B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.1 AC Sources-Operating

BASES

BACKGROUND

The AC sources to the Class 1E Electrical Power Distribution System consist of the offsite power sources starting at the 4.16 kV engineered safety feature (ESF) buses and the onsite diesel generators (DGs). As required by Reference 1, General Design Criteria (GDC) 17, the design of the AC electrical power system has sufficient independence and redundancy to ensure a source to the ESFs assuming a single failure.

The Class 1E AC Distribution System is divided into two redundant load groups so that the loss of one group does not prevent the minimum safety functions from being performed. Each load group has connections to two offsite sources and one Class 1E DG at its 4.16 kV 1E bus.

Offsite power is supplied to the 500 kV Switchyard from the transmission network by three 500 kV transmission lines. Two electrically and physically separated circuits supply electric power from the 500 kV Switchyard to two 13 kV buses and then to the two 4.16 kV ESF buses. A third 69 kV/13.8 kV offsite power source that may be manually connected to either 13 kV bus is available from the Southern Maryland Electric Cooperative (SMECO). When appropriate, the Engineered Safety Feature Actuation System (ESFAS) loss of coolant incident and shutdown sequencer for the 4.16 kV bus will sequence loads on the bus after the 69 kV/13.8 kV SMECO line has been manually placed in service. The SMECO offsite power source will not be used to carry loads for an operating unit. A detailed description of the offsite power network and the circuits to the Class 1E ESF buses, is found in Reference 2, Chapter 8.

The required offsite power circuits are the two 13 kV buses (Nos. 11 and 21) which can be powered by:

a. Two 500 kV lines, two 500 kV buses each of which have connections to a 500 kV line that does not pass through the other 500 kV bus and both P-13000 (500 kV/14 kV) transformers; or

b. One 500 kV line, one 500 kV bus, and one associated P-13000 (500 kV/13.8 kV) transformer, and the 69 kV/ 13.8 kV SMECO line. When the SMECO line is credited as one of the qualified offsite circuits, the disconnect from the SMECO line to Warehouse No. 1 must be open.

In addition, each offsite circuit includes the cabling to and from a 13.8/13.8 kV voltage regulator, 13.8/4.16 kV unit service transformer, and one of the two breakers to one 4.16 kV ESF bus. Transfer capability between the two required offsite circuits is by manual means only. The required circuit breaker to each 4.16 kV ESF bus must be from different 13.8/4.16 kV unit service transformers for the two required offsite circuits. Thus, each unit is able to align one 4.16 kV bus to one required offsite circuit, and the other 4.16 kV bus to the other required offsite circuit.

In some cases, inoperable components in the electrical circuit place both units in Conditions. Examples of these are 13.8 kV bus Nos. 11 or 21, two 500 kV transmission lines, one P-13000 service transformer, or one 500 kV bus. In other cases, inoperable components only place one unit in a Condition, such as an inoperable U-4000 and/or 13.8 kV regulator that feeds a required 4.16 kV bus.

The onsite standby power source to each 4.16 kV ESF bus is a dedicated DG. A DG starts automatically on an safety injection actuation signal or on a 4.16 kV degraded or undervoltage signal. If both 4.16 kV offsite source breakers are open, the DG, after reaching rated voltage and frequency, will automatically close onto the 4.16 kV bus.

In the event of a loss of offsite power to a 4.16 kV 1E bus, if required, the ESF electrical loads will be automatically sequenced onto the DG in sufficient time to provide for safe shutdown for an anticipated operational occurrence (AOO) and to ensure that the containment integrity and other vital functions are maintained in the event of a design bases accident.

Ratings for the No. 1A DG satisfies the requirements of Reference 3 and ratings for the Nos. 1B, 2A, and 2B DGs satisfy the requirements of Reference 4. The continuous service rating for the No. 1A DG is 5400 kW and for the Nos. 1B, 2A, and 2B DGs are 3000 kW.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in Reference 1, Chapters 6 and 14, assume ESF systems are OPERABLE. The AC electrical power sources are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, RCS, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Sections 3.2, 3.4, and 3.6.

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

a. An assumed loss of all offsite power; and

b. A single failure.

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

LCO

Two qualified circuits between the offsite transmission network and the onsite Class 1E Electrical Power Distribution System and separate and independent DGs for each train ensure 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.

Qualified offsite circuits are those that are described in the Updated Final Safety Analysis Report (UFSAR) and are part of the licensing basis for the unit.

Each offsite circuit must be capable of maintaining rated frequency and voltage and accepting required loads during an accident, while connected to the ESF buses. Loads are immediately connected to the ESF buses when the buses are powered from the 500 kV offsite circuits and, when powered from the 69/13.8 kV SMECO offsite circuit after being manually connected, the loads are sequenced onto the ESF bus utilizing the same sequencer used to sequence the loads onto the DG. The SMECO offsite circuit will not be used to carry loads for an operating unit.

The Limiting Condition for Operation (LCO) requires operability of two out of three qualified circuits between the transmission network and the onsite Class 1E AC Electrical Power Distribution System circuits. These circuits consist of two 500 kV circuits via 500 kV/14 kV and 13.8 kV/4.16 kV transformers and the 69 kV SMECO dedicated source (described in Reference 5) via 69 kV/13.8 kV and 13.8 kV/4.16 kV transformers. In addition, each offsite circuit includes one of the two breakers to one 4.16 kV ESF bus. The required circuit breaker to each 4.16 kV ESF bus must be from different 13.8/4.16 unit service transformers for the two required offsite circuits. Thus, each unit is able to align one 4.16 kV bus to one required offsite circuit, and the other 4.16 kV bus to the other required offsite circuit.

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 at ambient conditions. Additional DG capabilities must be demonstrated to meet required Surveillances, e.g., capability of the DG to reject a load ≥ 500 hp without tripping.

Proper sequencing of loads, including shedding of non-essential loads, is a required function for DG OPERABILITY in MODEs 1, 2, and 3.

BASES

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

The Control Room Emergency Ventilation System (CREVS) and Control Room Emergency Temperature System (CRETS) are shared systems with one train of each system connected to an onsite Class 1E AC electrical power distribution subsystem from each unit. Limiting Condition for Operation 3.8.1.c requires one qualified circuit between the offsite transmission network and the other unit's onsite Class 1E AC electrical power distribution subsystems needed to supply power to the CREVS and CRETS to be OPERABLE and one DG from the other unit capable of supplying power to the CREVS and CRETS to be OPERABLE. The qualified circuit in LCO 3.8.1.c must be separate and independent (to the extent possible) of the qualified circuit which provides power to the other train of the CREVS and CRETS. These requirements, in conjunction with the requirements for the unit AC electrical power sources in LCO 3.8.1.a and LCO 3.8.1.b, ensure that power is available to two trains of the CREVS and CRETS.

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.

ACTIONS

A Note prohibits the application of LCO 3.0.4.b to an inoperable DG. There is an increased risk associated with entering a MODE or other specified condition in the Applicability with an inoperable DG and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

A.1

To ensure a highly reliable power source remains with the one required LCO 3.8.1.a offsite circuit inoperable, it is necessary to verify the OPERABILITY of the remaining required offsite circuits on a more frequent basis. Since the Required Action only specifies "perform," a failure of Surveillance Requirement (SR) 3.8.1.1 or SR 3.8.1.2 acceptance criteria does not result in a Required Action not met. However, if a second required circuit fails SR 3.8.1.1 or SR 3.8.1.2, the second offsite circuit is inoperable, and Condition D and/or G, as applicable, for the two offsite circuits inoperable, is entered.

A.2

Required Action A.2, which only applies if the train cannot be powered from an offsite source, is intended to provide assurance that an event coincident with a single failure of the associated DG will not result in a complete loss of safety function of critical redundant required features. These features are powered from the redundant AC electrical power train(s). Single train systems may not be included.

The Completion Time for Required Action A.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. The train has no offsite power supplying its loads; and

b. A required feature on another train is inoperable.

If at any time during the existence of Condition A (one required LCO 3.8.1.a offsite circuit inoperable) a redundant required feature subsequently becomes inoperable, this Completion Time begins to be tracked.

The Completion Time must be started if it is discovered that there is no offsite power to one train of the onsite

Class 1E Electrical Power Distribution System coincident with one or more inoperable required support or supported features (or both) that are associated with the other train that has offsite power. Twenty-four hours is acceptable because it minimizes risk while allowing time for restoration before subjecting the unit to transients associated with shutdown.

The remaining OPERABLE offsite circuits and DGs are adequate to supply electrical power to Train A and Train B of the onsite Class 1E Distribution System. The 24 hour Completion Time takes into account the component OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the 24 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.

A.3

Consistent with Reference 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.

B.1

The 14 day Completion Time for Required Action B.5 is based on the OPERABILITY of both opposite-unit DGs and the availability of the OC DG. The OC DG is available to power the inoperable DG bus loads in the event of a station blackout or loss-of-offsite power. It is required to administratively verify both opposite-unit DGs OPERABLE and the OC DG available within one hour and to continue this action once per 24 hours thereafter until restoration of the required DG is accomplished. This verification provides assurance that both opposite-unit DGs and the OC DG are capable of supplying the onsite Class 1E AC Electrical Power Distribution System.

B.2

To ensure a highly reliable power source remains with an inoperable LCO 3.8.1.b 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 or SR 3.8.1.2 acceptance criteria does not result in a Required Action being not met. However, if a circuit fails to pass SR 3.8.1.1 or SR 3.8.1.2, it is inoperable. Upon offsite circuit inoperability, additional Conditions and Required Actions must then be entered.

B.3

Required Action B.3 is intended to provide assurance that a loss of offsite power, during the period that a LCO 3.8.1.b DG is inoperable, does not result in a complete loss of safety function of critical systems. These features are designed with redundant safety-related trains. Single train systems are not included. Redundant required feature failures consist of inoperable features with a train, redundant to the train that has an inoperable LCO 3.8.1.b DG.

The Completion Time for Required Action B.3 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 LCO 3.8.1.b DG exists; and

b. A required feature on another train is inoperable.

If at any time during the existence of this Condition (one LCO 3.8.1.b DG inoperable) a required feature subsequently becomes inoperable, this Completion Time begins to be tracked.

Discovering one required LCO 3.8.1.b DG inoperable coincident with one or more inoperable required support or supported features (or both) that are associated with 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 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 four hour Completion Time takes into account the OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the four 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.

B.4.1 and B.4.2

Required Action B.4.1 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 DG(s), SR 3.8.1.3 does not have to be performed. If the cause of inoperability exists on other DG(s), the other DG(s) would be declared inoperable upon discovery and Condition E and/or I of LCO 3.8.1, as applicable, would be entered. Once the failure is repaired, the common cause failure no longer exists and Required Action B.4.1 is satisfied. If the cause of the initial inoperable DG cannot be confirmed not to exist on the remaining DG(s), performance of SR 3.8.1.3 suffices to provide assurance of continued OPERABILITY of the DG(s).

In the event the inoperable DG is restored to OPERABLE status prior to completing either B.4.1 or B.4.2, the 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.

Consistent with Reference 7, 24 hours is reasonable to confirm that the OPERABLE DG(s) is not affected by the same problem as the inoperable DG.

These Conditions (B.4.1 and B.4.2) do not address the availability of the OC DG.

B.5

Operation may continue in Condition B for a period that should not exceed 14 days.

Planned entry into this Required Action requires that a risk assessment be performed in accordance with a configuration risk management program (Reference 11). This ensures that a proceduralized probabilistic risk assessment-informed process is in place that assesses the overall impact of plant maintenance on plant risk prior to entering this Required Action for planned activities.

In Condition B, the remaining OPERABLE DGs, available OC DG, and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 14 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.

In addition to utilizing Calvert Cliffs Nuclear Power Plant's processes for evaluating risk, Reference 11, Calvert Cliffs will administratively limit DG OOS time to 72 hours for elective maintenance unless the following actions are completed:

a. Weather conditions will be evaluated prior to entering the extended DG Completion Time for elective maintenance. An extended DG Completion Time will not be entered for elective maintenance purposes if official weather forecasts are predicting severe conditions (tornado or thunderstorm warnings).

b. The condition of the offsite power supply will be evaluated prior to entering the extended DG Completion Time.

c. No elective maintenance will be performed in the switchyard, on the 4 kV Distribution System, or on the 13 kV Distribution System.

d. No maintenance or testing that affects the reliability of the train associated with the operable DG on the affected unit will be scheduled during the extended DG Completion Time. If any testing or maintenance activities, which affects the train reliability must be performed while the extended DG Completion Time is in effect, a 10 CFR 50.65(a)(4) evaluation will be performed.

e. Elective maintenance will not be performed on the alternate AC power source (OC DG). Personnel will be made aware of the dedication of the alternate AC source to the affected Unit.

f. Planned maintenance will not be performed on the Auxiliary Feedwater System.

g. The system dispatcher (System Operations and Maintenance Department) will be contacted prior to removing the DG from service and after it has been returned to service.

h. The operations crews will be briefed concerning the Unit activities, including compensatory measures established and the importance of promptly starting and aligning the alternate AC source (OC DG).

i. The on-shift operations crew will discuss and review the appropriate normal and emergency operating procedures prior to or shortly after assuming the watch for the first time after having scheduled days off while the extended DG Completion Time is in effect.

j. The condition of the grid will be evaluated prior to entering the extended DG 3.8.1 Condition B Completion Time for elective maintenance. An extended DG Completion Time will not be entered to perform elective maintenance when grid stress conditions are considered "High" per plant procedures. This will include conditions such as expected extreme summer temperatures and/or high demand.

C.1.1 and C.1.2

In Condition C with an opposite-unit DG inoperable and/or the OC DG unavailable, the remaining OPERABLE unit-specific DG and required qualified circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Consistent with Reference 6, operation may continue in Condition C for a period that should not exceed 72 hours. 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.

D.1

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it, were inoperable resulting in de-energization. Therefore, the Required Actions of Condition D are modified by a Note to indicate that when Condition D is entered with no AC source to any train, the Conditions and Required Actions for LCO 3.8.9, must be immediately entered. This allows Condition D to provide requirements for the loss of the LCO 3.8.1.c offsite circuit and DG without regard to whether a train is de-energized. Limiting Condition for Operation 3.8.9 provides the appropriate restrictions for a de-energized train.

To ensure a highly reliable power source remains with the one required LCO 3.8.1.c offsite circuit inoperable, it is necessary to verify the OPERABILITY of the remaining required offsite circuits on a more frequent basis. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 or SR 3.8.1.2 acceptance criteria does not result in a Required Action not met. However, if a second required circuit fails SR 3.8.1.1 or SR 3.8.1.2, the second offsite circuit is inoperable, and Condition A and/or G, as applicable, for the two offsite circuits inoperable, is entered.

D.2

Required Action D.2, which only applies if the train cannot be powered from an offsite source, is intended to provide assurance that an event coincident with a single failure of the associated DG will not result in a complete loss of safety function for the CREVS or CRETS. The Completion Time for Required Action D.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. The train has no offsite power supplying its loads; and

b. A train of CREVS or CRETS on the other train is inoperable.

If at any time during the existence of Condition D (one required LCO 3.8.1.c offsite circuit inoperable) a train of CREVS or CRETS becomes inoperable, this Completion Time begins to be tracked.

Discovering no offsite power to one train of the onsite Class 1E Electrical Power Distribution System coincident with one train of CREVS or CRETS that is associated with the other train that has offsite power, results in starting the Completion Times for the Required Action. Twenty-four hours is acceptable because it minimizes risk while allowing time for restoration before subjecting the unit to transients associated with shutdown.

The remaining OPERABLE offsite circuits and DGs are adequate to supply electrical power to Train A and Train B of the onsite Class 1E Distribution System. The 24 hour Completion Time takes into account the component OPERABILITY of the redundant counterpart to the inoperable CREVS or CRETS. Additionally, the 24 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.

D.3

Consistent with the time provided in ACTION A, operation may continue in Condition D for a period that should not exceed 72 hours. With one required LCO 3.8.1.c 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 circuits and DGs are adequate to supply electrical power to the onsite Class 1E Distribution System.

If the LCO 3.8.1.c required offsite circuit cannot be restored to OPERABLE status within 72 hours, the CREVS and CRETS associated with the offsite circuit must be declared inoperable. The ACTIONS associated with the CREVS and CRETS will ensure the appropriate actions are taken. 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.

E.1

The 14 day Completion Time for Required Action E.5 is based on the OPERABILITY of the other three safety-related DGs and the availability of the OC DG. The OC DG is available to power the inoperable DG bus loads in the event of a station blackout or loss-of-offsite power. It is required to administratively verify the three safety-related DGs OPERABLE and the OC DG available within one hour and to continue this action once per 24 hours thereafter until restoration of the required DG is accomplished. This verification provides assurance that the three safety-related DGs and the OC DG are capable of supplying the onsite Class 1E AC Electrical Power Distribution System.

E.2

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it, were inoperable resulting in de-energization. Therefore, the Required Actions of Condition E are modified by a Note to indicate that when Condition E is entered with no AC source to any train, the Conditions and Required Actions for LCO 3.8.9 must be immediately entered. This allows Condition E to provide requirements for the loss of the LCO 3.8.1.c offsite circuit and DG without regard to whether a train is de-energized. Limiting Condition for Operation 3.8.9 provides the appropriate restrictions for a de-energized train.

To ensure a highly reliable power source remains with the one required LCO 3.8.1.c DG inoperable, it is necessary to verify the availability of the required offsite circuits on a more frequency basis. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 or SR 3.8.1.2 acceptance criteria does not result in a Required Action not met. However, if a circuit fails to pass SR 3.8.1.1 or SR 3.8.1.2, it is inoperable. Upon offsite circuit inoperability additional Conditions and Required Actions must then be entered.

<u>E.3</u>

Required Action E.3 is intended to provide assurance that a loss of offsite power, during the period the LCO 3.8.1.c DG is inoperable, does not result in a complete loss of safety function for the CREVS or CRETS. The Completion Time 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 LCO 3.8.1.c DG exists; and

b. A train of CREVS or CRETS on the other train is inoperable.

If at any time during the existence of this Condition (the LCO 3.8.1.c DG inoperable) a train of CREVS or CRETS becomes inoperable, this Completion Time begins to be tracked.

Discovering the LCO 3.8.1.c DG inoperable coincident with one train of CREVS or CRETS that is associated with the one LCO 3.8.1.b DG 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 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 CREVS or CRETS may have been lost; however, function has not been lost. The four hour Completion Time also takes into account the capacity and capability of the remaining CREVS and CRETS train, a reasonable time for repairs, and the low probability of a DBA occurring during this period.

E.4.1 and E.4.2

Required Action E.4.1 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 DG(s), SR 3.8.1.3 does not have to be performed. If the cause of inoperability exists on other DG(s), the other DG(s) would be declared inoperable upon discovery and Condition B and/or I of LCO 3.8.1, as applicable, would be entered. Once the failure is repaired, the common cause failure no longer exists and Required Action E.4.1 is satisfied. If the cause of the initial inoperable DG cannot be confirmed not to exist on the remaining DG(s), performance of SR 3.8.1.3 suffices to provide assurance of continued OPERABILITY of the DG(s).

In the event the inoperable DG is restored to OPERABLE status prior to completing either E.4.1 or E.4.2, the 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 E.

Consistent with Reference 6, 24 hours is reasonable to confirm that the OPERABLE DG(s) is not affected by the same problem as the inoperable DG.

These Conditions (E.4.1 and E.4.2) do not address the availability of the OC DG.

E.5

Consistent with the time provided in ACTION B, operation may continue in Condition E for a period that should not exceed 14 days. In Condition E, the remaining OPERABLE DGs, available OC DG, and offsite power circuits are adequate to supply electrical power to the Class 1E Distribution System.

If the LCO 3.8.1.c DG cannot be restored to OPERABLE status within 14 days the CREVS and CRETS associated with this DG must be declared inoperable. The Actions associated with the CREVS and CRETS will ensure the appropriate Actions are taken.

The 14 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.

F.1.1 and F.1.2

In Condition F, with an additional safety-related DG inoperable or the OC DG unavailable, the remaining OPERABLE DG and required qualified circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Consistent with Reference 6, operation may continue in Condition F for a period that should not exceed 72 hours. 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.

F.1.3

If the LCO 3.8.1.c DG cannot be restored to OPERABLE status within 72 hours the CREVS and CRETS associated with this DG must be declared inoperable. The Required Actions associated with the CREVS and CRETS will ensure that the appropriate actions are taken.

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 and G.2

Condition G is entered when both offsite circuits required by LCO 3.8.1.a are inoperable, or when the offsite circuit required by LCO 3.8.1.c and one offsite circuit required by LCO 3.8.1.a are concurrently inoperable, if the LCO 3.8.1.a offsite circuit is credited with providing power to the CREVS and CRETS.

Required Action G.1 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 Completion Time for this failure of redundant required features is reduced to 12 hours from that allowed for one train without offsite power (Required Action A.2). The rationale for the reduction to 12 hours is that Reference 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 the case, and a shorter Completion Time of 12 hours is appropriate. These features are powered from redundant AC safety trains. Single train features are not included in the list.

The Completion Time for Required Action G.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. Two required offsite circuits are inoperable; and

b. A required feature is inoperable.

If at any time during the existence of Condition G (e.g., two required LCO 3.8.1.a offsite circuits inoperable) and a required feature becomes inoperable, this Completion Time begins to be tracked.

Consistent with Reference 6, operation may continue in Condition G 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 could correspond 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 redundant 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 two 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 loss of coolant accident, 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.

Consistent with 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 or D, as applicable.

H.1 and H.2

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it were inoperable resulting in de-energization. Therefore, the Required Actions of Condition H are modified by a Note to indicate that when Condition H is entered with no AC source to any train, the Conditions and Required Actions for LCO 3.8.9, must be immediately entered. This allows Condition H to provide requirements for the loss of one required LCO 3.8.1.a offsite circuit and one LCO 3.8.1.b DG without regard to whether a train is de-energized. Limiting Condition for Operation 3.8.9 provides the appropriate restrictions for a de-energized train.

Consistent with Reference 6, operation may continue in Condition H for a period that should not exceed 12 hours.

In Condition H, individual redundancy is lost in both the offsite electrical power system and the onsite AC electrical power system. Since power system redundancy is provided by two diverse sources of power, however, the reliability of the power systems in this Condition may appear higher than that in Condition G (loss of two 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.

I.1

With two LCO 3.8.1.b DGs inoperable, there are no remaining standby AC sources to provide power to most of the ESF systems. With one LCO 3.8.1.c DG inoperable and the LCO 3.8.1.b DG that provides power to the CREVS and CRETS inoperable, there are no remaining standby AC sources to the CREVS and CRETS. 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 is the only source of AC power for this level of degradation, the risk associated with continued operation for a 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, however, the time allowed for continued operation is severely restricted. The intent here is to avoid the risk associated with an immediate controlled shutdown and to minimize the risk associated with this level of degradation.

Consistent with Reference 6, with both LCO 3.8.1.b DGs inoperable, or with the LCO 3.8.1.b DG that provides power to the CREVS and CRETS and the LCO 3.8.1.c DG inoperable, operation may continue for a period that should not exceed 2 hours.

J.1 and J.2

If any Required Action and associated Completion Time of Conditions A, B.2, B.3, B.4.1, B.4.2, B.5, C, E.2, E.3, E.4.1, E.4.2, E.5, F, G, H, or I are not met, 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 six 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 unit systems.

K.1

Condition K corresponds to a level of degradation in which all redundancy in LCO 3.8.1.a and LCO 3.8.1.b AC electrical power supplies has been lost. At this severely degraded level, any further losses in the AC electrical power system 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 Reference 1, GDC 18. 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 consistent with the recommendations of Reference 3, or Reference 4, and Reference 8.

When the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. The minimum transient output voltage of 3740 V is 90% of the nominal 4160 V output voltage. This value allows for voltage drop to the terminals of 4000 V motors whose minimum operating voltage is specified as 90% or 3600 V. The specified maximum output voltage of 4400 V is equal to the maximum operating voltage specified for 4000 V motors. It ensures that for a lightly loaded distribution system, the voltage at the terminals of 4000 V 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 the recommendations given in Reference 3.

The SRs are modified by a Note which states that SR 3.8.1.1 through SR 3.8.1.15 are applicable to LCO 3.8.1.a and LCO 3.8.1.b AC Sources. The Note also states that SR 3.8.1.16 is applicable to LCO 3.8.1.c AC sources. This Note clarifies that not all of the SRs are applicable to all the components described in the LCO.

<u>SR 3.8.1.1 and SR 3.8.1.2</u>

These SRs assure 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 Frequency of once within one hour after substitution for a 500 kV circuit and periodically thereafter, for SR 3.8.1.1 was established to ensure that the breaker alignment for the SMECO circuit (which does not have Control Room indication) is in its correct position although breaker position is unlikely to change. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

Surveillance Requirement 3.8.1.1 is modified by a Note which states that this SR is only required when SMECO is being credited for an offsite source. This SR will prevent unnecessary testing on an uncredited circuit.

SR 3.8.1.3 and SR 3.8.1.9

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 3.8.1.3) to indicate that all DG starts for these surveillance tests may be preceded by an engine prelube period and followed by a warmup period prior to loading by an engine prelube period.

For the purposes of SR 3.8.1.9 testing, the DGs are required to start from standby conditions only for SR 3.8.1.9. Standby conditions for a DG mean the diesel engine coolant and oil are being continuously circulated and temperature is being maintained consistent with manufacturer recommendations.

In order to reduce stress and mechanical wear on diesel engines, the DG manufacturers recommend a modified start in which the starting speed of DGs is limited, warmup is limited to this lower speed, and the DGs are gradually accelerated to synchronous speed prior to loading. This is the intent of Note 3, which is only applicable when such modified start procedures are recommended by the manufacturer.

Surveillance Requirement 3.8.1.9 requires that the DG starts from standby conditions and achieves required voltage and frequency within 10 seconds. The minimum voltage and frequency stated in the SR are those necessary to ensure the DG can accept DBA loading while maintaining acceptable voltage and frequency levels. The 10 second start requirement supports the assumptions of the design basis loss of coolant accident analysis in Reference 2, Chapter 14.

Since SR 3.8.1.9 requires a 10 second start, it is more restrictive than SR 3.8.1.3, and it may be performed in lieu of SR 3.8.1.3.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.4

This SR verifies that the DGs are capable of synchronizing with the offsite electrical system and accepting loads greater than or equal to 4000 kW for No. 1A DG and greater than or equal to 90% of the continuous duty rating for the remaining DGs. The 90% minimum load limit is consistent with Reference 3 and is acceptable because testing of these DGs at post-accident load values is performed by SR 3.8.1.11. 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 1.0 is an operational limitation. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

This SR is modified by four Notes. Note 1 indicates that the diesel engine runs for this surveillance test 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. Note 3 indicates that this surveillance test shall be conducted on only one DG at a time in order to prevent routinely paralleling multiple DGs and to minimize the potential for effects 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 3.8.1.5

This SR provides verification that the level of fuel oil in the day tank is at or above the level at which fuel oil is automatically added. The level required by the SR is selected to ensure adequate fuel oil for a minimum of one hour of DG operation at full load plus 10%. The fuel oil level ensuring a one hour supply is 325 gallons for DG 1A and 275 gallons for DGs 1B, 2A, and 2B when calculated in accordance with References 8 and 12.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.6

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 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 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 Frequency is controlled under the Surveillance Frequency Control Program. The presence of water does not necessarily represent failure of this SR provided the accumulated water is removed during the performance of this surveillance test.

SR 3.8.1.7

This SR demonstrates that one fuel oil transfer pump operates and transfers fuel oil from its associated storage tank to its associated day tank. This is required to support continuous operation of standby power sources. This SR provides assurance that the fuel oil transfer pump is OPERABLE, the fuel oil piping system is intact, the fuel delivery piping is not obstructed, and the controls and control systems for automatic fuel transfer systems are OPERABLE.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.8

Under accident and loss of offsite power conditions loads are sequentially connected to the bus by the automatic load sequencer (this SR verifies steps 1 through 5 for the emergency load sequencer and verifies steps 1 through 3 for the shutdown load sequencer). The sequencing logic controls the permissive and closing signals to breakers to prevent overloading of the DGs due to high motor starting currents. The 10% load sequence time interval tolerance ensures 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 UFSAR provides a summary of the automatic loading of ESF buses.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.9

See SR 3.8.1.3.

SR 3.8.1.10

Transfer of each 4.16 kV ESF bus power supply from the normal offsite circuit to the alternate offsite circuit demonstrates the OPERABILITY of the alternate circuit distribution network to power the shutdown loads. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.11

This SR provides verification that the DG can be operated at a load greater than predicted accident loads for at least 4 hours. Operation at the greater than calculated accident loads will clearly demonstrate the ability of the DGs to perform their safety function. 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 DG load greater than or equal to calculated accident load and using a power factor ≤ 0.84 for No. 1A DG and ≤ 0.83 for Nos. 1B, 2A, and 2B DGs. These power factors are chosen based on the calculated highest kW value of DG loads during the postulated design basis accidents.

In addition, the post-accident load for No. 1A DG is significantly lower than the continuous rating of No. 1A DG. To ensure No. 1A DG performance is not degraded, routine monitoring of engine parameters should be performed during the performance of this SR for No. 1A DG (Reference 9).

This SR 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 limit will not invalidate the test. Note 2 ensures that the DG is tested under load conditions that are as close to design basis conditions as practicable. When synchronized with offsite power, testing should be performed at a power factor of ≤ 0.84 for No. 1A DG and ≤ 0.83 for Nos. 1B, 2A, and 2B DGs. These power factors are representative of the actual inductive loading a DG would see under design basis accident conditions. Under certain conditions, however, Note 2 allows the surveillance to be conducted at a power factor other than ≤ 0.84 for No. 1A DG and ≤ 0.83 for Nos. 1B, 2A, and 2B DGs. These conditions occur when grid voltage is high, and the additional field excitation needed to get the power factor to ≤ 0.84 for No. 1A DG and ≤ 0.83 for Nos. 1B, 2A, and 2B DGs results in voltages on the emergency busses that are too high. Conditions can also occur that could result in emergency bus voltages which are too low. Under these conditions, the power factor shall be maintained as close a practicable to 0.84 for No. 1A DG and 0.83 for Nos. 1B, 2A, and 2B DGs while maintaining acceptable voltages on the emergency busses.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.12

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 SR demonstrates the DG load response characteristics. This SR is accomplished by 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.

Consistent with References 10, 3, and 4, the load rejection test is acceptable if the increase in diesel speed does not exceed 75% of the difference between synchronous speed and the overspeed trip setpoint, or 15% above synchronous speed, whichever is lower.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.13

This SR demonstrates that DG non-critical protective functions are bypassed on a required actuation signal. This SR is accomplished by verifying the bypass contact changes to the correct state which prevents actuation of the non-critical function. The non-critical protective functions are consistent with References 3 and 4, and Institute of Electrical and Electronic Engineers (IEEE)-387 and are listed in Reference 2, Chapter 8. Verifying the non-critical trips are bypassed will ensure DG operation during a required actuation. The non-critical trips are bypassed during DBAs and provide an alarm on an abnormal engine condition. A failure of the electronic governor results in the diesel generator operating in hydraulic mode. 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 Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.14

This SR ensures that the manual synchronization and load transfer from the DG to the offsite source can be made and that the DG can be returned to ready-to-load status when offsite power is restored. 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 sequence timers are reset.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.1.15

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 SR demonstrates the DG operation during a loss of offsite power actuation test signal in conjunction with an ESF (i.e., safety injection) actuation 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.

It is not necessary to energize loads which are dependent on temperature to load (i.e., heat tracing, switchgear HVAC compressor, computer room HVAC compressor). Also, it is acceptable to transfer the instrument AC bus to the non tested train to maintain safe operation of the plant during testing. Loads (both permanent and auto connect) < 15 kW do not require loading onto the diesel since these are insignificant loads for the DG.

Permanently- and auto-connected loads to the emergency diesel generators are defined as follows:

Permanently-Connected Load – Equipment that is not shed by an undervoltage or safety injection actuation signal and is normally operating, i.e., loads that are manually started, selected, or process signal controlled are not considered permanently-connected loads.

Auto-Connected Loads – Emergency equipment required for mitigating the events described in UFSAR Chapter 14 that are energized by loss-of-coolant incident sequencer actions after step zero and within the first minute of emergency diesel generator operation after the initiation of an undervoltage signal.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note. The reason for the Note is to minimize mechanical wear and stress 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 continuously circulated and temperature maintained consistent with manufacturer recommendations for DGs.

SR 3.8.1.16

This SR lists the SRs that are applicable to the LCO 3.8.1.c (SRs 3.8.1.1, 3.8.1.2, 3.8.1.3, 3.8.1.5, 3.8.1.6, and 3.8.1.7). Performance of any SR for the LCO 3.8.1.c will satisfy both Unit 1 and Unit 2 requirements for those SRs. Surveillance Requirements 3.8.1.4, 3.8.1.8, 3.8.1.9, 3.8.1.10, 3.8.1.11, 3.8.1.12, 3.8.1.13, 3.8.1.14, 3.8.1.15, and 3.8.1.17 are not required to be performed for the LCO 3.8.1.c. Surveillance Requirement 3.8.1.10 is not required because this SR verifies manual transfer of AC power sources from the normal offsite circuit to the alternate offsite circuit, but only one qualified offsite circuit is necessary for the LCO 3.8.1.c. Surveillance Requirements 3.8.1.4, 3.8.1.11, 3.1.8.12, and 3.8.1.17 are not required because they are tests that deal with loads. Surveillance Requirement 3.8.1.8 verifies the interval between sequenced loads. Surveillance Requirement 3.8.1.14 verifies the proper sequencing with offsite power. Surveillance Requirement 3.8.1.9 verifies that the DG starts within 10 seconds. These SRs are not required because they do not support the function of the LCO 3.8.1.c to provide power to the CREVS and CRETS. Surveillance Requirements 3.8.1.13 and 3.8.1.15 are not required to be performed because these SRs verify the emergency loads are actuated on an ESFAS signal for the Unit in which the test is being performed. The LCO 3.8.1.c DG will not start on an ESFAS signal for this Unit.

SR 3.8.1.17

Reference 13 requires demonstration 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 105-110% of the continuous service rating and the remainder of the time at a load equivalent to 90-100% of the continuous service rating. For the Nos. 1B, 2A, and 2B DGs the SR reflects these loading ranges. For the No. 1A DG, since the post accident loading is significantly less than the continuous service rating, the post accident loading (<4000 kW) is used instead of the continuous service rating. Actual testing is performed at a load higher than the post accident loading.

The DG starts for this Surveillance can be performed either from standby or hot conditions. The provisions for prelubricating and warmup, discussed in SR 3.8.1.3 and for gradual loading, discussed in SR 3.8.1.4 are applicable to this SR.

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.

In addition, the post-accident load for No. 1A DG is significantly lower than the continuous rating of No. 1A DG. To ensure No. 1A DG performance is not degraded, routine monitoring of engine parameters should be performed during the performance of this SR for No. 1A DG (Reference 9).

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

BASES

This SR is modified by a Note. Note 1 states that momentary transients due to changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the limit will not invalidate the test.

REFERENCES

1. 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants"
2. UFSAR
3. Regulatory Guide 1.9, Revision 3, "Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants," July 1993
4. Safety Guide 9, Revision 0, March 1971
5. NRC Safety Evaluation for Amendment Nos. 19 and 5 for Calvert Cliffs Nuclear Power Plant Unit Nos. 1 and 2, dated January 14, 1977
6. Regulatory Guide 1.93, Revision 0, "Availability of Electric Power Sources," December 1974
7. Generic Letter 84-15, Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability, July 2, 1984
8. Regulatory Guide 1.137, Revision 1, "Fuel-Oil Systems for Standby Diesel Generators," October 1979
9. Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. C. H. Cruse (BGE), dated April 2, 1996, Issuance of Amendments for Calvert Cliffs Nuclear Power Plant, Unit 1 (TAC No. M94030) and Unit 2 (TAC No. M94031)
10. IEEE Standard 308-1991, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations"
11. NO-1-117, Integrated Risk Management
12. ANSI N195-1976, "Fuel Oil Systems for Standby Diesel-Generators," April 1976, Section 5.4
13. Regulatory Guide 1.9, Revision 4, "Application and Testing of Safety Related Diesel Generators in Nuclear Power Plants," March 2007

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.

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 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 MODEs 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.

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 MODEs 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 DG power.

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

LCO

One offsite circuit capable of supplying the onsite Class 1E power distribution subsystem(s) of LCO 3.8.10, ensures that all required loads are powered from offsite power. An OPERABLE DG, associated with a distribution system train 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 ESF bus(es). Qualified offsite circuits are those that are described in the UFSAR and are part of the licensing basis for the unit.

The DG must be capable of starting, accelerating to rated speed and voltage, connecting to its respective ESF bus, and accepting required loads. The DG must 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 at ambient conditions.

It is acceptable for trains to be cross-tied during shutdown conditions, allowing a single offsite power circuit to supply all required trains.

The CREVS and CRETS are shared systems with one train of each system connected to an onsite Class 1E AC electrical power distribution subsystem from each unit. Limiting Condition for Operation 3.8.2.c requires one qualified circuit between the offsite transmission network and the other unit's onsite Class 1E AC electrical power distribution subsystems needed to supply power to the CREVS and CRETS to be OPERABLE. Limiting Condition for Operation 3.8.2.d requires one DG from the other unit capable of supplying power to the required CREVS and CRETS to be OPERABLE, if the DG required by LCO 3.8.2.b is not capable of supplying power to the required CREVS and CRETS. These requirements, in conjunction with the requirements for the unit AC electrical power sources in LCO 3.8.2.a and LCO 3.8.2.b, ensure that offsite power is available to both trains and onsite power is available to one train of the CREVS and CRETS, when they are required to be OPERABLE by their respective LCOs (LCOs 3.7.8 and 3.7.9).

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;

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.

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

ACTIONS

Limiting Condition for Operation 3.0.3 is not applicable while in MODEs 5 or 6. However, since irradiated fuel assembly movement can occur in MODEs 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODEs 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODEs 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

The ACTIONS have been modified by a second Note stating that performance of Required Actions shall not preclude completion of actions to establish a safe conservative position. This clarification is provided to avoid stopping movement of irradiated fuel assemblies while in a non-conservative position based on compliance with the Required Actions.

A.1

An offsite circuit would be considered inoperable, if it was unavailable to one required ESF train. Although two trains may be required by LCO 3.8.10, the remaining train with offsite power available may be capable of supporting sufficient required features to allow continuation of fuel movement. By the allowance of 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, B.1, B.2, and B.3

With the offsite circuit not available to all required trains, 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 movement of irradiated fuel assemblies, and operations involving positive reactivity additions that could result in loss of the required SHUTDOWN MARGIN (SDM) (MODE 5) or boron concentration (MODE 6). Suspending positive reactivity additions that could result in failure to meet the minimum SDM or boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that required in the RCS for the minimum SDM or refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides an acceptable margin to maintaining subcritical operation. Introduction of temperature changes including temperature increases when operating with a positive moderator temperature coefficient (MTC) must also be evaluated to ensure they do not result in a loss of the required SDM.

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.

Pursuant to LCO 3.0.6, the Electrical Distribution System's ACTIONS are not 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 a train is de-energized. Limiting Condition for Operation 3.8.10 provides the appropriate restrictions for the situation involving a de-energized train.

SURVEILLANCE REQUIREMENTS

SR 3.8.2.1 and SR 3.8.2.2

Surveillance Requirements 3.8.2.1 and 3.8.2.2 require the performance of SRs from LCO 3.8.1 that are necessary for ensuring the OPERABILITY of the AC sources in other than MODEs 1, 2, 3, and 4. Surveillance Requirement 3.8.1.10 is not required to be met, since only one offsite circuit is required to be OPERABLE. Surveillance Requirements 3.8.1.4, 3.8.1.8, 3.8.1.13, and 3.8.1.15 are related to automatic starting of the DGs for an operating unit, which is not applicable for a shutdown unit. Surveillance Requirement 3.8.1.16 is related to LCO 3.8.2.c and 3.8.2.d AC sources, and is addressed by SR 3.8.2.2.

Surveillance Requirement 3.8.2.1 is modified by a Note. The Note lists SRs not required to be performed in order to preclude de-energizing a required 4.16 kV ESF bus or disconnecting a required offsite circuit during performance of SRs. With limited AC Sources available, a single event could compromise both the required circuit and the DG. It is the intent that these SRs must still be capable of being met, but actual performance is not required during periods when the DG and offsite circuit are required to be OPERABLE.

BASES

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

BASES

BACKGROUND

The fuel oil storage tanks (FOSTs) contain sufficient capability for the DGs to operate one unit on accident loads and one unit on shutdown loads for seven days. This is discussed in Reference 1, Chapter 8. This onsite fuel oil capacity is sufficient to operate the DGs for longer than the time to replenish the onsite supply from outside sources.

Fuel oil is transferred from the storage tanks to the day tank by transfer pumps associated with each DG.

For proper operation of the standby DGs, it is necessary to ensure the proper quality of the fuel oil. Testing to check for water and sediment content, the kinematic viscosity, specific gravity (or API gravity), and impurity level (i.e., total particulates) ensures this quality.

The DG fuel oil system design at Calvert Cliffs supports four emergency DGs and other non-safety DGs. Three of the four emergency DGs, i.e., Nos. 1B, 2A, and 2B, are fueled from two FOSTs, i.e., FOST Nos. 11 and 21, and DG No. 1A is fueled from FOST No. 1A. Fuel Oil Storage Tank Nos. 1A and 21 are enclosed such as to be considered "tornado protected" but FOST No. 11 is not protected. As such, FOST No. 11 is not used as the primary source for the emergency DGs, but rather is used as a backup to support FOST No. 21, if it or the fuel oil it contains becomes degraded.

The operability of FOST No. 21 ensures that at least seven days of fuel oil will be available for operation of one DG on each unit, assuming one unit under accident conditions with a DG load of 3500 kW, and the opposite unit under normal shutdown conditions with a DG load of 3000 kW. Additionally, the operability of FOST No. 21 ensures that in the event of a loss of offsite power, concurrent with a loss of the non-bunkered FOST (tornado/missile event), at least seven days of fuel oil will be available for operation of one DG on each unit, assuming both DGs are loaded to 3000 kW. The operability of the FOST No. 1A ensures that at least seven days of fuel oil is available to support operation of DG No. 1A at 4000 kW.

The operability of the fuel oil day tanks ensures that at least one hour of DG operation is available without makeup to the day tanks, assuming DG No. 1A is loaded to 4000 kW and DG Nos. 1B, 2A, and 2B are loaded to 3500 kW.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in Reference 1, and Chapters 6 and 14, assume 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, RCS, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for LCO Section 3.2, 3.4, and 3.6.

Since diesel fuel oil supports the operation of the standby AC power sources, they satisfy 10 CFR 50.36(c)(2)(ii), Criterion 3.

LCO

Fuel Oil Storage Tank No. 1A is required to contain a minimum of 49,500 gallons of available diesel fuel oil which is a sufficient supply to operate DG No. 1A with accident loads for seven days. Fuel Oil Storage Tank No. 21 is required to contain a minimum of 85,000 gallons of available diesel fuel oil which is a sufficient supply to operate one unit with accident loads and one unit with shutdown loads for seven days. It is also required to meet specific standards for quality. This requirement, in conjunction with an ability to obtain replacement supplies within seven days, supports the availability of DGs required to shut down the reactor and to maintain it in a safe condition for an AOO or a postulated DBA with loss of offsite power. Diesel generator day tank fuel requirements, as well as transfer capability from the FOST to the day tank, are addressed in LCO 3.8.1 and LCO 3.8.2.

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 supports LCO 3.8.1 and LCO 3.8.2, stored diesel fuel oil is required to be within limits when the associated DG is required to be OPERABLE.

For both Unit 1 and Unit 2, the FOST No. 1A associated DG is only DG No. 1A. For Unit 1, the FOST No. 21 associated DGs are DG Nos. 1B and 2B. For Unit 2, the FOST No. 21 associated DGs are DG Nos. 2A and 2B. Alignment does not affect the association of DG and FOST since the individual DG fuel oil day tank provides sufficient volume for the DG to perform its safety function while re-alignment is accomplished, if necessary.

ACTIONS

The ACTIONS Table is modified by a Note indicating that separate Condition entry is allowed for each DG. 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.

A.1, B.1, B.2, C.1, C.2, and C.3

In this Condition, the seven day fuel oil supply for a DG is not available. However, fuel oil volume reduction is limited to 6/7 of the required volume which will provide sufficient capacity to operate one DG on one unit on accident loads, and one DG on the other unit on shutdown loads for approximately six days. The fuel oil level ensuring a six day supply is 42,430 gallons (FOST No. 1A) and 72,860 gallons (FOST No. 11, FOST No. 21). 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 DG inoperable. This period is acceptable based on the remaining capacity (approximately six days), the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

Condition A addresses only FOST No. 1A which is "tornado protected" and which contains sufficient fuel for seven days of required operation of DG No. 1A. It supports both Unit 1 and Unit 2 equipment since DG No. 1A provides power for equipment which is shared by both units, e.g., the CREVS.

Condition B addresses only FOST No. 21 which is "tornado protected" and which contains sufficient fuel for seven days of required operation of two DGs. Fuel Oil Storage Tank No. 21 supports both Unit 1 and Unit 2 equipment, but Condition B is written for Unit 1 only to reflect the Unit 1 requirements for DG Nos. 1B and 2B. For an accident, Unit 1 requires either DG No. 1A or both DG Nos. 1B and 2B (since DG No. 2B powers equipment which is redundant to some equipment powered by DG No. 1A, e.g., CREVS). Since DG No. 1A is supported by FOST No. 1A and the redundant required equipment is powered by DG Nos. 1B and 2B which are supported by FOST No. 21, at least one full train of required equipment is supported by a "tornado protected" FOST even with an inoperable FOST or DG. Therefore, low fuel oil volume in FOST No. 21 can be supplemented by the fuel oil volume of an OPERABLE FOST No. 11 to assure the necessary volume. Required Action B.1 requires the combined volume of FOST No. 21 and an OPERABLE FOST No. 11 to be verified to be greater than 6/7 of the required volume within one hour. The Completion Time of one hour is consistent with the time needed to verify through administrative means that the backup FOST is OPERABLE. Required Action B.2 requires the combined volume of FOST No. 21 and an OPERABLE FOST No. 11 to be ≥ 85,000 gallons within 48 hours. In addition, if FOST No. 21 is not restored and FOST No. 11 continues to be relied upon, Required Action B.2 must be repeated every 31 days. This effectively replaces the SR 3.8.3.1 periodic surveillance of available DG fuel oil volume for the inoperable FOST No. 21. Since FOST No. 11 is not required by the LCO, FOST No. 11 may be considered OPERABLE only when the stored fuel oil meets SR 3.8.3.2 and SR 3.8.3.3, and is capable of being delivered to the required DG, i.e., the necessary piping and valves are capable of performing their safety function.

Specific alignment to a particular FOST is not required since the individual DG fuel oil day tank provides sufficient volume for the DG to perform its safety function while re-alignment is accomplished, if necessary. Further, if any fuel oil in FOST No. 11 above the 33,000 gallons reserved for emergency DG use is credited for DG use, appropriate administrative controls must be in place to assure its retention for this purpose.

Condition C also addresses only FOST No. 21 which is "tornado protected" and which contains sufficient fuel for seven days of required operation of two DGs. Fuel Oil Storage Tank No. 21 supports both Unit 1 and Unit 2 equipment, but Condition C is written for Unit 2 only to reflect the Unit 2 requirements for DG Nos. 2A and 2B. For an accident, Unit 2 requires either DG No. 2B or both DG Nos. 1A and 2A (since DG No. 1A powers equipment which is redundant to some equipment powered by DG No. 2B, e.g., CREVS). Unlike Unit 1, at least one full train of required equipment is not supported by a "tornado protected" FOST with an inoperable FOST or DG since most of the redundant required equipment is powered by DG Nos. 2A and 2B which are both supported by FOST No. 21. Therefore, low fuel oil volume in FOST No. 21 can only be supplemented by the fuel oil volume of an OPERABLE FOST No. 11 to assure the necessary volume when the probability for a tornado is sufficiently low. This is reflected in Note 2 for Required Action C.2 which addresses the inoperability of FOST No. 21 from April 1 to September 30. During the time of low tornado probability, the Unit 2 requirements for the inoperability of FOST No. 21 are very similar to the Unit 1 requirements for inoperability of FOST No. 21. It is acceptable for the combined volume of FOST No. 11 and FOST No. 21 to be considered in providing 6/7 of the required volume for the 48 hours allowed by Required Action C.3. Required Action C.1 requires the combined volume of FOST No. 21 and an OPERABLE FOST No. 11 to be verified to be greater than 6/7 of the required volume within one hour. Required Action C.3 then requires the volume of FOST No. 21 to be restored to within volume limits within 48 hours. However, during tornado season, i.e., from April 1 to September 30, the fuel oil volume of FOST No. 11 is not allowed to be credited and the fuel oil seven day volume of

FOST No. 21 must be restored within two hours as indicated in Required Action C.2. Required Action C.2 is also modified by a Note such that it is only required during the operation of Unit 2 in MODEs 1, 2, 3, or 4 since the unit is already shutdown if it is in another MODE or condition. An OPERABLE FOST No. 11 is determined as described above in the discussion for Condition B.

D.1

This Condition is entered as a result of a failure to meet the acceptance criterion of SR 3.8.3.2. 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 SR 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 DG inoperable. The seven day Completion Time allows for further evaluation, resampling, and re-analysis of the DG fuel oil.

E.1

With the new fuel oil properties defined in the Bases for SR 3.8.3.2 not within the required limits, a period of 30 days is allowed for restoring the stored fuel oil properties to within the new fuel oil limits. 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 restore the stored fuel oil properties to within the new fuel oil limits. 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.

F.1

With a Required Action and associated Completion Time not met, or one or more DGs with diesel fuel oil not within limits for reasons other than addressed by Conditions A through E, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable. "Associated DG(s)" are identified in the Applicability Bases.

SURVEILLANCE REQUIREMENTS

SR 3.8.3.1

This SR provides verification that there is an adequate inventory of fuel oil in the DG FOSTs to support one unit on accident loads and one unit on shutdown loads for seven days. The fuel oil level ensuring a seven day supply is 49,500 gallons (FOST No. 1A) and 85,000 gallons (FOST No. 21) when calculated in accordance with References 3 and 4. The required fuel oil storage volume is determined using the most limiting energy content of the stored fuel. Using the limiting energy content, the required diesel generator output and the corresponding fuel oil consumption rate, the onsite fuel oil storage volume required for seven days of operation can be determined. Surveillance Requirement 3.8.3.2 requires new fuel to be tested to verify that the energy content is within the range assumed in the diesel fuel oil consumption calculations. The seven 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 Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.3.2

The tests listed below are a means of determining whether new fuel oil is of the appropriate grade (i.e., 2D and 2D low sulfur) and has not been contaminated with substances that would have an immediate, detrimental impact on diesel engine combustion. Note that further references to American Society for Testing Materials (ASTM) 2D fuel oil include both 2D and 2D low sulfur. 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 tank(s), but in no case is the time between receipt of new fuel and conducting the tests to exceed 31 days. The tests, limits, and applicable ASTM Standards are as follows:

a. Sample the new fuel oil in accordance with Reference 3, ASTM D4057-1995;

b. Verify in accordance with the tests specified in Reference 3, ASTM D975-1996, that the sample has an absolute specific gravity at 60/60°F of ≥ 0.8155 and ≤ 0.8871, or an American Petroleum Institute gravity at 60°F of ≥ 28° and ≤ 42°, a kinematic viscosity at 40°C of ≥ 1.9 centistokes and ≤ 4.1 centistokes, and a flash point ≥ 125°F; and

c. Verify that the new fuel oil has ≤ 0.05% water and sediment (Reference 3, ASTM D975-1996).

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 Reference 2, ASTM D975-1996, Table 1, are met for new fuel oil. 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 SR ensures the availability of high quality fuel oil for the DGs.

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

Particulate concentrations should be determined by gravimetric analysis (based on ASTM D2276-1989) 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. Because the total stored fuel oil volume for DG Nos. 1B, 2A, and 2B is contained in two interconnected tanks, each tank must be considered and tested separately. There is a separate FOST for DG No. 1A.

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 3.8.3.3

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 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, and contaminated fuel oil, and 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 Frequency is controlled under the Surveillance Frequency Control Program. The presence of water does not necessarily represent failure of this SR provided the accumulated water is removed during performance of the surveillance test.

REFERENCES

1. UFSAR
2. ASTM Standards
3. Regulatory Guide 1.137, "Fuel-Oil Systems for Standby Diesel Generators," October 1979
4. ANSI N195-1976, "Fuel Oil Systems for Standby Diesel-Generators," April 1976, Section 5.4

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources-Operating

BASES

BACKGROUND

The station DC sources provide the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment and preferred AC vital bus power (via inverters). As required by Reference 1, Appendix 1C, Criterion 39, the DC electrical power sources are designed to have sufficient independence, redundancy, and testability to perform their safety functions, assuming a single failure. The DC sources also conform to the recommendations of References 2 and 3.

The 125 VDC electrical power sources consist of four independent and redundant safety related Class 1E DC channels. Each channel consists of one 125 VDC battery, two associated battery charger for each battery, and all the associated control equipment and interconnecting cabling.

During normal operation, the 125 VDC load is powered from the battery chargers with the batteries floating on the system. In cases where momentary loads are greater than the charger capability, or a loss of normal power to the battery charger, the DC load is automatically powered from the station batteries.

The DC channels provide the control power for its associated Class 1E AC power load group, 4.16 kV switchgear, and 480 V load centers. The DC channels also provide a DC source to the inverters, which in turn power the AC vital buses.

The DC sources are described in more detail in the Bases for LCO 3.8.9 and for LCO 3.8.10.

Each battery has adequate storage capacity to carry the required load continuously for at least 2 hours and to carry load duty cycle as discussed in Reference 1, Chapter 8.

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each channel is separated physically and electrically from the other channel to ensure that a single failure in one channel does not cause a failure in a redundant channel. There is no sharing between redundant Class 1E channels, such as batteries, battery chargers, or distribution panels.

The batteries for DC channels 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. Battery size is based on 125% of required capacity. An average voltage of 2.13 V per cell, corresponds to a total minimum voltage output of 125 V per battery (128 V for the reserve battery) as discussed in Reference 1, Chapter 8. The criteria for sizing large lead storage batteries are defined in Reference 4.

Each DC channel 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 95% of its fully charged state within 24 hours while supplying normal steady state loads discussed in Reference 1, Chapter 8.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in Reference 1, Chapters 6 and 14, assume that ESF systems are OPERABLE. The DC channels provide a normal and emergency DC sources 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 10 CFR 50.36(c)(2)(ii), Criterion 3.

LCO

The DC channels, each channel consisting of one battery, two battery chargers, 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 AOO or a postulated DBA. Loss of any DC channel does not prevent the minimum safety function from being performed (Reference 1, Chapter 8).

An OPERABLE DC channel requires the battery and one OPERABLE charger to be operating and connected to the associated DC bus(es).

APPLICABILITY

The DC 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 sources requirement for MODEs 5 and 6 are addressed in the Bases for LCO 3.8.5.

ACTIONS

<u>A.1</u>

Required Action A.1 requires the inoperable battery to be replaced by the reserve battery within four hours when one DC channel is inoperable due to an inoperable battery and the reserve battery is available. The reserve battery is a qualified battery that can replace and perform the required function of any inoperable battery. The four hour Completion Time is acceptable based on the capability of the reserve battery and the time it takes to replace the inoperable battery with the reserve battery while minimizing the time in this degraded condition.

<u>B.1</u>

Condition B represents one channel with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. Therefore, it is imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected channel. The 2 hour limit is consistent with the allowed time for an inoperable DC channel.

If one of the required DC channels is inoperable for reasons other than Condition A (e.g., inoperable battery, inoperable battery charger(s), or inoperable battery charger and associated inoperable battery), the remaining DC channels 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 further loss of the 125 VDC channels with attendant loss of ESF functions, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Reference 5 and reflects a reasonable time to assess unit status as a function of the inoperable DC channel and, if the DC channel is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

C.1 and C.2

If the inoperable DC channel 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 unit systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Reference 5.

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge 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 connected loads and the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery (2.13 V per cell average) and are consistent with Reference 6 and the initial state of charge conditions assumed in the battery sizing calculations. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.4.2

Visual inspection to detect corrosion of the battery cells and connections, or measurement of the resistance of each cell to cell and terminal connection, provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

The limits established for this SR must be no more than 20% above the resistance as measured during installation or not above the ceiling value established by the manufacturer.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

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 damage or 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 Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of cell to cell and terminal connections provide an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anti-corrosion 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 connection resistance limits for SR 3.8.4.5 shall be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.4.6

This SR requires that each battery charger be capable of supplying 400 amps and 125 V for ≥ 30 minutes. These requirements are based on the output rating of the chargers (Reference 1, Chapter 8). According to Reference 7, the battery charger supply is required to be 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 test is performed while supplying normal DC loads or an equivalent or greater dummy load.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.4.7

A battery service test is a special test of battery capability, as found and with the associated battery charger disconnected, to satisfy the design requirements (battery duty cycle) of the DC source. The test duration must be ≥ 2 hours and battery terminal voltage must be maintained ≥ 105 volts during the test. The discharge rate and test length should correspond to the design accident load (duty) cycle requirements as specified in Reference 1, Chapter 8. A dummy load simulating the emergency loads of the design duty cycle may be used in lieu of the actual emergency loads.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note. The Note allows the performance of a modified performance discharge test in lieu of a service test. This substitution is acceptable because a modified performance discharge test represents a more severe test of battery capacity than SR 3.8.4.7.

SR 3.8.4.8

A battery performance discharge test is a test of constant current capacity of a battery 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 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 discharge 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 performance discharge test for the duration of time equal to that of the performance discharge test.

A modified performance 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 percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

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 SR are consistent with References 6 and 4. These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer 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 is controlled under the Surveillance Frequency Control Program. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the SR Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the SR Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to Reference 6, when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is ≥ 10% below the manufacturer's rating. These Frequencies are consistent with the recommendations in Reference 6.

REFERENCES

1. UFSAR
2. Safety Guide 6, Revision 0, "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems, August 10, 1971
3. IEEE Standard 308-1974, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations"
4. IEEE Standard 485-1983, "Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations (ANSI)," June 1983
5. Regulatory Guide 1.93, "Availability of Electric Power Sources," December 1974

6. IEEE Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," May 1995

7. Regulatory Guide 1.32, Revision 2, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants," February 1977

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.
APPLICABLE SAFETY ANALYSES	The initial conditions of DBA; and transient analyses in Reference 1, Chapters 6 and 14, assume that ESF systems are OPERABLE. The DC sources provide normal and emergency DC for the DGs, 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 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 sources are provided to mitigate events postulated during shutdown, such as a fuel handling accident. The DC sources satisfy 10 CFR 50.36(c)(2)(ii), Criterion 3.
LCO	The DC channels, each channel consisting of one battery, one battery charger, and the corresponding control equipment and interconnecting cabling within the channel, are required to be OPERABLE to support required trains of distribution systems required OPERABLE by LCO 3.8.10. This ensures the availability of sufficient DC 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 sources required to be OPERABLE in MODEs 5 and 6, and during movement of irradiated fuel assemblies provide assurance that:

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

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

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

The DC channel requirements for MODEs 1, 2, 3, and 4 are covered in LCO 3.8.4.

ACTIONS

Limiting Condition for Operation 3.0.3 is not applicable while in MODE 5 or 6. However, since irradiated fuel assembly movement can occur in MODE 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. 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 MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, in either case, the inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

The ACTIONS have been modified by a second Note stating that performance of REQUIRED ACTIONS shall not preclude completion of actions to establish a safe conservative position. This clarification is provided to avoid stopping movement of irradiated fuel assemblies while in a non-conservative position based on compliance with the REQUIRED ACTIONS.

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

If two trains are required per LCO 3.8.10, the remaining train with DC power available may be capable of supporting sufficient systems to allow continuation of movement of irradiated fuel assemblies. By allowing the option to declare 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. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend 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 channels and to continue this action until restoration is accomplished in order to provide the necessary DC source 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 channels 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

Surveillance Requirement 3.8.5.1 states that surveillance tests required by SR 3.8.4.1 through SR 3.8.4.8 are applicable in these MODEs. 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 SRs. It is the intent that these SRs must still be capable of being met, but actual performance is not required.

BASES

REFERENCES	1.	UFSAR

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

BACKGROUND	This LCO delineates the limits on electrolyte temperature, level, individual cell float voltage (ICV), 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 and LCO 3.8.5.
APPLICABLE SAFETY ANALYSES	The initial conditions of DBA and transient analyses in Reference 1, Chapters 6 and 14, assume ESF systems are OPERABLE. The DC sources provide 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 channels is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit, as discussed in the Bases for LCO 3.8.4 and LCO 3.8.5. Battery cell parameters satisfy Criterion 3 of the NRC Policy Statement.
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 AOO or a postulated DBA. Electrolyte limits are conservatively established, allowing continued DC electrical system function even with Category A or B limits not met.
APPLICABILITY	The battery parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery electrolyte is only required when the DC power source is required to be OPERABLE. Refer to the Applicability discussion in the Bases for LCO 3.8.4 and LCO 3.8.5.
ACTIONS	The Actions Table is modified by a Note which indicates that separate Condition entry is allowed for each battery. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each inoperable DC channel. Complying with the Required Actions for one

inoperable DC channel may allow for continued operation, and subsequent inoperable DC subsystem(s) are governed by separate Condition entry and application of associated Required Actions.

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

With parameters of one or more cells, in one or more batteries, not within limits (i.e., Category A limits not met or Category B limits not met) but within Category C limits specified in Table 3.8.6-1, 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 continued operation is permitted for a limited period.

The pilot cell electrolyte level and ICV are required to be verified to meet the Category C limits within one 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 inspect the electrolyte level and to confirm the ICV 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 will still be 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 seven day intervals until the parameters are restored to Category A and B limits. This periodic verification is consistent with the normal Frequency of pilot cell Surveillances.

BASES

Continued operation prior to declaring the affected batteries inoperable is 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 channel must be declared inoperable. Additionally, other potentially extreme conditions, such as any Required Action of Condition A and associated Completion Time not met, or average electrolyte temperature of representative cells < 69°F, are also cause for immediately declaring the associated DC channel inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

This SR verifies that Category A battery cell parameters are consistent with Reference 2, which recommends regular battery inspections including voltage, specific gravity, and electrolyte temperature of pilot cells.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.6.2

The inspection of specific gravity and voltage is consistent with Reference 2.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.6.3

This Surveillance verification that the average temperature of representative cells is > 69°F is consistent with a recommendation of Reference 2, which states that the temperature of electrolytes in representative cells should be determined. The temperature is also high enough to supply the required capacity.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

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 manufacturer recommendations.

Table 3.8.6-1

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

Category A defines the normal parameter limit for each designated pilot cell in each battery. The cells selected as pilot cells are those 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 Reference 2, 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 temporarily above the specified maximum level during and following equalizing charge (i.e., for up to seven days following the completion of an equalize 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. Reference 2 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 ICV is ≥ 2.13 V per cell. This value is based on a recommendation of Reference 2, 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 ≥ 1.200 (0.015 below the manufacturer fully charged nominal 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 Reference 2, the specific gravity readings are based on a temperature of 77°F (25°C) and full electrolyte level.

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation.

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

The Category B limits specified for electrolyte level and ICV are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ 1.195 (0.020 below the manufacturer fully charged, nominal specific gravity) with the average of all connected cells ≥ 1.205 (0.010 below the manufacturer fully charged, nominal specific gravity). These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures a cell with a marginal or unacceptable specific gravity is not masked by averaging cells having higher specific gravities.

Category C defines the limit 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 limit, the assurance of sufficient capability described above no longer exists and the battery must be declared inoperable.

The Category C limit specified for electrolyte level (above the top of the plates and not overflowing) ensures that the plates suffer no physical damage and maintain adequate electron transfer capability. The Category C limit for ICV is derived from Reference 2 recommendations, 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 $\geq$ 1.195 is based on manufacturer recommendations (0.020 below the manufacturer recommended fully charged, nominal 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 a cell with a marginal or unacceptable specific gravity is not masked by averaging with cells having higher specific gravities.

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 $<$ 1 amp on float charge. This current provides, in general, an indication of acceptable overall battery condition.

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 charging current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in Reference 2.

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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 seven days following a battery equalizing recharge. Within seven 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 seven days.

REFERENCES

1. UFSAR
2. IEEE Standard 4501995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement Vented Lead-Acid Batteries for Stationary Applications," May 1995

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Inverters-Operating

BASES

BACKGROUND

The 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. Each inverter has two built-in independent inverters, either one of which can serve as the preferred source of power. In these dual inverters, 120 volt AC power output can be manually switched from one side to the other side. The inverters can be powered from the DC bus which is energized from the station battery and/or battery chargers. The station battery and the inverters provides an uninterruptible power source for the instrumentation and controls for the Reactor Protective System (RPS) and the ESFAS. Specific details on inverters and their operating characteristics are found in Reference 1, Chapter 8.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in Reference 1, Chapters 6 and 14, assume ESF 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, RCS, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Sections 3.2, 3.4, and 3.6.

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 10 CFR 50.36(c)(2)(ii), Criterion 3.

BASES

LCO

The LCO requires four inverters to be operable, one inverter per AC vital bus. Each AC vital bus can receive power from either side of the dual inverter. Each side of the dual inverter is fully rated, to power the AC vital bus. Therefore, only one side of each dual inverter is required for the inverter to be considered OPERABLE.

The 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 AOO or a postulated DBA.

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 required inverters per unit ensure an uninterruptible supply of AC electrical power to each of the units AC vital buses even if the 4.16 kV safety buses are de-energized.

OPERABLE inverters require the associated vital bus to be powered by either side of the dual inverter with output voltage within tolerances, and power input to the inverter from a 125 VDC station battery. Alternatively, power supply may be from the battery charger 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.

ACTIONS

A.1

With a required inverter inoperable, its associated AC vital bus becomes inoperable until it is manually re-energized from its 120 VAC bus powered by an ESF motor control center through a regulating transformer.

Required Action A.1 is modified by a Note, which states to enter the applicable conditions and Required Actions of LCO 3.8.9, when Condition A is entered with one AC vital bus de-energized. This ensures the vital bus is re-energized within two 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 AC vital bus is powered from its constant voltage source, it is relying upon interruptible AC electrical power sources (offsite and onsite). The uninterruptible inverter source to the AC 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 six 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 unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.8.7.1

This SR 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 of the RPS and ESFAS connected to the AC vital buses. The Surveillance Frequency

BASES

is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. UFSAR

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.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in Reference 1, Chapters 6 and 14, assume ESF systems are OPERABLE. The DC to AC 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, RCS, 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 AC 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 10 CFR 50.36(c)(2)(ii), Criterion 3.

LCO

The inverters ensure the availability of electrical power for the instrumentation for systems required to shut down the reactor and maintain it in a safe condition after an AOO or a postulated DBA. The battery powered inverters provide uninterruptible supply of AC electrical power to the AC vital buses even if the 4.16 kV safety buses are de-energized. OPERABILITY of the inverters requires that the vital bus be powered by the inverter. This ensures the

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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).

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

Limiting Condition for Operation 3.0.3 is not applicable while in MODEs 5 or 6. However, since irradiated fuel assembly movement can occur in MODEs 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODEs 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODEs 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

<u>A.1, A.2.1, A.2.2, and A.2.3</u>

If two trains are required by LCO 3.8.10, the remaining OPERABLE inverters may be capable of supporting sufficient required features to allow continuation of movement of irradiated fuel assemblies, operations with a potential for draining the reactor vessel, and operations with a potential for positive reactivity additions. By the allowance of the option to declare required features inoperable with the associated 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. It is therefore required to suspend movement of irradiated fuel assemblies, and operations involving positive reactivity additions that could result in loss of the required SDM (MODE 5) or boron concentration (MODE 6). Suspending positive reactivity additions that could result in failure to meet the minimum SDM or boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that required in the RCS for the minimum SDM or refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides an acceptable margin to maintaining subcritical operation. Introduction of temperature changes including temperature increases when operating with a positive MTC must also be evaluated to ensure they do not result in a loss of the required SDM.

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 inverters and to continue this action until restoration is accomplished in order to provide the necessary inverter 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 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 SR 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

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voltage output ensures that the required power is readily available for the instrumentation connected to the AC vital buses. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. UFSAR

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.9 Distribution Systems-Operating

BASES

BACKGROUND

The onsite Class 1E AC, DC, and AC vital bus Electrical Power Distribution Systems are divided into two redundant and independent AC electrical power distribution subsystems and four independent and redundant DC and AC vital bus electrical power distribution subsystems (Reference 1, Chapter 8).

The AC primary Electrical Power Distribution System consists of two 4.16 kV ESF buses, each having at least one separate and independent offsite source of power as well as a dedicated onsite DG source. Each 4.16 kV ESF bus is normally connected to a preferred offsite source. After a loss of the preferred offsite power source to a 4.16 kV ESF bus, 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 LCOs 3.8.1 and 3.8.4.

The 480 V system include the safety-related load centers, motor control centers, and distribution panels shown in Table B 3.8.9-1.

The 120 VAC vital buses are divided into four independent and isolated subsystems and are normally supplied from an inverter. The alternate power supply for the vital buses are non-Class 1E 120 VAC Buses fed from a Class 1E ESF motor control center through the regulating transformer, and its use is governed by LCO 3.8.7. Each constant voltage source transformer is powered from a Class 1E AC bus.

There are four independent 125 VDC electrical power distribution subsystems.

The list of all required Distribution Systems-Operating is presented in Table B 3.8.9-1.

APPLICABLE SAFETY ANALYSES

The initial conditions of DBA and transient analyses in Reference 1, Chapters 6 and 14, assume ESF systems are OPERABLE. The AC, DC, and AC 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, RCS, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Sections 3.2, 3.4, and 3.6.

The OPERABILITY of the AC, DC, and AC 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 10 CFR 50.36(c)(2)(ii), Criterion 3.

LCO

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

Maintaining the AC, DC, and AC 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 AC electrical power distribution subsystems require the associated buses, load centers, motor control centers, and distribution panels to be energized to their proper voltages. OPERABLE DC electrical power distribution subsystems require the associated buses to be energized to their proper voltage from either the associated battery or charger. OPERABLE vital bus electrical distribution subsystems require the associated buses to be energized to their proper voltage.

In addition, tie breakers between redundant safety-related AC, DC, and AC vital bus distribution subsystems, if they exist, must be open. This prevents any electrical malfunction in any distribution subsystem from propagating to the redundant subsystem, which 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 distribution subsystems are considered inoperable. This applies to the onsite, safety-related redundant electrical power distribution subsystems.

APPLICABILITY

The electrical 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 distribution subsystem requirements for MODEs 5 and 6 are covered in the Bases for LCO 3.8.10.

ACTIONS

A.1

With one or more required AC buses, load centers, motor control centers, or distribution panels, except AC vital buses, inoperable and a loss of function has not yet occurred, the remaining 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 power distribution subsystems could result in the minimum required ESF functions not being supported. Therefore, the required AC buses, load centers, motor control centers, and distribution panels must be restored to OPERABLE status within eight hours.

Condition A worst scenario is one train without AC power (i.e., no offsite power to the train 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 train by stabilizing the unit, and on restoring power to the affected train. The eight 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 train, 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 train with AC power.

B.1

With one or more AC vital buses inoperable and a loss of Function has not yet occurred, the remaining OPERABLE AC 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 AC vital bus must be restored to OPERABLE status within two hours by powering the bus from an associated inverter via DC or the non-Class 1E 120 VAC bus powered by an ESF motor control center through a regulating transformer.

Condition B represents one or more AC vital buses without power; potentially both the DC source and the associated AC source are non-functioning. 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 vital bus.

This two hour limit is more conservative than Completion Times allowed for the vast majority of components that are without adequate vital AC power. Taking exception to LCO 3.0.2 for components without adequate vital AC power, which would have the Required Action Completion Times shorter than two 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 AC power and not providing sufficient time for the operators to perform the necessary evaluations and actions for restoring power to the affected train; and

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

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

C.1

With one DC bus inoperable, the remaining DC 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 DC electrical power distribution subsystem could result in the minimum required ESF functions not being supported. Therefore, the DC bus must be restored to OPERABLE status within two hours by powering the bus from the associated battery or charger.

Condition C represents one DC bus without adequate DC power; potentially both with the battery significantly degraded and the associated charger nonfunctioning. 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 trains and restoring power to the affected train.

This two hour limit is more conservative than Completion Times allowed for the vast majority of components which 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;

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 train; and

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

The two hour Completion Time for DC buses is consistent with Reference 2.

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 six 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 unit systems.

E.1

Condition E corresponds to a level of degradation in the electrical distribution system that causes a required safety function to be lost. When more than one inoperable electrical power distribution subsystem results in the loss of a required function, the plant is in a condition outside the accident analysis. Therefore, no additional time is justified for continued operation. Limiting Condition for Operation 3.0.3 must be entered immediately to commence a controlled shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.8.9.1

This SR verifies that the AC, DC, and AC 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 Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. UFSAR
2. Regulatory Guide 1.93, "Availability of Electric Power Sources," December 1974

Table B 3.8.9-1 (page 1 of 1)

AC and DC Electrical Power Distribution Systems[1]

4160 Volt Emergency Bus No. 11 (Unit 1), No. 21 (Unit 2)
4160 Volt Emergency Bus No. 14 (Unit 1), No. 24 (Unit 2)
480 Volt Emergency Bus No. 11A (Unit 1), No. 21A (Unit 2)
480 Volt Emergency Bus No. 11B (Unit 1), No. 21B (Unit 2)
480 Volt Emergency Bus No. 14A (Unit 1), No. 24A (Unit 2)
480 Volt Emergency Bus No. 14B (Unit 1), No. 24B (Unit 2)
480 Volt Emergency Bus No. 104R (Unit 1), No. 204R (Unit 2)
480 Volt Emergency Bus No. 114R (Unit 1), No. 214R (Unit 2)
120 Volt AC Vital Bus No. 11 (Unit 1), No. 21 (Unit 2)
120 Volt AC Vital Bus No. 12 (Unit 1), No. 22 (Unit 2)
120 Volt AC Vital Bus No. 13 (Unit 1), No. 23 (Unit 2)
120 Volt AC Vital Bus No. 14 (Unit 1), No. 24 (Unit 2)
125 Volt DC Bus No. 11 (Unit 1 and Unit 2)
125 Volt DC Bus No. 12 (Unit 1 and Unit 2)
125 Volt DC Bus No. 21 (Unit 1 and Unit 2)
125 Volt DC Bus No. 22 (Unit 1 and Unit 2)

[1] Each bus of the AC and DC Electrical Power Distribution System is a subsystem.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.10 Distribution Systems-Shutdown

BASES

BACKGROUND

A description of the AC, DC, and AC vital bus Electrical Power Distribution Systems is provided in the Bases for LCO 3.8.9.

The list of all required Distribution Systems-Shutdown is presented in Table B 3.8.10-1.

APPLICABLE SAFETY ANALYSES

The initial conditions of a DBA and transient analyses in Reference 1, Chapters 6 and 14, assume ESF systems are OPERABLE. The AC, DC, and AC 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, RCS, and containment design limits are not exceeded.

The OPERABILITY of the AC, DC, and AC 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 AC, DC, and AC 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 AC and DC Electrical Power Distribution Systems satisfy 10 CFR 50.36(c)(2)(ii), Criterion 3.

BASES

LCO

Various combinations of subsystems, equipment, and components are required OPERABLE by other LCOs, depending on the specific unit condition. 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 and DC 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 AC vital bus electrical power distribution subsystem requirements for MODEs 1, 2, 3, and 4 are covered in LCO 3.8.9.

ACTIONS

Limiting Condition for Operation 3.0.3 is not applicable while in MODEs 5 or 6. However, since irradiated fuel assembly movement can occur in MODEs 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODEs 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODEs 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

The ACTIONS have been modified by a second Note stating that performance of Required Actions shall not preclude completion of actions to establish a safe conservative position. This clarification is provided to avoid stopping movement of irradiated fuel assemblies while in a non-conservative position based on compliance with the Required Actions.

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

Although redundant required features may require redundant trains of electrical power distribution subsystems to be OPERABLE, one OPERABLE distribution subsystem train may be capable of supporting sufficient required features to allow continuation of movement of irradiated fuel assemblies. 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 subsystems 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 movement of irradiated fuel assemblies, and operations involving positive reactivity additions that could result in loss of the required SDM (MODE 5) or boron concentration (MODE 6)]. Suspending positive reactivity additions that could result in failure to meet the minimum SDM or boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that required in the RCS for the minimum SDM or refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides an acceptable margin to maintaining subcritical operation. Introduction of temperature changes including temperature increases when operating with a positive MTC must also be evaluated to ensure they do not result is a loss of the required SDM.

BASES

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 AC and DC 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 shutdown cooling (SDC) subsystem may be inoperable. In this case, Required Actions A.2.1 through A.2.3 do not adequately address the concerns relating to coolant circulation and heat removal. Pursuant to LCO 3.0.6, the SDC ACTIONS would not be entered. Therefore, Required Action A.2.4 is provided to direct declaring SDC inoperable, which results in taking the appropriate SDC actions. The SDC subsystem(s) declared inoperable and not in operation as a result of not meeting this LCO, may be used if needed. However, the appropriate actions are still required to be taken.

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.

SURVEILLANCE REQUIREMENTS

SR 3.8.10.1

This SR verifies that the AC, DC, and AC vital bus Electrical Power Distribution System is 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 Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. UFSAR

Table B 3.8.10-1 (page 1 of 1)
AC and DC Electrical Power Distribution Systems

1	4160 Volt Emergency Bus
1	480 Volt Emergency Bus
2	120 Volt AC Vital Busses
2	125 Volt DC Busses
2	125 Volt Battery Banks (one of which may be the reserve battery) (one associated battery charger per battery bank supplying the required DC busses)