of sufficient capacity described above no longer exists, and the battery must be declared inoperable.

The Category C limits specified for electrolyte level (above the top of the plates and not overflowing) ensure that the plates suffer no physical damage and maintain adequate electron transfer capability. The Category C limit for float voltage is based on IEEE-450 (Ref. 3), which states that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.

The Category C limit of average specific gravity ≥ 1.190 is based on manufacturer recommendations (0.020 below the manufacturer recommended minimum fully charged specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell does not mask overall degradation of the battery.

The footnotes to Table 3.8.6-1 are applicable to Category A, B, and C specific gravity. Footnote (b) to Table 3.8.6-1 requires the above mentioned correction for electrolyte level and temperature, with the exception that level correction is not required when battery charging current is < 2 amps on float charge. This current provides, in general, an indication of a battery in a charged condition.

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote (c) to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for up to 7 days following a battery recharge. Within 7 days, each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements may be made in less than 7 days.

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. IEEE-450-1995.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Inverters - Operating

BASES

BACKGROUND	The Class 1E UPS inverters are the preferred source of power for the AC vital buses because of the stability and reliability they achieve. The function of the inverter is to provide AC electrical power to the vital buses. The inverters can be powered from an internal AC source/rectifier or from the station battery. The station battery provides an uninterruptible power source for the instrumentation and controls for the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS). Specific details on inverters and their operating characteristics are found in the FSAR, Chapter 7 (Ref. 1).
APPLICABLE SAFETY ANALYSES	The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 2) and Chapter 15 (Ref. 3), assume Engineered Safety Feature systems are OPERABLE. The inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the RPS and ESFAS instrumentation and controls so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems. The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the unit. This includes maintaining required AC vital buses OPERABLE during accident conditions in the event of: a. An assumed loss of all offsite AC electrical power or all onsite AC electrical power; and b. A worst case single failure. Inverters are a part of the distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	The Class 1E UPS inverters ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.

(continued)

BASES

LCO (continued)

Maintaining the required inverters OPERABLE ensures that the redundancy incorporated into the design of the RPS and ESFAS instrumentation and controls is maintained. The four inverters ensure an uninterruptible supply of AC electrical power to the 120 VAC vital buses even if the 4.16 kV safety buses are de-energized.

Operable inverters require the associated 120 VAC vital bus to be powered by the inverter with output voltage within tolerances, and power input to the inverter from a 125 VDC station battery. Alternatively, power supply may be from an internal AC source via rectifier as long as the station battery is available as the uninterruptible power supply.

APPLICABILITY

The inverters 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.

Inverter requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.8, "Inverters - Shutdown."

ACTIONS

A.1

With a required inverter inoperable, its associated 120 VAC vital bus becomes inoperable until it is re-energized from its Class 1E constant voltage source transformer.

For this reason a Note has been included in Condition A requiring the entry into the Conditions and Required Actions of LCO 3.8.9, "Distribution Systems - Operating." This ensures that the 120 VAC bus is re-energized within 2 hours.

Required Action A.1 allows 24 hours to fix the inoperable inverter and return it to service. The 24 hour limit is based upon engineering judgment, taking into consideration the time required to repair an inverter and the additional risk to which the unit is exposed because of the inverter inoperability. This has to be balanced against the risk of an immediate shutdown, along with the potential challenges to safety systems such a shutdown might entail. When the 120 VAC vital bus is powered from its constant voltage source, it is relying upon interruptible

(continued)

BASES

ACTIONS	A.1 (continued) AC electrical power sources (offsite and onsite). The uninterruptible inverter source to the 120 VAC vital buses is the preferred source for powering instrumentation trip setpoint devices. B.1 and B.2 If the inoperable devices or components cannot be restored to OPERABLE status within the required Completion Time, 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 MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times 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.
SURVEILLANCE REQUIREMENTS	SR 3.8.7.1 This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and 120 VAC vital buses energized from the inverter. The verification of proper voltage output ensures that the required power is readily available for the instrumentation of the RPS and ESFAS connected to the AC vital buses. The 7 day Frequency takes into account the redundant capability of the inverters and other indications available in the control room that alert the operator to inverter malfunctions.
REFERENCES	1. FSAR, Chapter 7. 2. FSAR, Chapter 6. 3. FSAR, Chapter 15.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.8 Inverters-Shutdown

BASES

BACKGROUND	A description of the inverters is provided in the Bases for LCO 3.8.7, "Inverters - Operating."
APPLICABLE SAFETY ANALYSES	The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The Class 1E UPS inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the Reactor Protective System and Engineered Safety Features Actuation System instrumentation and controls so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY. The OPERABILITY of the minimum inverters to each 120 VAC vital bus during MODES 5 and 6 ensures that: a. The unit can be maintained in the shutdown or refueling condition for extended periods; b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and c. Adequate power is available to mitigate events postulated during shutdown, such as a fuel handling accident. The inverters were previously identified as part of the distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	This ensures the availability of sufficient inverter power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

(continued)

BASES (continued)

APPLICABILITY

The inverters required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

Inverter requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.7.

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, and A.2.4

One or more Class 1E UPS inverters may be inoperable provided that the remaining OPERABLE inverters support the Class 1E 120 VAC vital bus electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution Systems - Shutdown," and are capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for positive reactivity additions. By the allowance of the option to declare required features inoperable with the associated Class 1E UPS inverter(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCOs' Required Actions. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions). The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained.

Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required Class 1E UPS inverters and to continue this action until restoration is accomplished in order to provide the necessary Class 1E UPS inverter power to the unit safety systems.

(continued)

BASES

ACTIONS	A.1, A.2.1, A.2.2, A.2.3, and A.2.4 (continued) The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required inverters should be completed as quickly as possible in order to minimize the time the unit safety systems may be without power or powered from a constant voltage source transformer.
SURVEILLANCE REQUIREMENTS	SR 3.8.8.1 This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and AC vital buses energized from the inverter. The verification of proper voltage output ensures that the required power is readily available for the instrumentation connected to the 120 VAC vital buses. The 7 day Frequency takes into account the redundant capability of the inverters and other indications available in the control room that alert the operator to inverter malfunctions.
REFERENCES	1. FSAR, Chapter 6. 2. FSAR, Chapter 15.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.9 Distribution Systems-Operating

BASES

BACKGROUND

The onsite Class 1E electrical power distribution system is designed with three 4160 V and 480 V vital buses (F, G, and H) and three 125 V DC vital buses. The plant protection system (PPS) is designed with four input channels (I, II, III, and IV) powered from four 120 VAC vital buses (1, 2, 3, and 4). The four channels provide input to the solid state protection system (SSPS) Trains A and B. Each SSPS train actuates engineered safety feature (ESF) equipment in the three vital AC and DC buses and certain non-vital equipment in the non-vital AC and DC buses.

There are three AC electrical power subsystems, each comprised of a primary ESF 4.16 kV bus and secondary 480 and 120 V buses, distribution panels, motor control centers and load centers. Each 4.16 kV ESF bus has two separate and independent offsite sources of power as well as a dedicated onsite diesel generator (DG) source. Each 4.16 kV ESF bus is normally connected to the 500 kV offsite source. After a loss of this normal 500kV offsite power source to a 4.16 kV ESF bus, a transfer to the alternate 230 kV offsite source is accomplished by utilizing a time delayed bus undervoltage relay. If all offsite sources are unavailable, the onsite emergency DG supplies power to the 4.16 kV ESF bus. Control power for the 4.16 kV breakers is supplied from the Class 1E batteries. Additional description of this system may be found in the Bases for LCO 3.8.1, "AC Sources - Operating," and the Bases for LCO 3.8.4, "DC Sources - Operating."

The secondary 480 VAC electrical power distribution system for each bus includes the safety related motor control centers shown in Table B 3.8.9-1.

The 120 VAC vital buses are arranged in four buses and are normally powered from the inverters. The alternate power supply for the 120 VAC vital buses are Class 1E constant voltage source transformers powered from the same bus as the associated inverter, and its use is governed by LCO 3.8.7, "Inverters - Operating." Each constant voltage source transformer is powered from a Class 1E AC bus. In addition, each inverter can be powered from a bus other than its associated bus.

There are three independent 125 VDC electrical power distribution subsystems (one for each bus).

The list of all required distribution buses is presented in Table B 3.8.9-1.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 1), and in the FSAR, Chapter 15 (Ref. 2), assume ESF systems are OPERABLE. The Class 1E AC, DC, and 120 VAC vital bus electrical power distribution systems 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, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

The OPERABILITY of the Class 1E AC, DC, and 120 VAC vital bus electrical power distribution systems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining power distribution systems OPERABLE during accident conditions in the event of:

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

b. A worst case single failure.

The distribution systems satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The required power distribution subsystems listed in Table B 3.8.9-1 ensure the availability of Class 1E AC, DC, and 120 VAC vital bus electrical power for the systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. The Class 1E AC, DC, and 120 VAC vital bus electrical power distribution subsystems are required to be OPERABLE.

Maintaining the Class 1E AC, DC, and 120 VAC vital bus electrical power distribution subsystems OPERABLE ensures that the redundancy incorporated into the design of ESF is not defeated. Therefore, a single failure within any system or within the electrical power distribution subsystems will not prevent safe shutdown of the reactor.

OPERABLE Class 1E AC electrical power distribution subsystems require the associated buses and motor control centers to be energized to their proper voltages. OPERABLE Class 1E DC electrical power distribution subsystems require the associated buses to be energized to their proper voltage from either the associated battery or charger. OPERABLE 120 VAC vital bus electrical power distribution subsystems require the associated buses to be energized to their proper voltage from the associated inverter via inverted DC voltage, inverter using internal AC source, or Class 1E constant voltage transformer.

(continued)

BASES

LCO (continued)

In addition, tie breakers between redundant safety related Class 1E AC, DC, and 120 VAC vital bus power distribution subsystems, if they exist, must be open. This prevents any electrical malfunction in any power distribution subsystem from propagating to the redundant subsystem, that could cause the failure of a redundant subsystem and a loss of essential safety function(s). If any tie breakers are closed, the affected redundant electrical power distribution subsystems are considered inoperable. This applies to the onsite, safety related redundant electrical power distribution subsystems. It does not, however, preclude redundant Class 1E 4.16 kV buses from being powered from the same offsite circuit.

APPLICABILITY

The electrical power distribution subsystems 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.

Electrical power distribution subsystem requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.10, "Distribution Systems - Shutdown."

ACTIONS

A.1

With one required Class 1E AC electrical power subsystem inoperable, the remaining portions of the AC electrical power distribution subsystems are capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single failure. The overall reliability is reduced, however, because a single failure in the remaining portions of the power distribution subsystems could result in the minimum required ESF functions not being supported. Therefore, the required Class 1E AC buses, load centers, and motor control centers must be restored to OPERABLE status within 8 hours.

Condition A worst scenario is one AC electrical power distribution subsystem without AC power (i.e., no offsite power to the 4160 V ESF bus and the associated DG inoperable). In this Condition, the unit is more vulnerable to a complete loss of AC power. It is, therefore, imperative that the unit operator's attention be focused on minimizing the potential for loss of power to the remaining AC electrical power

(continued)

BASES

ACTIONS

A.1 (continued)

distribution subsystems by stabilizing the unit, and on restoring power to the affected subsystem. The 8 hour time limit before requiring a unit shutdown in this Condition is acceptable because of:

a. The potential for decreased safety if the unit operator's attention is diverted from the evaluations and actions necessary to restore power to the affected subsystem, to the actions associated with taking the unit to shutdown within this time limit; and

b. The potential for an event in conjunction with a single failure of a redundant component in the other AC electrical power distribution subsystems with AC power.

The second Completion Time for Required Action A.1 establishes a limit on the maximum time allowed for any combination of required distribution subsystems to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition A is entered while, for instance, a DC bus is inoperable and subsequently restored OPERABLE, the LCO may already have been not met for up to 2 hours. This could lead to a total of 10 hours, since initial failure of the LCO, to restore the AC distribution system. At this time, a DC circuit could again become inoperable, and AC distribution restored OPERABLE. This could continue indefinitely.

The Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time the LCO was initially not met, instead of the time Condition A was entered. The 16 hour Completion Time is an acceptable limitation on this potential to fail to meet the LCO indefinitely.

B.1

With one 120 VAC vital bus subsystem inoperable, the remaining OPERABLE 120 VAC vital buses are capable of supporting the minimum safety functions necessary to shut down the unit and maintain it in the safe shutdown condition. Overall reliability is reduced, however, since an additional single failure could result in the minimum required ESF functions not being supported. Therefore, the required AC vital bus subsystem must be powered from an alternate source within 2 hours by powering the bus from the associated inverter via inverted DC, inverter using internal AC source, or Class 1E

(continued)

BASES

ACTIONS

B.1 (continued)

constant voltage transformer. The required AC vital bus subsystems must then be re-powered by restoring it's associated inverter to OPERABLE status within 24 hours under LCO 3.8.7. ACTION A.1.

Condition B represents one 120 VAC vital bus without power; potentially both the DC source and the associated AC source are nonfunctioning. In this situation, the unit is significantly more vulnerable to a complete loss of all noninterruptible power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining vital buses and restoring power to the affected 120 VAC vital bus subsystem.

This 2 hour limit is more conservative than Completion Times allowed for the vast majority of components that are without adequate 120 VAC power. Taking exception to LCO 3.0.2 for components without adequate vital 120 VAC power, that would have the Required Action Completion Times shorter than 2 hours if declared inoperable, is acceptable because of:

a. The potential for decreased safety by requiring a change in unit conditions (i.e., requiring a shutdown) and not allowing stable operations to continue;

b. The potential for decreased safety by requiring entry into numerous Applicable Conditions and Required Actions for components without adequate vital 120 VAC power and not providing sufficient time for the operators to perform the necessary evaluations and actions for restoring power to the affected subsystem; and

c. The potential for an event in conjunction with a single failure of a redundant component.

The 2 hour Completion Time takes into account the importance to safety of restoring the 120 VAC vital bus to OPERABLE status, the redundant capability afforded by the other OPERABLE 120 VAC vital buses, and the low probability of a DBA occurring during this period.

The second Completion Time for Required Action B.1 establishes a limit on the maximum allowed for any combination of required distribution subsystems to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition B is entered while, for instance, an AC bus is inoperable and subsequently returned

(continued)

BASES

ACTIONS

B.1 (continued)

OPERABLE, the LCO may already have been not met for up to 8 hours. This could lead to a total of 10 hours, since initial failure of the LCO, to restore the 120 VAC vital bus distribution system. At this time, an AC bus could again become inoperable, and 120 VAC vital bus distribution restored OPERABLE. This could continue indefinitely.

This Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time the LCO was initially not met, instead of the time Condition B was entered. The 16 hour Completion Time is an acceptable limitation on this potential to fail to meet the LCO indefinitely.

C.1

With one DC electrical power distribution subsystem inoperable, the remaining portions of the DC electrical power distribution subsystem are capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single failure. The overall reliability is reduced, however, because a single failure in the remaining portion of the DC electrical power distribution subsystems could result in the minimum required ESF functions not being supported. Therefore, the DC buses must be restored to OPERABLE status within 2 hours by powering the bus from the associated battery or charger.

Condition C represents one DC electrical power distribution subsystem without adequate DC power; potentially both with the battery significantly degraded and the associated charger nonfunctioning for the affected bus. In this situation, the unit is significantly more vulnerable to a complete loss of all DC power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining DC electrical power distribution subsystems and restoring power to the affected subsystem.

This 2 hour limit is more conservative than Completion Times allowed for the vast majority of components that would be without power. Taking exception to LCO 3.0.2 for components without adequate DC power, which would have Required Action Completion Times shorter than 2 hours, is acceptable because of:

a. The potential for decreased safety by requiring a change in unit conditions (i.e., requiring a shutdown) while allowing stable operations to continue;

(continued)

BASES

ACTIONS

C.1 (continued)

b. The potential for decreased safety by requiring entry into numerous applicable Conditions and Required Actions for components without DC power and not providing sufficient time for the operators to perform the necessary evaluations and actions for restoring power to the affected subsystem; and

c. The potential for an event in conjunction with a single failure of a redundant component.

The 2 hour Completion Time for DC buses is consistent with Regulatory Guide 1.93 (Ref. 3).

The second Completion Time for Required Action C.1 establishes a limit on the maximum time allowed for any combination of required distribution subsystems to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition C is entered while, for instance, an AC bus is inoperable and subsequently returned OPERABLE, the LCO may already have been not met for up to 8 hours. This could lead to a total of 10 hours, since initial failure of the LCO, to restore the DC distribution system. At this time, an AC bus could again become inoperable, and DC distribution restored OPERABLE. This could continue indefinitely.

This Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time the LCO was initially not met, instead of the time Condition C was entered. The 16 hour Completion Time is an acceptable limitation on this potential to fail to meet the LCO indefinitely.

D.1 and D.2

If the inoperable distribution subsystem cannot be restored to OPERABLE status within the required Completion Time, 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 MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times 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.

(continued)

BASES

ACTIONS (continued)

E.1

Condition E corresponds to two required Class 1E AC, DC, or 120 VAC vital buses with inoperable distribution subsystems that result in a loss of safety function, adequate core cooling, containment OPERABILITY and other vital functions for DBA mitigation would be compromised, and immediate plant shutdown in accordance with LCO 3.0.3 is required.

SURVEILLANCE REQUIREMENTS

SR 3.8.9.1

This Surveillance verifies that the required Class 1E AC, DC, and 120 VAC vital bus electrical power distribution systems are functioning properly, with the correct circuit breaker alignment. The correct breaker alignment ensures the appropriate separation and independence of the electrical divisions is maintained, and the appropriate voltage is available to each required bus. The verification of proper voltage availability on the buses ensures that the required voltage is readily available for motive as well as control functions for critical system loads connected to these buses. The 7 day Frequency takes into account the redundant capability of the AC, DC, and 120 VAC vital bus electrical power distribution subsystems, and other indications available in the control room that alert the operator to subsystem malfunctions.

Table B 3.8.9-1

The table on the next page defines the general features of the AC and DC Electrical Power Distribution System.

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. Regulatory Guide 1.93, December 1974.

Table B 3.8.9-1 (page 1 of 1)
AC and DC Electrical Power Distribution Systems

LCO 3.8.9 CONDITION A
4160 VAC and 480 VAC

VOLTAGE	BUS F MAJOR ESF LOADS (TRAIN A)	BUS G MAJOR ESF LOADS (TRAIN B)	BUS H MAJOR ESF LOADS (TRAIN A&B)
4160 VAC	ASW PP 1 AFW PP 3 CC PP 1 CCW PP 1 SI PP 1 480 VAC BUS F	ASW PP 2 CS PP 1 RHR PP 1 CC PP 2 CCW PP 2 480 VAC BUS G	AFW PP 2 (B) CS PP 2 (A) RHR PP 2 (A) SI PP 2 (B) CCW PP 3 (A&B) 480 VAC BUS H
480 VAC *	CFCU 1 CFCU 2	CFCU 3 CFCU 5	CFCU 4 (A&B)

* Partial listing of loads

LCO 3.8.9 CONDITION B
120 VAC

BUS 1 PY11 (21)** PY11A (21A)**	BUS 2 PY12 (22)**	BUS 3 PY13 (23)** PY13A (23A)**	BUS 4 PY14 (24)**
IY Powered by: 480 VAC BUS F/DC BUS 1 or TRY1 Powered by: 480 VAC BUS F or Backup 480 VAC BUS G	IY1 Powered by: 480 VAC BUS G/DC BUS 2 or TRY2 Powered by: 480 VAC BUS G or Backup 480 VAC BUS F	IY Powered by: 480 VAC BUS H/DC BUS 3 or TRY3 Powered by: 480 VAC BUS H or Backup 480 VAC BUS G	IY Powered by: 480 VAC BUS H/DC BUS 2 or TRY1 Powered by: 480 VAC BUS H or Backup 480 VAC BUS F

** Unit 2 in parentheses

LCO 3.8.9 CONDITION C
125 VDC

DC BUS 1 - Powered From:	DC BUS 2 - Powered From:	DC BUS 3 - Powered From:
Battery 1 and Battery Charger 11 (21)** or Battery Charger 121 (221)**	Battery 2 and Battery Charger 12 (22)** or Battery Charger 121 (221)**	Battery 3 and Battery Charger 131 (231)** or Battery Charger 132 (232)**

** Unit 2 in Parentheses

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.10 Distribution Systems - Shutdown

BASES

BACKGROUND	A description of the Class 1E AC, DC, and 120 VAC vital bus electrical power distribution systems is provided in the Bases for LCO 3.8.9, "Distribution Systems - Operating."
APPLICABLE SAFETY ANALYSES	The initial conditions of Design Basis Accident and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature (ESF) systems are OPERABLE. The Class 1E AC, DC, and 120 VAC vital bus electrical power distribution systems 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, and containment design limits are not exceeded. The OPERABILITY of the Class 1E AC, DC, and 120 VAC vital bus electrical power distribution system is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY. The OPERABILITY of the minimum Class 1E AC, DC, and 120 VAC vital bus electrical power distribution subsystems during MODES 5 and 6, and during movement of irradiated fuel assemblies ensures that: a. The unit can be maintained in the shutdown or refueling condition for extended periods; b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and c. Adequate power is provided to mitigate events postulated during shutdown, such as a fuel handling accident. The Class 1E AC, DC, and 120 VAC electrical power distribution systems satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	Various combinations of subsystems, equipment, and components are required OPERABLE by other LCOs, depending on the specific plant condition. An OPERABLE AC subsystem shall consist of a 4kV vital bus powered from at least one energized offsite power source with the capability of being powered from an OPERABLE DG. The DG may be the DG associated with that bus or, with administrative controls in place, a DG that can be cross-tied (via the startup cross-tie feeder breakers) to another bus. However, credit for this cross-tie capability cannot be taken credit for in those LCOs which specifically require an

(continued)

BASES

LCO (continued)

OPERABLE emergency power source. The latter ensures that the 4 kV bus will be immediately available after a LOOP without operator action. An OPERABLE DC subsystem consists of an OPERABLE DC bus (see B 3.8.5). An OPERABLE Class 1E 120 VAC subsystem consists of a vital 120 VAC bus that is powered by its OPERABLE inverter which is connected to an OPERABLE DC bus per LCO 3.8.8, or one that is powered from its associated vital 120 VAC regulating transformer that is selected to be powered from an OPERABLE AC vital bus. This ensures that the vital 120 VAC bus is capable of supplying either uninterruptable power from its associated inverter, or with administrative controls in place, from its vital 120 VAC regulating transformer after a brief time delay for the DG to load the bus following a LOOP. The 120 VAC regulating transformer must be capable of being energized without any operator action. Implicit in those requirements is the required OPERABILITY of necessary support required features. This LCO explicitly requires energization of the portions of the electrical distribution system necessary to support OPERABILITY of required systems, equipment, and components - all specifically addressed in each LCO and implicitly required via the definition of OPERABILITY.

Maintaining these portions of the distribution system energized ensures the availability of sufficient power to operate the unit in a safe manner to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

APPLICABILITY

The AC, DC, and 120 VAC electrical power distribution subsystems required to be OPERABLE in MODES 5 and 6, and during movement of irradiated fuel assemblies, provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition and refueling condition.

The AC, DC, and 120 VAC vital bus electrical power distribution subsystems requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.9.

(continued)

BASES (continued)

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5

Although redundant required features may require redundant subsystems of electrical power distribution systems to be OPERABLE, one OPERABLE distribution subsystem may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare required features associated with an inoperable distribution subsystem inoperable, appropriate restrictions are implemented in accordance with the affected distribution subsystem LCO's Required Actions. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions).

Suspension of these activities does not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required AC, DC, and 120 VAC electrical power distribution subsystems and to continue this action until restoration is accomplished in order to provide the necessary power to the unit safety systems.

Notwithstanding performance of the above conservative Required Actions, a required residual heat removal (RHR) subsystem may be inoperable. In this case, Required Actions A.2.1 through A.2.4 do not adequately address the concerns relating to coolant circulation and heat removal. Pursuant to LCO 3.0.6, the RHR ACTIONS would not be entered. Therefore, Required Action A.2.5 is provided to direct declaring RHR inoperable, which results in taking the appropriate RHR actions.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required distribution subsystems should be completed as quickly as possible in order to minimize the time the unit safety systems may be without power.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS	SR 3.8.10.1 This Surveillance verifies that the Class 1E AC, DC, and 120 VAC vital bus electrical power distribution subsystems are functioning properly, with all the buses energized. The verification of proper voltage availability on the buses ensures that the required power is readily available for motive as well as control functions for critical system loads connected to these buses. The 7 day Frequency takes into account the capability of the electrical power distribution subsystems, and other indications available in the control room that alert the operator to subsystem malfunctions.
REFERENCES	1. FSAR, Chapter 6. 2. FSAR, Chapter 15.

B 3.9 REFUELING OPERATIONS

B 3.9.1 Boron Concentration

BASES

BACKGROUND

The limit on the boron concentrations of the filled portions of the Reactor Coolant System (RCS), the refueling canal, and the refueling cavity, that have direct access to the reactor vessel, during refueling ensures that the reactor remains subcritical during MODE 6. Refueling boron concentration is the soluble boron concentration in the coolant in each of these volumes having direct access to the reactor core during refueling.

The soluble boron concentration offsets the core reactivity and is measured by chemical analysis of a representative sample of the coolant in each of the volumes. The refueling boron concentration limit is specified in the COLR. The refueling boron concentration is sufficient to maintain shutdown margin (SDM) with the most adverse conditions of fuel assembly and control rod position allowed by plant procedures. The boron concentration that is maintained in MODE 6 is sufficient to maintain $k_{eff} \leq 0.95$ with the most reactive rod control assembly completely removed from its fuel assembly.

GDC 26 of 10 CFR 50, Appendix A, requires that two independent reactivity control systems of different design principles be provided (Ref. 1). One of these systems must be capable of holding the reactor core subcritical under cold conditions. The Chemical and Volume Control System (CVCS) is the principle system capable of maintaining the reactor subcritical in cold conditions by maintaining the boron concentration.

The reactor is brought to shutdown conditions before beginning operations to open the reactor vessel for refueling. After the RCS is cooled and depressurized and the vessel head is unbolted, the head is slowly removed to form the refueling cavity. The refueling canal and the refueling cavity are then flooded with refueling grade borated water from the liquid hold up tanks or the refueling water storage tank.

The pumping action of the RHR System in the RCS and the natural circulation due to thermal driving heads in the reactor vessel and refueling cavity mix the added concentrated boric acid with the water in the refueling canal. The RHR System is in operation during refueling (see LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation—High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation—Low Water Level") to provide forced circulation cooling in the RCS and assist in maintaining the boron concentration uniformity in the RCS, the refueling canal, and the refueling cavity above the COLR limit.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSIS	During refueling operations, the reactivity condition of the core is consistent with the initial conditions assumed for the boron dilution accident in the accident analysis and is conservative for MODE 6. The boron concentration limit specified in the COLR is based on the core reactivity at the beginning of each fuel cycle (the end of refueling) and includes an uncertainty allowance. The required boron concentration and the plant refueling procedures that verify the correct fuel loading plan (including core mapping) ensure that the k_{eff} of the core will remain ≤ 0.95 during the refueling operation. Hence, at least a 5% $\Delta k/k$ margin of safety is established during refueling. During refueling, the water volume in the spent fuel pool, the transfer canal, the refueling canal, the refueling cavity, and the reactor vessel form a single mass. As a result, the soluble boron concentration is relatively the same in each of these volumes. The limiting boron dilution accident analyzed occurs in MODE 5 (Ref. 2). It is based upon a maximum dilution flow of 300 g.p.m. and prompt identification and operation preclude the event from proceeding to a boron dilution accident. Prompt identification is assured through audible count rate instrumentation, visual count rate instrumentation and a high source range flux level alarm. The RCS boron concentration satisfies Criterion 2 of 10CFR50.36(c)(2)(ii).
LCO	The LCO requires that a minimum boron concentration be maintained in the filled portions of the RCS, the refueling canal, and the refueling cavity that have direct access to the reactor vessel while in MODE 6. The boron concentration limit specified in the COLR ensures that a core k_{eff} of ≤ 0.95 is maintained during fuel handling operations. Violation of the LCO could lead to an inadvertent criticality during MODE 6.
APPLICABILITY	This LCO is applicable in MODE 6 to ensure that the fuel in the reactor vessel will remain subcritical. The required boron concentration ensures a $k_{eff} \leq 0.95$. Above MODE 6, LCO 3.1.1, "SHUTDOWN MARGIN (SDM)," LCO 3.1.5, "Shutdown Bank Insertion Limits," and LCO 3.1.6, "Control Bank Insertion Limits," ensures that an adequate amount of negative reactivity is available to shut down the reactor and maintain it subcritical. A Note is added to the applicability to assure that MODE 6 cannot be entered unless boron concentration limits are met.

(continued)

BASES (continued)

ACTIONS

A.1 and A.2

Continuation of CORE ALTERATIONS or positive reactivity additions (including actions to reduce boron concentration) is contingent upon maintaining the unit in compliance with the LCO. If the boron concentration of any coolant volume in the RCS, and when connected, the refueling canal or the refueling cavity is less than its limit, all operations involving CORE ALTERATIONS or positive reactivity additions must be suspended immediately.

Suspension of CORE ALTERATIONS and positive reactivity additions shall not preclude moving a component to a safe position.

A.3

In addition to immediately suspending CORE ALTERATIONS or positive reactivity additions, boration to restore the concentration must be initiated immediately.

In determining the required combination of boration flow rate and concentration, no unique Design Basis Event must be satisfied. The only requirement is to restore the boron concentration to its required value as soon as possible. In order to raise the boron concentration as soon as possible, the operator should begin boration with the best source available for unit conditions.

Once actions have been initiated, they must be continued until the boron concentration is restored. The restoration time depends on the amount of boron that must be injected to reach the required concentration.

SURVEILLANCE REQUIREMENTS

SR 3.9.1.1

This SR ensures that the coolant boron concentration in the filled portions of the RCS, the refueling canal, and the refueling cavity that have direct access to the reactor vessel is within the COLR limits. The boron concentration of the coolant in each required volume is determined periodically by chemical analysis.

A minimum Frequency of once every 72 hours is a reasonable amount of time to verify the boron concentration of representative samples. The Frequency is based on operating experience, which has shown 72 hours to be adequate.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 26.
2. FSAR, Chapter 15, Section 15.2.4

B 3.9 REFUELING OPERATIONS

B 3.9.3 Nuclear Instrumentation

BASES

BACKGROUND

The source range neutron flux monitors are used during refueling operations to monitor the core reactivity condition. The installed source range neutron flux monitors are part of the Nuclear Instrumentation System (NIS). These detectors are located external to the reactor vessel and detect neutrons leaking from the core.

The installed source range neutron flux monitors are BF3 detectors operating in the proportional region of the gas filled detector characteristic curve. The detectors monitor the neutron flux in counts per second. The instrument range (source range drawer) covers six decades of neutron flux (1 to 1E+6 cps) with a ± 3% instrument accuracy. The detectors also provide continuous visual indication in the control room and an audible alarm and count rate to alert operators to a possible dilution accident. The NIS is designed in accordance with the criteria presented in Reference 1. In addition to the other indicators, these detectors provide an audible count rate in the containment.

The Gamma-Metrics neutron flux monitors (N-51 and N-52) are designed in accordance with Regulatory Guide 1.97. The wide range neutron flux monitors in this system provide indication of neutron flux from reactor shutdown to reactor full power level (source range through power range). The wide range monitors (1E-8 to 1E+2 % power) provide continuous visual indication in the control room to allow operators to monitor core flux. The narrow range monitors (1E-1 to 1E+5 cps) provides indication of neutron flux to the hot shut down panel and control room by way of the plant process computer (PPC).

APPLICABLE SAFETY ANALYSIS

Two OPERABLE source range neutron flux monitors are required to provide a signal to alert the operator to unexpected changes in core reactivity such as with a boron dilution accident (Ref. 2) or an improperly loaded fuel assembly. Prompt identification is required to assure sufficient time for operator action to preclude the event from proceeding to a Boron Dilution Accident. Prompt identification is assured through audible count rate indication, a visual flux indication and a high source range flux level alarm in the control room. Although an audible count rate is provided in the containment it is not credited for OPERABILITY of the flux monitors.

The source range neutron flux monitors satisfy Criterion 3 of 10CFR50.36(c)(2)(ii).

(continued)

BASES (continued)

LCO	This LCO requires that two source range neutron flux monitors be OPERABLE to ensure that redundant monitoring capability is available to detect changes in core reactivity. To be OPERABLE, each monitor must provide visual indication and at least one of the two monitors must provide an audible alarm and count rate indication in the Control Room. Therefore, with no audible alarm and count rate indication from at least one monitor, both monitors are inoperable until the audible indication is restored to the operable monitor – Action A must also be entered with no audible count rate indication in the control room.
APPLICABILITY	In MODE 6, the source range neutron flux monitors must be OPERABLE to determine changes in core reactivity. There are no other direct means available to check core reactivity levels. In MODES 2, 3, 4, and 5, these same installed source range detectors and circuitry are also required to be OPERABLE by LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation."
ACTIONS	A.1 and A.2 With only one source range neutron flux monitor OPERABLE, redundancy has been lost. Since these instruments are the only direct means of monitoring core reactivity conditions, CORE ALTERATIONS and positive reactivity additions must be suspended immediately. The exception given in A.1 for the process of latching/unlatching control rods and friction testing of control rods is provided to allow completion of head installation prior to replacing a failed source range detector. RCCA latching and friction testing is conducted with the reactor vessel upper internals in place, thereby preventing the lowering of a temporary source range detector into the region of the core. This NOTE allows control rod movement with only one source range in place. Friction testing involves fully withdrawing and reinserting each rod in turn, which could change core reactivity by as much as one percent for the most reactive rod. The increase in count rate would be one to two counts per second. For Gamma Metrics, the increase in count rate would be 0.1 to 0.2 counts per second. The core coupling in this configuration would allow one source range detector to detect significant reactivity changes associated with control rod movement (Ref. 3). Performance of Required Action A.1 shall not preclude completion of movement of a component to a safe position or normal cooldown of a coolant volume for the purpose of system temperature control.

(continued)

BASES

ACTIONS

B.1

With no source range neutron flux monitor OPERABLE including no OPERABLE audible alarm and count rate functions, action to restore a monitor to OPERABLE status shall be initiated immediately. Once initiated, action shall be continued until a source range neutron flux monitor including no OPERABLE audible alarm and count rate functions is restored to OPERABLE status.

B.2

With no source range neutron flux monitor OPERABLE, there are no direct means of detecting changes in core reactivity. However, since CORE ALTERATIONS and positive reactivity additions are not to be made, the core reactivity condition is stabilized until the source range neutron flux monitors are OPERABLE. This stabilized condition is determined by performing SR 3.9.1.1 to ensure that the required boron concentration exists.

The Completion Time of once per 12 hours ensures that unplanned changes in boron concentration would be identified. The 12 hour Frequency is reasonable, considering the low probability of a change in core reactivity during this time period.

SURVEILLANCE REQUIREMENTS

SR 3.9.3.1

SR 3.9.3.1 is the performance of a CHANNEL CHECK, which is a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that the two indication channels should be consistent with core conditions. Changes in fuel loading and core geometry can result in significant differences between source range channels, but each channel should be consistent with its local conditions. For core reload, the first CHANNEL CHECK for each channel may be performed using the first fuel assembly as a source, prior to unlatching it in the core.

The Frequency of 12 hours is consistent with the CHANNEL CHECK Frequency specified similarly for the same instruments in LCO 3.3.1.

SR 3.9.3.2

SR 3.9.3.2 is the performance of a CHANNEL CALIBRATION every 24 months. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. The CHANNEL CALIBRATION for the normal N31 and N32 source range neutron flux monitors is described in B 3.3.1, "Reactor Trip System

(continued)

BASES

SURVEILLANCE REQUIREMENTS	SR 3.9.3.2 (continued) (RTS) Instrumentation." The CHANNEL CALIBRATION for the normal N31 and N32 audible alarm and count rate functions includes verification of the control room audible alarm and count rate functions using a simulated signal. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage. Operating experience has shown these components usually pass the Surveillance when performed at the 24 month Frequency.
REFERENCES	1. 10 CFR 50, Appendix A, GDC 13, GDC 26, GDC 28, and GDC 29. 2. FSAR , Section 15.2.4. 3. License Amendment 46/45, October, 1989

B 3.9 REFUELING OPERATIONS

B 3.9.4 Containment Penetrations

BASES

BACKGROUND

During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, a release of fission product radioactivity within containment will be restricted from escaping to the environment when the LCO requirements are met. In MODES 1, 2, 3, and 4, this is accomplished by maintaining containment OPERABLE as described in LCO 3.6.1, "Containment." In MODE 6, the potential for containment pressurization as a result of an accident is not likely; therefore, requirements to isolate the containment from the outside atmosphere can be less stringent. The LCO requirements are referred to as "containment closure" rather than "containment OPERABILITY." Containment closure means that all potential escape paths are closed or capable of being closed by automatic means. Since any potential for containment pressurization yields very low levels, the 10CFR50, Appendix J leakage criteria and tests are not required. (Ref. 1)

The containment serves to contain fission product radioactivity that may be released from the reactor core following an accident, such that offsite radiation exposures are maintained well within the requirements of 10CFR100. Additionally, the containment provides radiation shielding from the fission products that may be present in the containment atmosphere following accident conditions.

The containment equipment hatch, which is part of the containment pressure boundary, provides a means for moving large equipment and components into and out of containment. During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, the equipment hatch must be held in place by at least four bolts. Good engineering practice dictates that the bolts required by this LCO be approximately equally spaced.

The containment air locks, which are also part of the containment pressure boundary, provide a means for personnel access during MODES 1, 2, 3, and 4 unit operation in accordance with LCO 3.6.2, "Containment Air Locks." Each air lock has a door at both ends. The doors are normally interlocked to prevent simultaneous opening when containment OPERABILITY is required. During periods of unit shutdown when containment closure is not required, the door interlock mechanism may be disabled, allowing both doors of an air lock to remain open for extended periods when frequent containment entry is necessary. During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, containment closure is required; therefore, the door interlock mechanism may remain disabled, but one air lock door must always remain closed for normal entry and exit.

(continued)

BASES

BACKGROUND (continued)

The requirements for containment penetration closure ensure that a release of fission product radioactivity within containment will be restricted from escaping to the environment. The closure restrictions are sufficient to restrict fission product radioactivity release from containment due to a fuel handling accident during refueling.

The Containment Purge and Exhaust System includes two subsystems. The normal subsystem includes a 48 inch purge penetration and a 48 inch exhaust penetration in which the flow path is limited to being open 200 hour or less per calendar year. The second subsystem, a pressure equalization system provides a single 12 inch supply and exhaust penetration. The three valves in the 12 inch pressure equalization penetration can be opened intermittently. Each of these system are qualified to closed automatically by the Engineered Safety Features Actuation System (ESFAS). Neither of the subsystems is subject to a Specification in MODE 5.

In MODE 6, large air exchanges are necessary to conduct refueling operations. The normal 48 inch purge system is used for this purpose, and all four valves are closed by the ESFAS in accordance with LCO 3.3.6, "Containment Purge and Exhaust Isolation Instrumentation."

The pressure equalization system is disassembled and used in MODE 6 for other outage functions.

The other containment penetrations that provide direct access from containment atmosphere to outside atmosphere must be isolated on at least one side. Isolation may be achieved by an OPERABLE automatic isolation valve, or by a manual isolation valve, blind flange, or equivalent. The fuel transfer tube is open but closure is provided by an equivalent isolation of a water loop seal. Equivalent isolation methods must be approved and may include use of a material that can provide a temporary, ventilation barrier for the other containment penetrations during fuel movements (Ref. 1).

APPLICABLE SAFETY ANALYSIS

During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, the most severe radiological consequences result from a fuel handling accident. The fuel handling accident is a postulated event that involves damage to irradiated fuel (Ref. 2). Fuel handling accidents, analyzed in Reference 2, consists of dropping a single irradiated fuel assembly. The requirements of LCO 3.9.7, "Refueling Cavity Water Level," and the minimum decay time of 100 hours prior to CORE ALTERATIONS ensure that the release of fission product radioactivity, subsequent to a fuel handling accident, results in doses that are well within the guideline values specified in 10 CFR 100. Standard Review Plan, Section 15.7.4,

(continued)

BASES

APPLICABLE SAFETY ANALYSIS (continued)	Rev. 1 (Ref. 3), defines "well within" 10 CFR 100 to be 25% or less of the 10CFR 100 values. The acceptance limits for offsite radiation exposure will be 25% of 10 CFR 100 values. Containment penetrations satisfy Criterion 3 of 10CFR50.36(c)(2)(ii).
LCO	This LCO limits the consequences of a fuel handling accident in containment by limiting the potential escape paths for fission product radioactivity released within containment. The LCO requires any penetration providing direct access from the containment atmosphere to the outside atmosphere to be closed except for the OPERABLE containment purge and exhaust penetrations. For the OPERABLE containment purge and exhaust penetrations, this LCO ensures that these penetrations are isolable by the Containment Purge and Exhaust Isolation System. The OPERABILITY requirements for this LCO ensure that the automatic purge and exhaust valve closure times specified in the FSAR can be achieved and, therefore, meet the assumptions used in the safety analysis to ensure that releases through the valves are terminated, such that radiological doses are within the acceptance limit.
APPLICABILITY	The containment penetration requirements are applicable during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment because this is when there is a potential for a fuel handling accident. In MODES 1, 2, 3, and 4, containment penetration requirements are addressed by LCO 3.6.1. In MODES 5 and 6, when CORE ALTERATIONS or movement of irradiated fuel assemblies within containment are not being conducted, the potential for a fuel handling accident does not exist. Therefore, under these conditions no requirements are placed on containment penetration status.
ACTIONS	A.1 and A.2 If the containment equipment hatch, air locks, or any containment penetration that provides direct access from the containment atmosphere to the outside atmosphere is not in the required status, including the Containment Purge and Exhaust Isolation System not capable of automatic actuation when the purge and exhaust valves are open, the unit must be placed in a condition where the isolation function is not needed. This is accomplished by immediately suspending CORE ALTERATIONS and movement of irradiated fuel assemblies within containment. Performance of these actions shall not preclude completion of movement of a component to a safe position.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.9.4.1

This Surveillance demonstrates by inspection or administrative means that each of the containment penetrations required to be in its closed position is in that position. The Surveillance on the open purge and exhaust valves will demonstrate that the valves are not blocked from closing. Also the Surveillance will demonstrate that each valve operator has motive power, which will ensure that each valve is capable of being closed by an OPERABLE automatic containment purge and exhaust isolation signal.

The Surveillance is performed every 7 days during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment. The Surveillance interval is selected to be commensurate with the normal duration of time to complete fuel handling operations. A surveillance before the start of refueling operations will provide two or three surveillance verifications during the applicable period for this LCO. As such, this Surveillance ensures that a postulated fuel handling accident that releases fission product radioactivity within the containment will not result in a release of fission product radioactivity to the environment.

SR 3.9.4.2

This Surveillance demonstrates that each containment purge and exhaust valve actuates to its isolation position on manual initiation or on an actual or simulated high radiation signal. The 24 month Frequency maintains consistency with other similar ESFAS instrumentation and valve testing requirements. In LCO 3.3.6, the Containment Purge and Exhaust Isolation instrumentation requires a CHANNEL CHECK every 12 hours and a CFT every 92 days to ensure the channel OPERABILITY during refueling operations. Every 24 months a CHANNEL CALIBRATION is performed. The system actuation response time is demonstrated every 24 months, during refueling, on a STAGGERED TEST BASIS. SR 3.6.3.5 demonstrates that the isolation time of each valve is in accordance with the Inservice Testing Program requirements. These Surveillances performed during MODE 6 will ensure that the valves are capable of closing after a postulated fuel handling accident to limit a release of fission product radioactivity from the containment.

REFERENCES

1. Design Criteria Memorandum T-16, Containment Functions.
2. FSAR , Section 15.4.5.
3. NUREG-0800, Section 15.7.4, Rev. 1, July 1981.

B 3.9 REFUELING OPERATIONS

B 3.9.5 Residual Heat Removal (RHR) and Coolant Circulation - High Water Level

BASES

BACKGROUND	The purpose of the RHR System in MODE 6 is to remove decay heat and sensible heat from the Reactor Coolant System (RCS), as required by GDC 34 (DCPP meets the intent of this 1971 GDC), to provide mixing of borated coolant and to prevent boron stratification (Ref. 1). Heat is removed from the RCS by circulating reactor coolant through the RHR heat exchanger(s), where the heat is transferred to the Component Cooling Water System. The coolant is then returned to the RCS via the RCS cold leg(s). Operation of the RHR System for normal cooldown or decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of reactor coolant through the RHR heat exchanger(s) and the bypass lines. Mixing of the reactor coolant is maintained by this continuous circulation of reactor coolant through the RHR System.
APPLICABLE SAFETY ANALYSIS	If the reactor coolant temperature is not maintained below 200°F, boiling of the reactor coolant could result. This could lead to a loss of coolant in the reactor vessel. Additionally, boiling of the reactor coolant could lead to boron plating out on components near the areas of the boiling activity. The loss of reactor coolant and the reduction of boron concentration in the reactor coolant would eventually challenge the integrity of the fuel cladding, which is a fission product barrier. One train of the RHR System is required to be operational in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange, to prevent this challenge. The LCO does permit de-energizing the RHR pump for short durations, under the condition that the boron concentration is not diluted. This conditional de-energizing of the RHR pump does not result in a challenge to the fission product barrier. Although the RHR System does not meet a specific criterion of the NRC Policy Statement, it was identified in 10CFR50.36(c)(2)(ii) as an important contributor to risk reduction. Therefore, the RHR System is retained as a Specification.
LCO	Only one RHR loop is required for decay heat removal in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange. Only one RHR loop is required to be OPERABLE, because the volume of water above the reactor vessel flange provides backup decay heat removal capability. At least one RHR loop must be OPERABLE and in operation to provide: a. Removal of decay heat;

(continued)

BASES

LCO (continued)

b. Mixing of borated coolant to minimize the possibility of criticality; and

c. Indication of reactor coolant temperature.

An OPERABLE RHR loop includes an RHR pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the low end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs.

The LCO is modified by a Note that allows the required operating RHR loop to be removed from service for up to 1 hour per 8 hour period, provided no operations are permitted that would cause a reduction of the RCS boron concentration. Boron concentration reduction is prohibited because uniform concentration distribution cannot be ensured without forced circulation. This permits operations such as valve testing, core mapping, or alterations in the vicinity of the reactor vessel hot leg nozzles. During this 1 hour period, decay heat is removed by natural convection to the large mass of water in the refueling cavity.

The LCO is also modified by a second Note that allows the required RHR Loop to be removed from service for up to 2 hours per 8 hour period to support surveillance leak rate testing of the RCS to RHR suction isolation valves, provided that no operations are permitted which might result in reduction of boron concentration. During this 2 hour period, decay heat is removed by natural convection to the large mass of water in the refueling cavity and the RCS.

APPLICABILITY

One RHR loop must be OPERABLE and in operation in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange, to provide decay heat removal. The 23 ft water level was selected because it corresponds to the 23 ft requirement established for fuel movement in LCO 3.9.7, "Refueling Cavity Water Level." Requirements for the RHR System in other MODES are covered by LCOs in Section 3.4, Reactor Coolant System (RCS), and Section 3.5, Emergency Core Cooling Systems (ECCS). RHR loop requirements in MODE 6 with the water level < 23 ft are located in LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation-Low Water Level."

ACTIONS

RHR loop requirements are met by having one RHR loop OPERABLE and in operation, except as permitted in the Notes to the LCO.

(continued)

BASES

ACTIONS (continued)

A.1

If RHR loop requirements are not met, there will be no forced circulation to provide mixing to establish uniform boron concentrations. The suspension of any operation involving a reduction in reactor coolant boron concentration will reduce the likelihood of stratification of the boron concentration developing within the RCS.

A.2

If RHR loop requirements are not met, actions shall be taken immediately to suspend loading of irradiated fuel assemblies in the core. With no forced circulation cooling, decay heat removal from the core occurs by natural convection to the heat sink provided by the water above the core. A minimum refueling water level of 23 ft above the reactor vessel flange provides an adequate available heat sink. Suspending any operation that would increase decay heat load, such as loading an irradiated fuel assembly, is a prudent action under this condition.

A.3

If RHR loop requirements are not met, actions shall be initiated and continued in order to satisfy RHR loop requirements. With the unit in MODE 6 and the refueling water level ≥ 23 ft above the top of the reactor vessel flange, corrective actions shall be initiated immediately.

A.4

If RHR loop requirements are not met, all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere must be closed within 4 hours. With the RHR loop requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Closing containment penetrations that are open to the outside atmosphere ensures dose limits are not exceeded.

The Completion Time of 4 hours is reasonable, based on the low probability of the coolant boiling in that time.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS	SR 3.9.5.1 This Surveillance demonstrates that the RHR loop is in operation and circulating reactor coolant. The flow rate of 3000 gpm is determined by the flow rate necessary to provide sufficient decay heat removal capability and to prevent thermal and boron stratification in the core prior to 57 hours of core subcriticality. The second part of this Surveillance serves the same function but with 57 hours or more of core subcriticality. The flow rate of 1300 gpm is determined by the flow rate necessary to provide sufficient decay heat removal capability and to prevent thermal and boron stratification in the core. Both of these flow rates are points of the same flow rate verses decay heat. The Frequency of 12 hours is sufficient, considering the flow, temperature, pump control, and alarm indications available to the operator in the control room for monitoring the RHR System (Ref. 2).
REFERENCES	1. FSAR , Section 5.5.7 2. LAR 88-01, dated 1/22/88, submitted by "RHR System Flow Rate Reduction," DCL 88-014.

B 3.9 REFUELING OPERATIONS

B 3.9.6 Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level

BASES

BACKGROUND	The purpose of the RHR System in MODE 6 is to remove decay heat and sensible heat from the Reactor Coolant System (RCS), as required by GDC 34 (DCPP meets intent of this 1971 GDC), to provide mixing of borated coolant, and to prevent boron stratification (Ref. 1). Heat is removed from the RCS by circulating reactor coolant through the RHR heat exchangers where the heat is transferred to the Component Cooling Water System. The coolant is then returned to the RCS via the RCS cold leg(s). Operation of the RHR System for normal cooldown decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of reactor coolant through the RHR heat exchanger(s) and the bypass lines. Mixing of the reactor coolant is maintained by this continuous circulation of reactor coolant through the RHR System.
APPLICABLE SAFETY ANALYSIS	If the reactor coolant temperature is not maintained below 200°F, boiling of the reactor coolant could result. This could lead to a loss of coolant in the reactor vessel. Additionally, boiling of the reactor coolant could lead to boron plating out on components near the areas of the boiling activity. The loss of reactor coolant and the reduction of boron concentration in the reactor coolant will eventually challenge the integrity of the fuel cladding, which is a fission product barrier. Two trains of the RHR System are required to be OPERABLE, and one train in operation, to prevent this challenge. Although the RHR System does not meet a specific criterion of the NRC Policy Statement, it was identified in 10CFR50.36(c)(2)(ii) as an important contributor to risk reduction. Therefore, the RHR System is retained as a Specification.
LCO	In MODE 6, with the water level < 23 ft above the top of the reactor vessel flange, both RHR loops must be OPERABLE. Additionally, one loop of RHR must be in operation in order to provide: a. Removal of decay heat; b. Mixing of borated coolant to minimize the possibility of criticality; and c. Indication of reactor coolant temperature.

(continued)

BASES

LCO (continued)

An OPERABLE RHR loop consists of an RHR pump, a heat exchanger, valves, piping, instruments and controls to ensure an OPERABLE flow path and to determine the low end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs. An operable RHR loop must be capable of being realigned to provide an operable flow path.

APPLICABILITY

Two RHR loops are required to be OPERABLE, and one RHR loop must be in operation in MODE 6, with the water level < 23 ft above the top of the reactor vessel flange, to provide decay heat removal. Requirements for the RHR System in other MODES are covered by LCOs in Section 3.4, Reactor Coolant System (RCS), and Section 3.5, Emergency Core Cooling Systems (ECCS). RHR loop requirements in MODE 6 with the water level ≥ 23 ft are located in LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation-High Water Level." A Note is added to the applicability to assure that MODE 6 operation with water level < 23 ft. is not permitted unless two RHR loops are operable.

ACTIONS

A.1 and A.2

If less than the required number of RHR loops are OPERABLE, action shall be immediately initiated and continued until the RHR loop is restored to OPERABLE status and to operation or until ≥ 23 ft of water level is established above the reactor vessel flange. When the water level is ≥ 23 ft above the reactor vessel flange, the Applicability changes to that of LCO 3.9.5, and only one RHR loop is required to be OPERABLE and in operation. An immediate Completion Time is necessary for an operator to initiate corrective actions.

B.1

If no RHR loop is in operation, there will be no forced circulation to provide mixing to establish uniform boron concentrations. The suspension of any operation involving a reduction in Reactor Coolant Boron Concentration will reduce the likelihood of boron stratifcation in the RCS.

B.2

If no RHR loop is in operation, actions shall be initiated immediately, and continued, to restore one RHR loop to operation. Since the unit is in Conditions A and B concurrently, the restoration of two OPERABLE RHR loops and one operating RHR loop should be accomplished expeditiously.

(continued)

BASES

ACTIONS (continued)

B.3

If no RHR loop is in operation, all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere must be closed within 4 hours. With the RHR loop requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Closing containment penetrations that are open to the outside atmosphere ensures that dose limits are not exceeded.

The Completion Time of 4 hours is reasonable at water levels above reduced inventory, based on the low probability of the coolant boiling in that time. At reduced inventory conditions or mid-loop operations, additional actions are taken to provide containment closure in a reduced period of time (Ref. 3). Reduced inventory is defined as less than Elev. 111 ft.

SURVEILLANCE REQUIREMENTS

SR 3.9.6.1

This Surveillance demonstrates that one RHR loop is in operation and circulating reactor coolant. The flow rate of more than 3000 gpm is determined by the flow rate necessary to provide sufficient decay heat removal capability and to prevent thermal and boron stratification in the core prior to 57 hours subcritical. The second part of this Surveillance serves the same function but with 57 hours or more of core subcriticality and provides a reduced flow rate of 1300 gpm based upon a reduced decay heat load. Both of these flow rates are points of the same flow rate verses decay heat curves. The 1300 gpm limit also precludes exceeding the 1675 gpm upper flow limit to prevent vortexing and air entrainment of the RHR piping system. RHR pump vortexing (failure to meet pump suction requirements) during mid-loop operation may result in RHR pump failure and non-conservative RCS level indication. The Frequency of 12 hours is sufficient, considering the flow, temperature, pump control, and alarm indications available to the operator for monitoring the RHR System in the control room (Ref. 2).

SR 3.9.6.2

Verification that the required pump is OPERABLE ensures that an additional RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

(continued)

BASES (continued)

REFERENCES

1. FSAR , Section 5.5.7
2. LAR 88-01, dated 1/22/88, submitted by "RHR System Flow Rate Reduction," DCL 88-014.
3. Generic Letter 88-17, “Loss of Decay Heat Removal.”

B 3.9 REFUELING OPERATIONS

B 3.9.7 Refueling Cavity Water Level

BASES

BACKGROUND	The movement of irradiated fuel assemblies within containment requires a minimum water level of 23 ft above the top of the reactor vessel flange. During refueling, this maintains sufficient water level in the containment, refueling canal, fuel transfer canal, refueling cavity, and spent fuel pool. Sufficient water is necessary to retain iodine fission product activity in the water in the event of a fuel handling accident (Refs. 1 and 2). Sufficient iodine activity would be retained to limit offsite doses from the accident to < 25% of 10 CFR 100 limits, as provided by the guidance of Reference 3.
APPLICABLE SAFETY ANALYSIS	During CORE ALTERATIONS and movement of irradiated fuel assemblies, the water level in the refueling canal and the refueling cavity is an initial condition design parameter in the analysis of a fuel handling accident in containment, as postulated by Regulatory Guide 1.25 (Ref. 1). A minimum water level of 23 ft (Regulatory Position C.1.c of Ref. 1) allows a decontamination factor of 100 (Regulatory Position C.1.g of Ref. 1) to be used in the accident analysis for iodine. This relates to the assumption that 99% of the total iodine released from the pellet to cladding gap of all the dropped fuel assembly rods is retained by the refueling cavity water. The fuel pellet to cladding gap is assumed to contain 10% of the total fuel rod iodine inventory (Ref. 1). The fuel handling accident analysis inside containment is described in Reference 2. With a minimum water level of 23 ft and a minimum decay time of 100 hours prior to fuel handling, the analysis and test programs demonstrate that the iodine release due to a postulated fuel handling accident is adequately captured by the water and offsite doses are maintained well within allowable limits (Refs. 4, and 5). Refueling cavity water level satisfies Criterion 2 of 10CFR50.36(c)(2)(ii).
LCO	A minimum refueling cavity water level of 23 ft above the reactor vessel flange is required to ensure that the radiological consequences of a postulated fuel handling accident inside containment are within acceptable limits, as provided by the guidance of Reference 3.

(continued)

BASES (continued)

APPLICABILITY	LCO 3.9.7 is applicable during CORE ALTERATIONS, except during latching and unlatching of control rod drive shafts, and when moving irradiated fuel assemblies within containment. The LCO minimizes the possibility of a fuel handling accident in containment that is beyond the assumptions of the safety analysis. If irradiated fuel assemblies are not present in containment, there can be no significant radioactivity release as a result of a postulated fuel handling accident. Requirements for fuel handling accidents in the spent fuel pool are covered by LCO 3.7.15, "Fuel Storage Pool Water Level."
ACTIONS	A.1 With a water level of < 23 ft above the top of the reactor vessel flange, all operations involving movement of irradiated fuel assemblies within the containment shall be suspended immediately to ensure that a fuel handling accident cannot occur. The suspension of fuel movement shall not preclude completion of movement of a component to a safe position.
SURVEILLANCE REQUIREMENTS	SR 3.9.7.1 Verification of a minimum water level of 23 ft above the top of the reactor vessel flange ensures that the design basis for the analysis of the postulated fuel handling accident during refueling operations is met. Water at the required level above the top of the reactor vessel flange limits the consequences of damaged fuel rods that are postulated to result from a fuel handling accident inside containment (Ref. 2). The Frequency of 24 hours is based on engineering judgment and is considered adequate in view of the large volume of water and the normal procedural controls of valve positions, which make significant unplanned level changes unlikely.
REFERENCES	1. Regulatory Guide 1.25, March 23, 1972. 2. FSAR, Section 15.4.5. 3. NUREG-0800, Section 15.7.4. 4. 10 CFR 100.10. 5. Malinowski, D. D., Bell, M. J., Duhn, E., and Locante, J., WCAP-828, Radiological Consequences of a Fuel Handling Accident, December 1971.