

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.2 AC Sources – Shutdown

BASES

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BACKGROUND	A description of the AC sources is provided in the Bases for LCO 3.8.1, "AC Sources – Operating."
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APPLICABLE SAFETY ANALYSES	The OPERABILITY of the minimum AC sources during MODES 4 and 5, and during movement of irradiated fuel assemblies in the secondary containment ensures that:
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- a. The facility 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 an inadvertent draindown of the vessel or a fuel handling accident.

In general, when the unit is shutdown 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 loss of all onsite power is not required. The rationale for this is based on the fact that many Design Basis Accidents (DBAs) that are analyzed in MODES 1, 2, and 3 have no specific analyses in MODES 4 and 5. Worst case bounding events are deemed not credible in MODES 4 and 5 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and corresponding stresses result in the probabilities of occurrences significantly reduced or eliminated, and 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, and 3, various deviations from the analysis assumptions and design requirements are allowed within the ACTIONS. This allowance is in recognition that

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BASES

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APPLICABLE  
SAFETY ANALYSES  
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certain testing and maintenance activities must be conducted, provided an acceptable level of risk is not exceeded. During MODES 4 and 5, performance of a significant number of required testing and maintenance activities is also required. In MODES 4 and 5, the activities are generally planned and administratively controlled. Relaxations from typical MODES 1, 2, and 3 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 operation 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, and 3 OPERABILITY requirements) with systems assumed to function during an event.

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

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

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LCO

One offsite circuit supplying the onsite Class 1E power distribution subsystem(s) of LCO 3.8.8, "Distribution Systems – Shutdown," ensures that all required loads are powered from offsite power. An OPERABLE DG, associated with a Distribution System Essential Service System (ESS) bus required OPERABLE by LCO 3.8.8, ensures that a diverse power source is available for providing electrical power support

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BASES

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LCO  
(continued)

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 plant in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents and reactor vessel draindown).

The qualified offsite circuit(s) must be capable of maintaining rated frequency and voltage while connected to their respective ESS bus(es), and of accepting required loads during an accident. Qualified offsite circuits are those that are described in the UFSAR and are part of the licensing basis for the unit. The offsite circuit from the 345 kV switchyard consists of the incoming breakers and disconnects to the 12 or 22 reserve auxiliary transformer (RAT), associated 12 or 22 RAT, and the respective circuit path including feeder breakers to 4160 kV ESS buses required by LCO 3.8.8. Another qualified circuit is provided by the bus tie between the corresponding ESS buses of the two units.

The required DG must be capable of starting, accelerating to rated speed and voltage, connecting to its respective 4160 V ESS bus on detection of bus undervoltage, and accepting required loads. This sequence must be accomplished within 10 seconds. Each DG must also be capable of accepting required loads within the assumed loading sequence intervals, and must continue to operate until offsite power can be restored to the 4160 V ESS buses. These capabilities are required to be met from a variety of initial conditions such as DG in standby with engine hot and DG in standby with engine at ambient conditions. Additional DG capabilities must be demonstrated to meet required Surveillances. Proper sequencing of loads, including tripping of nonessential loads, is a required function for DG OPERABILITY. The necessary portions of the DG Cooling Water System capable of providing cooling to the required DG is also required.

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

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BASES (continued)

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APPLICABILITY      The AC sources are required to be OPERABLE in MODES 4 and 5 and during movement of irradiated fuel assemblies in the secondary containment to provide assurance that:

- a.    Systems providing adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core in case of an inadvertent draindown of the reactor vessel;
- 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.

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

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ACTIONS            LCO 3.0.3 is not applicable while in MODE 4 or 5. However, since irradiated fuel assembly movement can occur in MODE 1, 2, or 3, 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 4 or 5, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Entering LCO 3.0.3 while in MODE 1, 2, or 3 would require the unit to be shutdown, but would not require immediate suspension of movement of irradiated fuel assemblies. The Note to the ACTIONS, "LCO 3.0.3 is not applicable," ensures that the actions for immediate suspension of irradiated fuel assembly movement are not postponed due to entry into LCO 3.0.3.

A.1

An offsite circuit is considered inoperable if it is not available to one required ESS 4160 V ESS bus. If two or more 4160 V ESS buses are required per LCO 3.8.8, one

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BASES

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ACTIONS

A.1 (continued)

division with offsite power available may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. By the allowance of the option to declare required features inoperable that are not powered from offsite power, appropriate restrictions can be implemented in accordance with the required feature(s) LCOs' ACTIONS. Required features remaining powered from a qualified offsite circuit, even if that circuit is considered inoperable because it is not powering other required features, are not declared inoperable by this Required Action. For example, if both Division 1 and 2 ESS buses are required OPERABLE by LCO 3.8.8 and only the Division 1 ESS buses are not capable of being powered from offsite power, then only the required features powered from Division 1 ESS buses are required to be declared inoperable.

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

With the required offsite circuit not available to all required divisions, the option still exists to declare all required features inoperable per Required Action A.1. Since this option may involve undesired administrative efforts, the allowance for sufficiently conservative actions is made. With the required DG inoperable, the minimum required diversity of AC power sources is not available. It is, therefore, required to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies in the secondary containment, and activities that could result in inadvertent draining of the reactor vessel.

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 sources and to continue this action until restoration is accomplished in order to provide the necessary AC power to the plant safety systems.

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BASES

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ACTIONS

A.2.1, A.2.2, A.2.3, A.2.4, B.1, B.2, B.3, and B.4  
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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 plant safety systems may be without sufficient power.

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it are inoperable, resulting in de-energization. Therefore, the Required Actions of Condition A have been modified by a Note to indicate that when Condition A is entered with no AC power to any required ESS bus, ACTIONS for LCO 3.8.8 must be immediately entered. This Note allows Condition A to provide requirements for the loss of the offsite circuit whether or not a division is de-energized. LCO 3.8.8 provides the appropriate restrictions for the situation involving a de-energized division.

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.2.1

SR 3.8.2.1 requires the SRs from LCO 3.8.1 that are necessary for ensuring the OPERABILITY of the AC sources in other than MODES 1, 2, and 3 to be applicable. SR 3.8.1.9 is not required to be met since only one offsite circuit is required to be OPERABLE. SR 3.8.1.20 is excepted because starting independence is not required with the DG(s) that is not required to be OPERABLE. SR 3.8.1.21 is not required to be met because the opposite unit's DG is not required to be OPERABLE in MODES 4 and 5, and during movement of irradiated fuel assemblies in secondary containment. Refer to the corresponding Bases for LCO 3.8.1 for a discussion of each SR.

This SR is modified by two Notes. The reason for Note 1 is to preclude requiring the OPERABLE DG(s) from being paralleled with the offsite power network or otherwise rendered inoperable during the performance of SRs, and to preclude de-energizing a required 4160 V ESS bus or disconnecting a required offsite circuit during performance

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.2.1 (continued)

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. Note 2 states that SRs 3.8.1.13 and 3.8.1.19 are not required to be met when its associated ECCS subsystem(s) are not required to be OPERABLE. These SRs demonstrate the DG response to an ECCS initiation signal (either alone or in conjunction with a loss of offsite power signal). This is consistent with the ECCS instrumentation requirements that do not require the ECCS initiation signals when the associated ECCS subsystem is not required to be OPERABLE per LCO 3.5.2, "ECCS – Shutdown."

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REFERENCES

None.

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Diesel Fuel Oil and Starting Air

BASES

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**BACKGROUND** For proper operation of the standby DGs, it is necessary to ensure the proper quality of the fuel oil. Regulatory Guide 1.137 (Ref. 1) addresses the recommended fuel oil practices as supplemented by ANSI N195 (Ref. 2). The fuel oil properties governed by these SRs are the water and sediment content, the flashpoint and kinematic viscosity, specific gravity (or API gravity), and impurity level.

Each DG has a starting air system that includes two pair of air receivers. Each pair has adequate capacity for three successive starts without recharging the air start receivers.

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**APPLICABLE SAFETY ANALYSES** The initial conditions of Design Basis Accident (DBA) and transient analyses in UFSAR, Chapter 6 (Ref. 3), and Chapter 15 (Ref. 4), assume Engineered Safety Feature (ESF) systems are OPERABLE. The DGs are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.5, Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling (RCIC) System; and Section 3.6, Containment Systems.

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

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**LCO** Stored diesel fuel oil is required to meet specific standards for quality. This requirement supports the availability of DGs required to shut down the reactor and to maintain it in a safe condition for an anticipated operational occurrence (AOO) or a postulated DBA with loss of offsite power.

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BASES

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LCO  
(continued)            The starting air system is required to have a minimum capacity for three successive DG starts without recharging the air start receivers.

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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. Because stored diesel fuel oil and starting air subsystems support LCO 3.8.1 and LCO 3.8.2, stored diesel fuel oil and starting air are required to be within limits when the associated DG is required to be OPERABLE.

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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

This Condition is entered as a result of a failure to meet the acceptance criterion for particulates. Normally, trending of particulate levels allows sufficient time to correct high particulate levels prior to reaching the limit of acceptability. Poor sample procedures, 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, since particulate concentration is unlikely to change significantly between Surveillance Frequency intervals, and since 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 7 day Completion Time allows for further evaluation, resampling, and re-analysis of the DG fuel oil.

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BASES

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ACTIONS  
(continued)

B.1

With the new fuel oil properties defined in the Bases for SR 3.8.3.1 not within the required limits, a period of 30 days is allowed for restoring the stored fuel oil properties. This period provides sufficient time to test the stored fuel oil to determine that the new fuel oil, when mixed with previously stored fuel oil, remains acceptable, or to restore the stored fuel oil properties. This restoration may involve feed and bleed procedures, filtering, or combination 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 high likelihood that the DG would still be capable of performing its intended function.

C.1

With the required starting air receiver pressure < 230 psig, sufficient capacity for three successive DG starts does not exist. However, as long as the receiver pressure is  $\geq$  175 psig, there is adequate capacity for at least one start, and the DG can be considered OPERABLE while the air receiver pressure is restored to the required limit. A period of 48 hours is considered sufficient to complete restoration to the required pressure prior to declaring the DG inoperable. This period is acceptable based on the remaining air start capacity, the fact that most DG starts are accomplished on the first attempt, and the low probability of an event during this brief period.

D.1

With a Required Action and associated Completion Time of Condition A, B, or C not met, or the stored diesel fuel oil or starting air subsystem not within limits for reasons other than addressed by Condition A, B, or C, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable.

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BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.3.1

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

- a. Sample the new fuel oil in accordance with ASTM D4057-95 (Ref. 5);
- b. Verify that the new fuel oil sample has: (1) an absolute specific gravity at 60°F of  $\geq 0.80$  and  $\leq 0.85$  for ASTM Number 1 fuel oil ( $\geq 0.83$  and  $\leq 0.89$  for ASTM Number 2 fuel oil) or an API gravity at 60°F of  $\geq 35$  and  $\leq 45$  for ASTM Number 1 fuel oil ( $\geq 27$  and  $\leq 39$  for ASTM Number 2 fuel oil) when tested in accordance with ASTM D1298-99 (Ref. 5); (2) a kinematic viscosity at 40°C of  $\geq 1.3$  centistokes for ASTM Number 1 fuel oil ( $\geq 1.9$  centistokes for ASTM Number 2 fuel oil) and  $\leq 2.4$  centistokes for ASTM Number 1 fuel oil ( $\leq 4.1$  centistokes for ASTM Number 2 fuel oil) when tested in accordance with ASTM D445-97 (Ref. 5); and (3) a flash point of  $\geq 100^\circ\text{F}$  for ASTM Number 1 fuel oil ( $\geq 125^\circ\text{F}$  for ASTM Number 2 fuel oil) when tested in accordance with ASTM D93-99c (Ref. 5); and
- c. Verify that the new fuel oil has a clear and bright appearance with proper color when tested in accordance with ASTM D4176-93 (Ref. 5) or a water and sediment content within limits when tested in accordance with ASTM D2709-96e (Ref. 5). The clear and bright appearance with proper color test is only applicable to fuels that meet the ASTM color requirements (i.e., ASTM color 5 or less).

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.3.1 (continued)

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.

Following the initial new fuel oil sample, the fuel oil is analyzed within 31 days following addition of the new fuel oil to the fuel oil storage tank(s) to establish that the other properties specified in Table 1 of ASTM D975-98b (Ref. 5) are met for new fuel oil when tested in accordance with ASTM D975-98b (Ref. 5), except that the analysis for sulfur may be performed in accordance with ASTM D1552-95 (Ref. 5), ASTM D2622-98 (Ref. 5), or ASTM D4294-98 (Ref. 5). The 31 day period is acceptable because the fuel oil properties of interest, even if they were not within stated limits, would not have an immediate effect on DG operation. This Surveillance ensures the availability of high quality fuel oil for the DGs.

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

Particulate concentrations should be determined in accordance with ASTM D5452-98 (Ref. 5). This method involves a gravimetric determination of total particulate concentration in the fuel oil and has a limit of 10 mg/l. It is acceptable to obtain a field sample for subsequent laboratory testing in lieu of field testing.

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 3.8.3.2

This Surveillance ensures that, without the aid of the refill compressor, sufficient air start capacity for each DG is available. The system design requirements provide for a

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.3.2 (continued)

minimum of three engine starts without recharging. The pressure specified in this SR is intended to support the lowest value at which the three starts can be accomplished.

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

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REFERENCES

1. Regulatory Guide 1.137, Rev. 1, October 1979.
  2. ANSI N195, 1976.
  3. UFSAR, Chapter 6.
  4. UFSAR, Chapter 15.
  5. ASTM Standards: D4057-95; D1298-99; D445-97; D93-99c; D4176-93; D2709-96e; D975-98b; D1552-95; D2622-98; D4294-98; and D5452-98.
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources – Operating

BASES

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BACKGROUND

The DC electrical power systems provide the AC emergency power system with control power. They also provide both motive and control power to selected safety related equipment. Also, these DC subsystems provide DC electrical power to inverters, which in turn power the AC essential service buses. As required by UFSAR, Section 8.3.2 (Ref. 1), the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system is consistent with the recommendations of Safety Guide 6 (Ref. 2) and IEEE-308 (Ref. 3).

The 250 VDC electrical power sources provide motive power to larger DC loads such as DC motor-driven pumps and valves. Each unit includes a 250 VDC source consisting of a 250 VDC battery and an associated 250 VDC full capacity battery charger. An additional 250 VDC full capacity (swing) charger is available for use between the units. The swing charger can only be aligned to one battery at a time. Each 250 VDC battery and charger supplies power to both Unit 1 and Unit 2 loads. Therefore, for the purposes of this Specification, each unit has two 250 VDC electrical power subsystems. One 250 VDC electrical power subsystem includes the associated unit 250 VDC battery and full capacity battery charger while the other 250 VDC electrical power subsystem includes the opposite unit 250 VDC battery and the full capacity charger. The normal supply to each 250 VDC full capacity charger is via a 480 V Division 2 power supply from the associated unit. The swing charger can be powered from a Division 1 bus for each unit.

The Division 1 and 2 125 VDC electrical power sources provide control power to selected safety related equipment as well as circuit breaker control power for 4160 V, 480 V, control relays and annunciators. Each unit includes a 125 VDC source consisting of a 125 VDC battery and two 125 VDC full capacity chargers (normal and spare). Each 125 VDC unit source (125 VDC battery and associated chargers) supplies power to the associated unit Division 1

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BASES

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BACKGROUND  
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125 VDC electrical power distribution subsystem and the opposite unit Division 2 125 VDC electrical power distribution subsystem. The Division 1 and 2 125 VDC electrical power distribution subsystems provide power to redundant loads, therefore both unit 125 VDC sources are needed to support the operation of both units. These sources are referred to as the Division 1 and 2 125 VDC electrical power sources since they supply the associated units Division 1 and 2 125 VDC electrical power distribution subsystems, respectively. In addition, the Division 2 125 VDC electrical power distribution subsystems provide control power to safety related loads common to both units such as the Standby Gas Treatment System. Therefore, the opposite unit Division 2 125 VDC electrical power distribution subsystem is needed to support the operations of the given unit. This source is referred to as the opposite unit's 125 VDC electrical power subsystem; however it receives power from the given units battery and full capacity chargers. The design also includes an alternate battery for each 125 VDC electrical power distribution subsystem. However, the design configuration of the alternate battery is susceptible to single failure and therefore, is not reliable as a normal 125 VDC source. The loads between the redundant 125/250 VDC subsystem are not automatically transferable except for the Automatic Depressurization System and the 1/2 diesel generator, the logic circuits and valves of which are normally fed from the Division 1 125 VDC system.

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC loads are automatically powered from the associated battery.

The DC power distribution system is described in more detail in Bases for LCO 3.8.7, "Distribution System—Operating," and LCO 3.8.8, "Distribution System—Shutdown."

Each battery has adequate storage capacity to carry the required normal loads plus all loads required for safe shutdown on one unit and operations required to limit the consequences of a design basis event on the other unit for a period of 4 hours (Ref. 1).

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BASES

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BACKGROUND  
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The DC batteries associated with each unit are housed in a ventilated room apart from its charger and distribution buses. This arrangement ensures redundant subsystems are located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, battery chargers, or distribution buses.

The 125 VDC batteries for DC electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 105 V. For the 250 VDC batteries, the minimum allowable battery capacity is based on the capacity margin calculated for the design load profile. The minimum design voltage limit is 210 V.

Each DC electrical power subsystem battery charger 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 station service battery charger has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads (Ref. 1).

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APPLICABLE  
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 4) and Chapter 15 (Ref. 5), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining 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

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BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

- b. A worst case single failure.
- The DC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).
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LCO

The DC electrical power subsystems—with: a) each 250 VDC subsystem consisting of one 250 VDC battery, one battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated unit bus, b) the Division 1 125 VDC subsystem consisting of the unit 125 VDC battery, one full capacity battery charger, a unit bus, and the corresponding control equipment and interconnecting cabling to the associated unit 125 VDC Division 1 bus, c) the Division 2 125 VDC subsystem consisting of the opposite unit 125 VDC battery, one full capacity battery charger, opposite unit buses, and all the corresponding control equipment, interconnecting cabling, and bus ties up to the unit 125 VDC Division 2 bus, and d) the opposite unit Division 2 125 VDC subsystem consisting of the unit 125 VDC battery, one full capacity battery charger, unit buses, and the corresponding control equipment, interconnecting cabling, and bus ties up to the associated opposite unit 125 VDC Division 2 bus are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 1).

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APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, and 3 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.

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BASES

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APPLICABILITY (continued)      The DC electrical power requirements for MODES 4 and 5 and other conditions in which the DC electrical power sources are required are addressed in LCO 3.8.5, "DC Sources – Shutdown."

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ACTIONS

A.1

Condition A represents one 250 VDC electrical power subsystem with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of 250 VDC power to the affected buses.

If one 250 VDC electrical power subsystem is inoperable (e.g., inoperable battery, inoperable required battery charger, or inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary 250 VDC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 72 hours. The Completion Time is based on the capacity and capability of the remaining 250 VDC subsystem.

B.1 and B.2

Condition B, Division 1 or 2 125 VDC battery inoperable as a result of maintenance or testing, represents one division with a loss of ability to completely respond to an event. It is therefore imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected division. Operation in this Condition is needed during the operating cycle to ensure the battery is maintained OPERABLE. Condition B is modified by a Note indicating that the Condition is only applicable when the opposite unit is in MODE 1, 2, or 3.

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(continued)

BASES

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ACTIONS            B.1 and B.2 (continued)

If one of the 125 VDC batteries is inoperable, the remaining 125 VDC electrical power subsystem has the capacity to support a safe shutdown of one unit and to mitigate an accident condition in the other unit. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation is limited. Required Action B.2 limits the time the unit can operate in this condition to 7 cumulative days per operating cycle, for any one battery. Therefore, each 125 VDC battery can be removed from service to perform maintenance or testing as long as the cumulative time is not exceeded for that battery. In addition, Required Action B.1 requires the associated OPERABLE alternate 125 VDC electrical power subsystem to be placed in service. An OPERABLE alternate 125 VDC electrical power subsystem consists of the alternate 125 VDC battery and one full capacity battery charger. For the alternate 125 VDC battery to be considered OPERABLE, all SR requirements associated with the alternate 125 VDC battery must be met. (The full capacity battery charger is the same battery charger (normal or spare) associated with the normal 125 VDC electrical power subsystem.) Therefore, placement of the OPERABLE alternate 125 VDC electrical power subsystem in service will help ensure that the design basis can be met. However, the design configuration of the alternate battery is susceptible to single failure and hence, is not as reliable as the normal battery. Therefore, only a limited time of operation is allowed in this condition.

The 72 hour Completion Time to place the associated OPERABLE alternate 125 VDC electrical power subsystem in service provides sufficient time to safely remove the Division 1 or 2 125 VDC electrical power subsystem from service and place the alternate supply in service. The 7 day cumulative Completion Time is based on the capacity and capability of the remaining DC Sources, including the enhanced capability afforded by the capability of the alternate 125 VDC electrical power subsystem to supply the required loads.

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(continued)

BASES

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ACTIONS  
(continued)

C.1 and C.2

Condition C, Division 1 or 2 125 VDC battery inoperable due to the need to replace the battery as determined by maintenance or testing, represents one division with a loss of ability to completely respond to an event. It is therefore imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected division. Operation in this Condition may be needed during the operating cycle to completely replace a battery to maintain the Division 1 or 2 VDC subsystem OPERABLE for the remainder of the cycle. Condition C is modified by a Note indicating that the Condition is only applicable when the opposite unit is in MODE 1, 2, or 3.

If one of the 125 VDC batteries is inoperable, the remaining 125 VDC electrical power subsystem has the capacity to support a safe shutdown of one unit and to mitigate an accident condition in the other unit. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation is limited. Required Action C.2 limits the time the unit can operate in this condition to 7 days. Therefore, each 125 VDC battery can be removed from service to completely replace a battery. In addition, Required Action C.1 requires the associated OPERABLE alternate 125 VDC electrical power subsystem to be placed in service. An OPERABLE alternate 125 VDC electrical power subsystem consists of the alternate 125 VDC battery and one full capacity battery charger. For the alternate 125 VDC battery to be considered OPERABLE, all SR requirements associated with the alternate 125 VDC battery must be met. (The full capacity battery charger is the same battery charger (normal or spare) associated with the normal 125 VDC electrical power subsystem.) Therefore, placement of the OPERABLE alternate 125 VDC electrical power subsystem in service will help ensure that the design basis can be met. However, the design configuration of the alternate battery is susceptible to single failure and hence, is not as reliable as the normal battery. Therefore, only a limited time of operation is allowed in this condition.

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BASES

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ACTIONS

C.1 and C.2 (continued)

The 72 hour Completion Time to place the associated OPERABLE alternate 125 VDC electrical power subsystem in service provides sufficient time to safely remove the Division 1 or 2 125 VDC electrical power subsystem from service and place the alternate supply in service. The 7 day Completion Time to restore the 125 VDC battery is based on the capacity and capability of the remaining DC Sources, including the enhanced capability afforded by the capability of the alternate 125 VDC electrical power subsystem to supply the required loads.

D.1 and D.2

With one Division 1 or 2 125 VDC electrical power subsystem inoperable for reasons other than Condition B or C represents one division with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of 125 VDC power to the affected division.

If one 125 VDC electrical power subsystem is inoperable (e.g., inoperable battery, inoperable required battery charger, or inoperable required battery charger and associated inoperable battery), the remaining 125 VDC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 72 hours. The Completion Time of Required Action D.1 to restore the 125 VDC electrical power subsystem to OPERABLE status is based on the capacity, reliability and capability of the remaining 125 VDC subsystem.

Required Action D.2 is modified by a Note indicating that the action is only applicable if the opposite unit is not in MODE 1, 2, or 3. In this condition, the shutdown unit is under maintenance and a complete test of at least one 125 VDC subsystem may be necessary. Required Action D.2

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(continued)

BASES

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ACTIONS

D.1 and D.2 (continued)

requires the OPERABLE alternate 125 VDC electrical power subsystem to be placed in service in 72 hours. The 72 hour Completion Time to place associated OPERABLE alternate 125 VDC electrical power subsystem in service provides sufficient time to safely remove the Division 1 or 2 125 VDC electrical power subsystem from service and place the alternate supply in service. An OPERABLE alternate 125 VDC electrical power subsystem consists of the alternate 125 VDC battery and one full capacity battery charger. For the alternate 125 VDC battery to be considered OPERABLE, all SR requirements associated with the alternate 125 VDC battery must be met. (The full capacity battery charger is the same battery charger (normal or spare) associated with the normal 125 VDC electrical power subsystem.) Upon completing this Required Action continuous operation is allowed, since if the opposite unit associated OPERABLE alternate 125 VDC electrical power subsystem is placed in service supplying the unit Division 2 loads, the design configuration will not be susceptible to single failure and hence, the reliability is consistent with the normal circuit.

E.1

With the opposite unit Division 2 125 VDC electrical power system inoperable, certain redundant Division 2 features (e.g., Standby Gas Treatment System) will not function if a design basis event were to occur. With a standby gas treatment subsystem inoperable, LCO 3.6.4.3, "Standby Gas Treatment System" requires restoration of the inoperable SGT subsystem to OPERABLE status in 7 days. Therefore, a 7 day Completion Time is provided to restore the opposite unit Division 2 125 VDC electrical power subsystem to OPERABLE status. The 7 day Completion Time is based on consideration of such factors as the availability of the OPERABLE redundant system(s) and the low probability of a DBA occurring during this time period.

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(continued)

BASES

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ACTIONS  
(continued)

F.1 and F.2

If the DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and to MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 4 is consistent with the time required in Regulatory Guide 1.93 (Ref. 6).

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.4.1

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

SR 3.8.4.2

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

The connection resistance limits established for this SR are within the values established by industry practice. The connection resistance limits of this SR are related to the resistance of individual bolted connections and do not include the resistance of conductive components (e.g., cables or conductors located between cells, racks, or tiers).

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(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.4.2 (continued)

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

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical 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 24 month Frequency for the Surveillance is based on engineering judgement. Operating experience has shown that these components usually pass the SR when performed at the 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of intercell and terminal connections provides 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 this Surveillance.

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.4.4 and SR 3.8.4.5 (continued)

The connection resistance limits established for this SR are within the values established by industry practice. The connection resistance limits of this SR are related to the resistance of individual bolted connections and do not include the resistance of conductive components (e.g., cables or conductors located between cells, racks, or tiers).

The 24 month Frequency for the Surveillance is based on engineering judgement. Operating experience has shown that these components usually pass the SR when performed at the 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.8.4.6

Battery charger capability requirements are based on the design capacity of the chargers (Ref. 1). According to Regulatory Guide 1.32 (Ref. 8), 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 Frequency is acceptable given the administrative controls existing to ensure adequate charger performance during these 24 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

SR 3.8.4.7

A battery service test is a special test of the battery's capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The test can be performed using simulated or actual loads. The discharge rate and test length corresponds to the design duty cycle requirements as specified in Reference 1.

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(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.4.7 (continued)

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

This SR is modified by a Note. The Note allows the performance of a modified performance discharge test in lieu of a service test provided the modified performance discharge test completely envelopes the service test. This substitution is acceptable because a modified performance 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, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

A battery modified performance discharge test is a simulated duty cycle normally 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. (The test can consist of a single rate if the test rate employed for the performance discharge test exceeds the 1 minute rate and continues to envelope the duty cycle of the service test.) Since the ampere-hours removed by a rated one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.

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(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.4.8 (continued)

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 when the modified performance discharge test is performed in lieu of the 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.

For the 125 VDC battery, the acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 7) and IEEE-485 (Ref. 9). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating, since IEEE-485 (Ref. 9) recommends using an aging factor of 125% in the battery size calculation. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. However, since the 250 VDC batteries are not sized consistent with IEEE-485 (Ref. 9), they must be replaced when their actual capacity is below the minimum acceptable battery capacity based on the load profile, which is a value greater than 80% of the manufacturer's rating.

The Frequency for this test is normally 60 months. 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 Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity  $\geq$  100% of the manufacturer's rating. Degradation is indicated, consistent with IEEE-450 (Ref. 7), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is

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(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.4.8 (continued)

≥ 10% below the manufacturer's rating. The 12 month and 60 month Frequencies are consistent with the recommendations in IEEE-450 (Ref. 7). The 24 month Frequency is derived from the recommendations of IEEE-450 (Ref. 7).

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REFERENCES

1. UFSAR, Section 8.3.2.
  2. Safety Guide 6, March 10, 1971.
  3. IEEE Standard 308, 1978.
  4. UFSAR, Chapter 6.
  5. UFSAR, Chapter 15.
  6. Regulatory Guide 1.93, Revision 0, December 1974.
  7. IEEE Standard 450, 1987.
  8. Regulatory Guide 1.32, Revision 2, February 1977.
  9. IEEE Standard 485, 1978.
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources – Shutdown

BASES

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BACKGROUND            A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources – Operating."

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APPLICABLE SAFETY ANALYSES    The initial conditions of Design Basis Accident and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators (DGs), emergency auxiliaries, and control and switching during all MODES of operation and during movement of irradiated fuel assemblies in the secondary containment.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum DC electrical power sources during MODES 4 and 5 and during movement of irradiated fuel assemblies in the secondary containment ensures that:

- a. The facility can be maintained in the shutdown or refueling condition for extended periods;
- b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and
- c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or 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

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BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

many Design Basis Accidents (DBAs) that are analyzed in MODES 1, 2, and 3 have no specific analyses in MODES 4 and 5. Worst case bounding events are deemed not credible in MODES 4 and 5 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.

The shutdown Technical Specification requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case Design Basis Accidents which are analyzed for operating MODES are generally viewed not to be a significant concern during shutdown MODES due to the lower energies involved. The Technical Specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, have found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," as an industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

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

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LCO

The DC electrical power subsystems—with: a) the required 250 VDC subsystem consisting of one 250 VDC battery, one battery charger, and the corresponding control equipment and interconnecting cabling supplying power to the associated bus; and b) the required 125 VDC subsystem consisting of one battery, one battery charger, and the corresponding control equipment and interconnecting cabling supplying power to the

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BASES

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LCO  
(continued) associated bus—are required to be OPERABLE to support some of the required DC distribution subsystems required OPERABLE by LCO 3.8.8, "Distribution Systems—Shutdown." This requirement ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents and inadvertent reactor vessel draindown). The associated alternate 125 VDC electrical power subsystem may be used to satisfy the requirements of the 125 VDC subsystem.

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APPLICABILITY The DC electrical power sources required to be OPERABLE in MODES 4 and 5 and during movement of irradiated fuel assemblies in the secondary containment provide assurance that:

- a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core in case of an inadvertent draindown of the reactor vessel;
- b. Required features needed to mitigate a fuel handling accident are available;
- c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and
- d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

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

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ACTIONS LCO 3.0.3 is not applicable while in MODE 4 or 5. However, since irradiated fuel assembly movement can occur in MODE 1, 2, or 3, 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 4 or 5, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in

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BASES

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ACTIONS (continued)      MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Entering LCO 3.0.3 while in MODE 1, 2, or 3 would require the unit to be shutdown, but would not require immediate suspension of movement of irradiated fuel assemblies. The Note to the ACTIONS, "LCO 3.0.3 is not applicable," ensures that the actions for immediate suspension of irradiated fuel assembly movement are not postponed due to entry into LCO 3.0.3.

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

By allowance of the option to declare required features inoperable with associated DC electrical power subsystem(s) inoperable, appropriate restrictions are implemented in accordance with the affected system LCOs' ACTIONS. However, in many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies in the secondary containment, and any activities that could result in inadvertent draining of the reactor vessel).

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 DC electrical power subsystems and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the plant safety systems.

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

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.5.1

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

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.5.1 (continued)

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE 250 VDC source 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.

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REFERENCES

1. UFSAR, Chapter 6.
  2. UFSAR, Chapter 15.
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

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**BACKGROUND** This LCO delineates the limits on electrolyte temperature, level, float voltage, and specific gravity for the DC electrical power subsystems batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources - Operating," and LCO 3.8.5, "DC Sources - Shutdown."

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**APPLICABLE SAFETY ANALYSES** The initial conditions of Design Basis Accident (DBA) and transient analyses in UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power subsystems provide normal and emergency DC electrical power for the diesel generators (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 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.

Since battery cell parameters support the operation of the DC electrical power subsystems, they satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

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**LCO** Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Electrolyte limits are conservatively established, allowing continued DC electrical system function even with Category A and B limits not met.

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**APPLICABILITY** The battery cell parameters are required solely for the support of the associated DC electrical power subsystem. Therefore, these cell parameters are only required when the associated DC electrical power subsystem is required to be OPERABLE. Refer to the Applicability discussions in Bases for LCO 3.8.4 and LCO 3.8.5.

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BASES (continued)

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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 electrical power subsystem. Complying with the Required Actions for one inoperable DC electrical power subsystem may allow for continued operation, and subsequent inoperable DC electrical power 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 Table 3.8.6-1 limits (i.e., Category A limits not met or Category B limits not met, or Category A and B limits not met) but within the Category C limits specified in Table 3.8.6-1, 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(s) electrolyte level and float voltage are required to be verified to meet the Category C limits within 1 hour (Required Action A.1). This check provides 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 float voltage of the pilot cell(s). One hour is considered a reasonable amount of time to perform the required verification.

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

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BASES

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ACTIONS

A.1, A.2, and A.3 (continued)

7 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.

Continued operation is only permitted for 31 days before battery cell parameters must be restored to within Category A and B limits. Taking into 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 for operation prior to declaring the associated DC batteries inoperable.

B.1

When any battery parameter is outside the Table 3.8.6-1 Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not ensured and the corresponding DC electrical power subsystem 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  $\leq 65^{\circ}\text{F}$ , also are cause for immediately declaring the associated DC electrical power subsystem inoperable.

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.6.1

This SR verifies that Table 3.8.6-1 Category A battery cell parameters are consistent with IEEE-450 (Ref. 3), which recommends regular battery inspections (at least one per month) including voltage, specific gravity, and electrolyte level of pilot cells.

SR 3.8.6.2

The quarterly inspection of specific gravity, voltage, and electrolyte level for each connected cell is consistent with IEEE-450 (Ref. 3). In addition, within 7 days of a battery discharge  $< 105\text{ V}$  for a 125 V battery and  $< 210\text{ V}$  for a

(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.6.2 (continued)

250 V battery or a battery overcharge > 150 V for a 125 V battery and > 300 V for a 250 V battery, the battery must be demonstrated to meet Table 3.8.6-1 Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to < 105 V or < 210 V, as applicable, do not constitute a battery discharge provided the battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge. The 7 day requirement is based on engineering judgement.

SR 3.8.6.3

This Surveillance verification that the average temperature of representative cells is within limits is consistent with a recommendation of IEEE-450 (Ref. 3) that states that the temperature of electrolytes in representative cells should be determined on a quarterly basis. For this SR, a check of 10% of the connected cells is considered representative.

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's recommendations and the battery sizing calculation.

Table 3.8.6-1

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

Category A defines the normal parameter limit for each designed 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.

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BASES

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SURVEILLANCE  
REQUIREMENTS

Table 3.8.6-1 (continued)

The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra  $\frac{1}{4}$  inch allowance above the high water level indication for operating margin to account for temperature 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, for a limited time, following an equalizing charge (normally up to 3 days following the completion of an equalize charge to allow electrolyte stabilization), provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 3) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

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

The Category A limit specified for specific gravity for each pilot cell is  $\geq 1.200$  (0.015 below the manufacturer's 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 IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. 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. Level correction will be in accordance with manufacturer's recommendations.

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

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(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS

Table 3.8.6-1 (continued)

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

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

The Category C 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 voltage is based on IEEE-450 (Ref. 3), which states that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.

The Category C limit on average specific gravity  $\geq 1.195$ , is based on manufacturer's recommendations (0.020 below the manufacturer's 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 more 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.

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BASES

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SURVEILLANCE  
REQUIREMENTS

Table 3.8.6-1 (continued)

The footnotes to Table 3.8.6-1 that apply to specific gravity are applicable to Category A, B, and C specific gravity. Footnote (b) requires the above mentioned correction for electrolyte level and temperature.

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 of the designated pilot cell. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote (c) allows the float charge current to be used as an alternate to specific gravity for up to 7 days following a battery recharge. Within 7 days, each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements may be made in less than 7 days.

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REFERENCES

1. UFSAR, Chapter 6.
  2. UFSAR, Chapter 15.
  3. IEEE Standard 450, 1995.
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Distribution Systems – Operating

BASES

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BACKGROUND

The onsite Class 1E AC electrical power distribution system for each unit is divided into redundant and independent AC electrical power distribution subsystems.

Each AC distribution subsystem consists of two 4160 V Essential Service System (ESS) buses having an offsite source of power as well as an onsite diesel generator (DG) source. During normal operation, each subsystem's ESS buses are connected such that power is supplied to the Division 2 4160 V loads from the unit's main generator through a unit auxiliary transformer (UAT) and from the 345 kV system through the reserve auxiliary transformer (RAT) to supply the Division 1 4160 V loads. The UAT and RAT are connected in a normal – alternate power source arrangement for each of the 4160 V divisions (i.e., the RAT provides alternate power for the Division 2 ESS buses and the UAT for the Division 1 ESS buses). During a loss of the normal offsite power source to the 4160 V ESS buses, the alternate supply breaker attempts to close. If all offsite sources are unavailable, the onsite emergency unit DGs supply power to the 4160 V ESS buses.

Each AC distribution subsystem also includes 480 VAC ESS buses 18 and 19 (Unit 1) and buses 28 and 29 (Unit 2), associated motor control centers, transformers and distribution panels.

The 120 VAC instrument bus is normally powered from 480 VAC bus 18-2 for Unit 1 and 480 VAC MCC 28-2 for Unit 2. The alternate power supply for the Unit 1 120 VAC instrument bus is supplied from 480 VAC MCC 15-2 and the Unit 2 120 VAC instrument bus is supplied from 480 VAC MCC 25-2. On a loss of normal power to the instrument bus an automatic bus transfer (ABT) switches to the alternate supply and automatically switches back to the normal supply when the normal supply is restored. However, the instrument bus ABT is only provided for reliability and is not required to be OPERABLE (i.e., only one power source to the instrument bus is required).

(continued)

BASES

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BACKGROUND  
(continued)

The 120 VAC essential services bus is supplied by a static uninterruptible power supply (UPS). Power to the UPS is supplied, in order of preference; for Unit 1 by 480 VAC bus 18, 250 VDC MCC 2, or 480 VAC bus 17; and for Unit 2 by 480 VAC bus 28, 250 VDC MCC 1, or 480 VAC bus 26.

There are two independent 250 VDC station service electrical power distribution subsystems and two independent 125 VDC electrical power distribution subsystems that support the necessary power for ESF functions. The 250 VDC electrical power distribution subsystem provides motive power to large DC loads such as DC motor-driven pumps and valves. Division 1 and 2 125 VDC electrical power distribution subsystems provide control power to selected safety related equipment as well as circuit breaker control power for 4160 V, 480 V, control relays, and annunciators. The Division 2 125 VDC subsystem for each unit is provided power by the opposite unit's battery and provides control power to a shared standby gas treatment subsystem.

The list of required distribution buses for Unit 1 and Unit 2 is presented in Tables B 3.8.7-1 and B 3.8.7-2, respectively.

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APPLICABLE  
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume ESF systems are OPERABLE. The AC and DC electrical power distribution systems are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.5, Emergency Core Cooling Systems (ECCS) and Reactor Core Isolation Cooling (RCIC) System; and Section 3.6, Containment Systems.

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

(continued)

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BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

- a. An assumed loss of all offsite power or all onsite AC electrical power; and
- b. A worst case single failure.

The AC and DC electrical power distribution system satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

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LCO

The required electrical power distribution subsystems listed in Table B 3.8.7-1 for Unit 1 and Table B 3.8.7-2 for Unit 2 ensure the availability of AC and DC electrical power for the systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. The AC and DC electrical power distribution subsystems are required to be OPERABLE. As noted in Table B 3.8.7-1 and Table B 3.8.7-2 (Footnote a), each division of the AC and DC electrical power distribution systems is a subsystem.

Maintaining the Division 1 and 2 AC and DC electrical power distribution subsystems OPERABLE, as well as the portions of the opposite unit's AC and DC electrical power distribution subsystems necessary to support equipment required to be OPERABLE by LCO 3.6.4.3, "Standby Gas Treatment (SGT) System," LCO 3.7.4, "Control Room Emergency Ventilation (CREV) System" (Unit 2 only), LCO 3.7.5, "Control Room Emergency Ventilation Air Conditioning (AC) System (Unit 2 only), and LCO 3.8.1, "AC Sources – Operating," 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.

The AC electrical power distribution subsystems require the associated buses and electrical circuits 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.

Based on the number of safety significant electrical loads associated with each bus listed in Table B 3.8.7-1 for Unit 1 and Table B 3.8.7-2 for Unit 2, if one or more of the

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BASES

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LCO  
(continued)

buses becomes inoperable, entry into the appropriate ACTIONS of LCO 3.8.7 is required. Some buses, such as distribution panels, which help comprise the AC and DC distribution systems are not listed in Table B 3.8.7-1 for Unit 1 and Table B 3.8.7-2 for Unit 2. The loss of electrical loads associated with these buses may not result in a complete loss of a redundant safety function necessary to shut down the reactor and maintain it in a safe condition. Therefore, should one or more of these buses become inoperable due to a failure not affecting the OPERABILITY of a bus listed in Table B 3.8.7-1 for Unit 1 and Table B 3.8.7-2 for Unit 2 (e.g., a breaker supplying a single distribution panel fails open), the individual loads on the bus would be considered inoperable, and the appropriate Conditions and Required Actions of the LCOs governing the individual loads would be entered. However, if one or more of these buses is inoperable due to a failure also affecting the OPERABILITY of a bus listed in Table B 3.8.7-1 for Unit 1 and Table B 3.8.7-2 for Unit 2 (e.g., loss of 4160 V ESS bus, which results in de-energization of all buses powered from the 4160 V ESS bus), then although the individual loads are still considered inoperable, the Conditions and Required Actions of the LCO for the individual loads are not required to be entered, since LCO 3.0.6 allows this exception (i.e., the loads are inoperable due to the inoperability of a support system governed by a Technical Specification; the 4160 V ESS bus).

In addition, tie breakers between redundant safety related AC and DC power distribution subsystems must be open. This prevents any electrical malfunction in any power 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 between redundant safety related AC or DC power distribution subsystems are closed, the electrical power distribution subsystem that is not being powered from its normal source (i.e., it is being powered from its redundant electrical power distribution subsystem) is considered inoperable. This applies to the onsite, safety related, redundant electrical power distribution subsystems. It does not, however, preclude redundant Class 1E 4160 V ESS buses from being powered from the same offsite circuit.

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(continued)

BASES (continued)

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APPLICABILITY      The electrical power distribution subsystems are required to be OPERABLE in MODES 1, 2, and 3 to ensure that:

- a.    Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and
- b.    Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

Electrical power distribution subsystem requirements for MODES 4 and 5 and other conditions in which AC and DC electrical power distribution subsystems are required are covered in the Bases for LCO 3.8.8, "Distribution Systems – Shutdown."

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ACTIONS

A.1

With one or more required AC buses, motor control centers, or distribution panels 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 electrical power distribution subsystems could result in the minimum required ESF functions not being supported. Therefore, the required AC buses, motor control centers, and distribution panels must be restored to OPERABLE status within 8 hours.

The Condition A worst scenario is one division without AC power (i.e., no offsite power to the division and the associated DG inoperable). In this situation, the unit is more vulnerable to a complete loss of AC power. It is, therefore, imperative that the unit operators' attention be focused on minimizing the potential for loss of power to the remaining division by stabilizing the unit and restoring power to the affected division. The 8 hour time limit before requiring a unit shutdown in this Condition is acceptable because of:

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BASES

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ACTIONS

A.1 (continued)

- a. The potential for decreased safety if the unit operators' attention is diverted from the evaluations and actions necessary to restore power to the affected division to the actions associated with taking the unit to shutdown within this time limit.
- b. The low potential for an event in conjunction with a single failure of a redundant component in the division with AC power. (The redundant component is verified OPERABLE in accordance with Specification 5.5.11, "Safety Function Determination Program (SFDP).")

The second Completion Time for Required Action A.1 establishes a limit on the maximum time allowed for any combination of required distribution subsystems to be inoperable during any single contiguous occurrence of failing to meet LCO 3.8.7.a. If Condition A is entered while, for instance, a DC electrical power distribution subsystem is inoperable and subsequently returned OPERABLE, LCO 3.8.7.a may already have been not met for up to 2 hours. This situation could lead to a total duration of 10 hours, since initial failure of LCO 3.8.7.a to restore the AC electrical power distribution system. At this time a DC electrical power distribution subsystem could again become inoperable, and the AC electrical power distribution subsystem could be restored OPERABLE. This could continue indefinitely.

This Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This results in establishing the "time zero" at the time LCO 3.8.7.a was initially not met, instead of at the time Condition A was entered. The 16 hour Completion Time is an acceptable limitation on this potential to fail to meet LCO 3.8.7.a indefinitely.

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(continued)

BASES

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ACTIONS  
(continued)

B.1

With one or more DC buses inoperable and a loss of safety function has not yet occurred, the remaining DC electrical power distribution subsystem is 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 required DC electrical power distribution subsystem(s) must be restored to OPERABLE status within 2 hours by powering the bus from the associated battery or charger.

Condition B worst scenario is one subsystem without adequate DC power, potentially with both the battery significantly degraded and the associated charger nonfunctioning. In this situation the plant 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 plant, minimizing the potential for loss of power to the remaining subsystem, and restoring power to the affected subsystem.

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

- a. The potential for decreased safety when requiring a change in plant conditions (i.e., requiring a shutdown) while not allowing stable operations to continue;
- b. The potential for decreased safety when requiring entry into numerous applicable Conditions and Required Actions for components without DC power, while not providing sufficient time for the operators to perform the necessary evaluations and actions for restoring power to the affected division;

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BASES

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ACTIONS

B.1 (continued)

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

The 2 hour Completion Time for DC electrical power distribution subsystems is consistent with Regulatory Guide 1.93 (Ref. 3).

The second Completion Time for Required Action B.1 establishes a limit on the maximum time allowed for any combination of required distribution subsystems to be inoperable during any single contiguous occurrence of failing to meet LCO 3.8.7.a. If Condition B is entered while, for instance, an AC electrical power distribution subsystem is inoperable and subsequently restored OPERABLE, LCO 3.8.7.a may already have been not met for up to 8 hours. This situation could lead to a total duration of 10 hours, since initial failure of LCO 3.8.7.a, to restore the DC electrical power distribution subsystem. At this time, an AC electrical power distribution subsystem could again become inoperable, and DC electrical power distribution could be restored OPERABLE. This could continue indefinitely.

This Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This allowance results in establishing the "time zero" at the time LCO 3.8.7.a was initially not met, instead of at the time Condition B was entered. The 16 hour Completion Time is an acceptable limitation on this potential of failing to meet LCO 3.8.7.a indefinitely.

C.1

With one or more required opposite unit AC or DC electrical power distribution subsystems inoperable, the redundant required features of the standby gas treatment (SGT) subsystem may not function if a design basis event were to occur. In addition, Unit 1 and Unit 2 share the single train Control Room Emergency Ventilation (CREV) and the associated Air Conditioning (AC) System. Since these

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BASES

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ACTIONS

C.1 (continued)

systems are powered only from Unit 1, an inoperable Unit 1 AC electrical power distribution subsystem could result in a loss of the CREV System and Control Room Emergency Ventilation AC System functions (for both units).

With a standby gas treatment (SGT) subsystem inoperable, LCO 3.6.4.3 requires restoration of the inoperable SGT subsystem to OPERABLE status in 7 days. Similarly, with the CREV System inoperable, LCO 3.7.4 requires restoration of the inoperable CREV System to OPERABLE status within 7 days. With the Control Room Emergency Ventilation AC System inoperable, LCO 3.7.5 requires restoration of the inoperable Control Room Emergency Ventilation AC System to OPERABLE status in 30 days. Therefore, a 7 day Completion Time is provided to restore the required opposite unit AC and DC electrical power subsystems to OPERABLE status. The 7 day Completion Time is based on consideration of such factors as the availability of the OPERABLE redundant system(s) and the low probability of a DBA occurring during this time period.

The Required Action is modified by a Note indicating that the applicable Conditions of LCO 3.8.1 be entered and Required Actions taken if the inoperable opposite unit AC electrical power distribution subsystem results in an inoperable required offsite circuit. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

D.1 and D.2

If the inoperable distribution subsystem cannot be restored to OPERABLE status within the associated Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours and to MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

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(continued)

BASES

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ACTIONS  
(continued)

E.1

Condition E corresponds to a level of degradation in the electrical power distribution system that causes a required safety function to be lost. When the inoperability of two or more AC or DC electrical power distribution subsystems, in combination, 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. LCO 3.0.3 must be entered immediately to commence a controlled shutdown. The term "in combination" means that the loss of function must result from the inoperability of two or more AC and DC electrical power distribution subsystems; a loss of function solely due to a single AC or DC electrical power distribution subsystem inoperability even with another AC or DC electrical power distribution subsystem concurrently inoperable, does not require entry into Condition E.

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SURVEILLANCE  
REQUIREMENTS

SR 3.8.7.1

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

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REFERENCES

1. UFSAR, Chapter 6.
  2. UFSAR, Chapter 15.
  3. Regulatory Guide 1.93, December 1974.
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Table B 3.8.7-1 (page 1 of 1)  
Unit 1 AC and DC Electrical Power Distribution Systems

TYPE	VOLTAGE	DIVISION 1 <sup>(a)</sup>	DIVISION 2 <sup>(a)(b)</sup>
AC safety bus	4160 V	ESS buses 13, 13-1	ESS buses 14, 14-1
	480 V	ESS bus 18	ESS bus 19
	120 V	Unit essential services bus, unit instrument bus	NA
250 VDC buses	250 V	NA	TB MCC 1, RB MCC 1A, RB MCC 1B
125 VDC buses	125 V	TB main buses 1A, 1A-1; RB distribution panel 1	TB main bus 2A; TB reserve buses 1B and 1B-1

- (a) Each division of the AC and DC electrical power distribution systems is a subsystem. The 250 VDC buses constitute a single subsystem (Division 2).
- (b) OPERABILITY requirements of the opposite unit's Division 1 and Division 2 AC and DC electrical power distribution systems require OPERABILITY of the 4160 VAC bus 24-1, 480 VAC bus 29, essential services 120 VAC bus (must be powered from 480 VAC bus 28, 250 VDC TB MCC 2, or 480 VAC MCC 28-2), and 125 VDC bus 2B.

Table B 3.8.7-2 (page 1 of 1)  
Unit 2 AC and DC Electrical Power Distribution Systems

TYPE	VOLTAGE	DIVISION 1 <sup>(a)</sup>	DIVISION 2 <sup>(a)(b)</sup>
AC safety bus	4160 V	ESS buses 23, 23-1	ESS bus 24, 24-1
	480 V	ESS bus 28	ESS bus 29
	120 V	Unit essential services bus, unit instrument bus	NA
250 VDC buses	250 V	NA	TB MCC 2, RB MCC 2A, RB MCC 2B
125 VDC buses	125 V	TB main bus 2A, 2A-1; RB distribution panel 2	TB main bus 1A; TB reserve buses 2B, 2B-1

- (a) Each division of the AC and DC electrical power distribution systems is a subsystem. The 250 VDC buses constitute a single subsystem (Division 2).
- (b) OPERABILITY requirements of the opposite unit's Division 1 and Division 2 AC and DC electrical power distribution systems require OPERABILITY of the 4160 VAC bus 14-1, 480 VAC bus 19, essential services 120 VAC bus (must be powered from 480 VAC bus 18, 250 VDC TB MCC 1, or 480 VAC MCC 18-2), and 125 VDC bus 1B.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.8 Distribution Systems – Shutdown

BASES

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BACKGROUND            A description of the AC and DC electrical power distribution systems is provided in the Bases for LCO 3.8.7, "Distribution Systems – Operating."

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APPLICABLE SAFETY ANALYSES        The initial conditions of Design Basis Accident and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature (ESF) systems are OPERABLE. The AC and DC electrical power distribution systems are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System, and containment design limits are not exceeded.

The OPERABILITY of the AC and DC 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 and DC electrical power sources and associated power distribution subsystems during MODES 4 and 5, and during movement of irradiated fuel assemblies in the secondary containment ensures that:

- a. The facility 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 an inadvertent draindown of the vessel or a fuel handling accident.

The AC and DC electrical power distribution systems satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

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(continued)

BASES (continued)

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LCO Various combinations of subsystems, equipment, and components are required OPERABLE by other LCOs, depending on the specific plant condition. Implicit in those requirements is the required OPERABILITY of necessary support features. This LCO explicitly requires energization of the portions of the electrical distribution system, including the opposite unit electrical distribution systems, necessary to support OPERABILITY of Technical Specifications required systems, equipment, and components - both specifically addressed by their own LCO, and implicitly required by the definition of OPERABILITY.

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

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APPLICABILITY The AC and DC electrical power distribution subsystems required to be OPERABLE in MODES 4 and 5 and during movement of irradiated fuel assemblies in the secondary containment provide assurance that:

- a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core in case of an inadvertent draindown of the reactor vessel;
- 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 and DC electrical power distribution subsystem requirements for MODES 1, 2, and 3 are covered in LCO 3.8.7.

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(continued)

BASES (continued)

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ACTIONS

LCO 3.0.3 is not applicable while in MODE 4 or 5. However, since irradiated fuel assembly movement can occur in MODE 1, 2, or 3, 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 4 or 5, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Entering LCO 3.0.3 while in MODE 1, 2, or 3 would require the unit to be shutdown, but would not require immediate suspension of movement of irradiated fuel assemblies. The Note to the ACTIONS, "LCO 3.0.3 is not applicable," ensures that the actions for immediate suspension of irradiated fuel assembly movement are not postponed due to entry into LCO 3.0.3.

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

Although redundant required features may require redundant divisions of electrical power distribution subsystems to be OPERABLE, one OPERABLE distribution subsystem division may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. By allowing the option to declare required features associated with an inoperable distribution subsystem inoperable, appropriate restrictions are implemented in accordance with the affected distribution subsystem LCO's Required Actions. In many instances this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made, (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies in the secondary containment, and any activities that could result in inadvertent draining of the reactor vessel).

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 plant safety systems.

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(continued)

BASES

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ACTIONS A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5 (continued)

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

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

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SURVEILLANCE  
REQUIREMENTS SR 3.8.8.1

This Surveillance verifies that the required AC and DC electrical power distribution subsystems are functioning properly, with the buses energized. The verification of proper voltage availability on the buses ensures that the required power is readily available for motive as well as control functions for critical system loads connected to these buses. The 7 day Frequency takes into account the redundant capability of the electrical power distribution subsystems, as well as other indications available in the control room that alert the operator to subsystem malfunctions.

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- REFERENCES
1. UFSAR, Chapter 6.
  2. UFSAR, Chapter 15.
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B 3.9 REFUELING OPERATIONS

B 3.9.1 Refueling Equipment Interlocks

BASES

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BACKGROUND

Refueling equipment interlocks restrict the operation of the refueling equipment or the withdrawal of control rods to reinforce unit procedures that prevent the reactor from achieving criticality during refueling. The refueling interlock circuitry senses the conditions of the refueling equipment and the control rods. Depending on the sensed conditions, interlocks are actuated to prevent the operation of the refueling equipment or the withdrawal of control rods.

UFSAR, Sections 3.1.5.3 and 3.1.5.4, require that one of the two required independent reactivity control systems be capable of holding the reactor core subcritical under cold conditions (Ref. 1). The control rods, when fully inserted, serve as the system capable of maintaining the reactor subcritical in cold conditions during all fuel movement activities and accidents.

Two channels of instrumentation are provided to sense the position of the refueling platform and the full insertion of all control rods. Additionally, inputs are provided for the loading of the refueling platform main hoist fuel grapple, the loading of the refueling platform trolley frame mounted hoist, the loading of the refueling platform monorail mounted hoist, and the full retraction of the fuel grapple. With the reactor mode switch in the shutdown or refuel position, the indicated conditions are combined in logic circuits to determine if all restrictions on refueling equipment operations and control rod insertion are satisfied.

A control rod not at its full-in position interrupts power to the refueling equipment to prevent operating the equipment over the reactor core when loaded with a fuel assembly. Conversely, the refueling equipment located over the core and loaded with fuel inserts a control rod withdrawal block in the Reactor Manual Control System to prevent withdrawing a control rod.

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BASES

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BACKGROUND  
(continued)

The refueling platform has two mechanical switches that open before the platform or any of its hoists are physically located over the reactor vessel. The fuel grapple main hoist load is sensed by an electronic load cell. The fuel grapple main hoist load signals are inputs to a programmable logic controller (PLC). The PLC performs the associated interlock and load functions. The monorail and frame-mounted hoist use hydraulic load cells in conjunction with a force switch that perform their associated interlock and load functions. The PLC opens the associated fuel-loaded circuits at a load lighter than the combined weight of a single fuel assembly and inner-most mast section assembly in water. The electronic setpoint modules open the associated fuel-loaded circuits at a load lighter than the weight of a single fuel assembly in water.

The refueling interlocks use these indications to prevent operation of the refueling equipment with fuel loaded over the core whenever any control rod is withdrawn, or to prevent control rod withdrawal whenever fuel loaded refueling equipment is over the core (Ref. 2).

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APPLICABLE  
SAFETY ANALYSES

The refueling interlocks are explicitly assumed in the UFSAR analysis for the control rod removal error during refueling (Ref. 3). This analysis evaluates the consequences of control rod withdrawal during refueling. A prompt reactivity excursion during refueling could potentially result in fuel failure with subsequent release of radioactive material to the environment.

Criticality and, therefore, subsequent prompt reactivity excursions are prevented during the insertion of fuel, provided all control rods are fully inserted during the fuel insertion. The refueling interlocks accomplish this by preventing loading of fuel into the core with any control rod withdrawn or by preventing withdrawal of a rod from the core during fuel loading.

The refueling platform location switches activate at a point outside of the reactor core, such that, with a fuel assembly loaded and a control rod withdrawn, the fuel is not over the core.

(continued)

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BASES

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APPLICABLE SAFETY ANALYSES (continued) Refueling equipment interlocks satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

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LCO To prevent criticality during refueling, the refueling interlocks associated with the reactor mode switch refuel position ensure that fuel assemblies are not loaded into the core with any control rod withdrawn.

To prevent these conditions from developing, the all-rods-in, the refueling platform position, the refueling platform fuel grapple fuel loaded, the refueling platform trolley frame mounted hoist fuel loaded, the refueling platform monorail mounted hoist fuel loaded, and the refueling platform fuel grapple fully retracted position are required to be OPERABLE when the associated equipment is in use for in-vessel fuel movement. These inputs are combined in logic circuits, which provide refueling equipment or control rod blocks to prevent operations that could result in criticality during refueling operations.

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APPLICABILITY In MODE 5, a prompt reactivity excursion could cause fuel damage and subsequent release of radioactive material to the environment. The refueling equipment interlocks protect against prompt reactivity excursions during MODE 5. The interlocks are required to be OPERABLE during in-vessel fuel movement with refueling equipment associated with the interlocks when the reactor mode switch is in the refuel position. The interlocks are not required when the reactor mode switch is in the shutdown position since a control rod block (LCO 3.3.2.1, "Control Rod Block Instrumentation") ensures control rod withdrawals can not occur simultaneously with in-vessel fuel movements.

In MODES 1, 2, 3, and 4, the reactor pressure vessel head is on, and CORE ALTERATIONS are not possible. Therefore, the refueling interlocks are not required to be OPERABLE in these MODES.

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(continued)

BASES (continued)

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ACTIONS

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

With one or more of the required refueling equipment interlocks inoperable (does not include the one-rod-out interlock addressed in LCO 3.9.2), the unit must be placed in a condition in which the LCO does not apply or is not necessary. This can be performed by ensuring fuel assemblies are not moved in the reactor vessel or by ensuring that the control rods are inserted and cannot be withdrawn. Therefore, Required Action A.1 requires that in-vessel fuel movement with the affected refueling equipment must be immediately suspended. This action ensures that operations are not performed with equipment that would potentially not be blocked from unacceptable operations (e.g., loading fuel into a cell with a control rod withdrawn). Suspension of in-vessel fuel movement shall not preclude completion of movement of a component to a safe position. Alternately, Required Actions A.2.1 and A.2.2 require that a control rod withdrawal block be inserted and that all control rods are subsequently verified to be fully inserted. Required Action A.2.1 ensures that no control rods can be withdrawn. This action ensures that control rods cannot be inappropriately withdrawn since an electrical or hydraulic block to control rod withdrawal is in place. Required Action A.2.2 is normally performed after placing the rod withdrawal block in effect and provides a verification that all control rods are fully inserted. Like Required Action A.1, Required Actions A.2.1 and A.2.2 ensure that unacceptable operations are prohibited (e.g., loading fuel into a core cell with the control rod withdrawn).

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.1.1

Performance of a CHANNEL FUNCTIONAL TEST demonstrates each required refueling equipment interlock will function properly when a simulated or actual signal indicative of a required condition is injected into the logic. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.1.1 (continued)

single contact of the relay. This clarifies what is an acceptable CHANNEL FUNCTIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions.

The 7 day Frequency is based on engineering judgment and is considered adequate in view of other indications of refueling interlocks and their associated input status that are available to unit operations personnel.

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REFERENCES

1. UFSAR, Sections 3.1.5.3 and 3.1.5.4.
  2. UFSAR, Section 7.7.1.2.2.
  3. UFSAR, Section 15.4.1.
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B 3.9 REFUELING OPERATIONS

B 3.9.2 Refuel Position One-Rod-Out Interlock

BASES

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BACKGROUND

The refuel position one-rod-out interlock restricts the movement of control rods to reinforce unit procedures that prevent the reactor from becoming critical during refueling operations. During refueling operations, no more than one control rod is permitted to be withdrawn.

UFSAR, Sections 3.1.5.3 and 3.1.5.4, requires that one of the two required independent reactivity control systems be capable of holding the reactor core subcritical under cold conditions (Ref. 1). The control rods serve as the system capable of maintaining the reactor subcritical in cold conditions.

The refuel position one-rod-out interlock prevents the selection of a second control rod for movement when any other control rod is not fully inserted (Ref. 2). It is a logic circuit that has redundant channels. It uses the all-rods-in signal (from the control rod full-in position indicators discussed in LCO 3.9.4, "Control Rod Position Indication") and a rod selection signal (from the Reactor Manual Control System).

This Specification ensures that the performance of the refuel position one-rod-out interlock in the event of a Design Basis Accident meets the assumptions used in the safety analysis of Reference 3.

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APPLICABLE  
SAFETY ANALYSES

The refueling position one-rod-out interlock is explicitly assumed in the UFSAR analysis for the control rod removal error during refueling (Ref. 3). This analysis evaluates the consequences of control rod withdrawal during refueling. A prompt reactivity excursion during refueling could potentially result in fuel failure with subsequent release of radioactive material to the environment.

The refuel position one-rod-out interlock and adequate SDM (LCO 3.1.1, "SHUTDOWN MARGIN (SDM)") prevent criticality by preventing withdrawal of more than one control rod. With

(continued)

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BASES

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APPLICABLE SAFETY ANALYSES (continued)      one control rod withdrawn, the core will remain subcritical, thereby preventing any prompt critical excursion.

The refuel position one-rod-out interlock satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

---

LCO      To prevent criticality during MODE 5, the refuel position one-rod-out interlock ensures no more than one control rod may be withdrawn. Both channels of the refuel position one-rod-out interlock are required to be OPERABLE and the reactor mode switch must be locked in the refuel position to support the OPERABILITY of these channels.

---

APPLICABILITY      In MODE 5, with the reactor mode switch in the refuel position, the OPERABLE refuel position one-rod-out interlock provides protection against prompt reactivity excursions.

In MODES 1, 2, 3, and 4, the refuel position one-rod-out interlock is not required to be OPERABLE and is bypassed. In MODES 1 and 2, the Reactor Protection System (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation") and the control rods (LCO 3.1.3, "Control Rod OPERABILITY") provide mitigation of potential reactivity excursions. In MODES 3, 4, and 5, with the reactor mode switch in the shutdown position, a control rod block (LCO 3.3.2.1, "Control Rod Block Instrumentation") ensures all control rods are inserted, thereby preventing criticality during shutdown conditions.

---

ACTIONS      A.1 and A.2

With the refueling position one-rod-out interlock inoperable, the refueling interlocks may not be capable of preventing more than one control rod from being withdrawn. This condition may lead to criticality.

Control rod withdrawal must be immediately suspended, and action must be immediately initiated to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Action must continue until all such

(continued)

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BASES

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ACTIONS

A.1 and A.2 (continued)

control rods are fully inserted. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and, therefore, do not have to be inserted.

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.2.1

Proper functioning of the refueling position one-rod-out interlock requires the reactor mode switch to be in Refuel. During control rod withdrawal in MODE 5, improper positioning of the reactor mode switch could, in some instances, allow improper bypassing of required interlocks. Therefore, this Surveillance imposes an additional level of assurance that the refueling position one-rod-out interlock will be OPERABLE when required. By "locking" the reactor mode switch in the proper position (i.e., removing the reactor mode switch key from the console while the reactor mode switch is positioned in refuel), an additional administrative control is in place to preclude operator errors from resulting in unanalyzed operation.

The Frequency of 12 hours is sufficient in view of other administrative controls utilized during refueling operations to ensure safe operation.

SR 3.9.2.2

Performance of a CHANNEL FUNCTIONAL TEST on each channel demonstrates the associated refuel position one-rod-out interlock will function properly when a simulated or actual signal indicative of a required condition is injected into the logic. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL FUNCTIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. The 7 day Frequency is considered adequate because of demonstrated circuit reliability, procedural

(continued)

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.2.2 (continued)

controls on control rod withdrawals, and visual indications available in the control room to alert the operator to control rods not fully inserted. To perform the required testing, the applicable condition must be entered (i.e., a control rod must be withdrawn from its full-in position). Therefore, SR 3.9.2.2 has been modified by a Note that states the CHANNEL FUNCTIONAL TEST is not required to be performed until 1 hour after any control rod is withdrawn.

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REFERENCES

1. UFSAR, Sections 3.1.5.3 and 3.1.5.4.
  2. UFSAR, Section 7.7.1.2.1.
  3. UFSAR, Section 15.4.1.
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-

B 3.9 REFUELING OPERATIONS

B 3.9.3 Control Rod Position

BASES

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BACKGROUND

Control rods provide the capability to maintain the reactor subcritical under all conditions and to limit the potential amount and rate of reactivity increase caused by a malfunction in the Control Rod Drive System. During refueling, movement of control rods is limited by the refueling interlocks (LCO 3.9.1, "Refueling Equipment Interlocks," and LCO 3.9.2, "Refuel Position One-Rod-Out Interlock") or the control rod block with the reactor mode switch in the shutdown position (LCO 3.3.2.1, "Control Rod Block Instrumentation").

UFSAR, Sections 3.1.5.3 and 3.1.5.4, requires that one of the two required independent reactivity control systems be capable of holding the reactor core subcritical under cold conditions (Ref. 1). The control rods serve as the system capable of maintaining the reactor subcritical in cold conditions.

The refueling interlocks allow a single control rod to be withdrawn at any time unless fuel is being loaded into the core. To preclude loading fuel assemblies into the core with a control rod withdrawn, all control rods must be fully inserted. This prevents the reactor from achieving criticality during refueling operations.

---

APPLICABLE  
SAFETY ANALYSES

Prevention and mitigation of prompt reactivity excursions during refueling are provided by the refueling interlocks (LCO 3.9.1 and LCO 3.9.2), the SDM (LCO 3.1.1, "SHUTDOWN MARGIN (SDM)"), the intermediate range monitor neutron flux scram (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation"), and the control rod block instrumentation (LCO 3.3.2.1).

The safety analysis for the control rod removal error during refueling in the UFSAR (Ref. 2) assumes the functioning of the refueling interlocks and adequate SDM.

(continued)

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BASES

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APPLICABLE SAFETY ANALYSES (continued)      Thus, prior to fuel reload, all control rods must be fully inserted to minimize the probability of an inadvertent criticality.

Control rod position satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

---

LCO      All control rods must be fully inserted during applicable refueling conditions to minimize the probability of an inadvertent criticality during refueling.

---

APPLICABILITY      During MODE 5, loading fuel into core cells with control rods withdrawn may result in inadvertent criticality. Therefore, the control rods must be inserted before loading fuel into a core cell. All control rods must be inserted before loading fuel to ensure that a fuel loading error does not result in loading fuel into a core cell with the control rod withdrawn.

In MODES 1, 2, 3, and 4, the reactor pressure vessel head is on, and no fuel loading activities are possible. Therefore, this Specification is not applicable in these MODES.

---

ACTIONS

A.1

With all control rods not fully inserted during the applicable conditions, an inadvertent criticality could occur that is not analyzed in the UFSAR. All fuel loading operations must be immediately suspended. Suspension of these activities shall not preclude completion of movement of a component to a safe position.

---

SURVEILLANCE REQUIREMENTS

SR 3.9.3.1

During refueling, to ensure that the reactor remains subcritical, all control rods must be fully inserted prior to and during fuel loading. Periodic checks of the control rod position ensure this condition is maintained.

(continued)

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.3.1 (continued)

The 12 hour Frequency takes into consideration the procedural controls on control rod movement during refueling as well as the redundant functions of the refueling interlocks.

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REFERENCES

1. UFSAR, Sections 3.1.5.3 and 3.1.5.4.
  2. UFSAR, Section 15.4.1.
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## B 3.9 REFUELING OPERATIONS

### B 3.9.4 Control Rod Position Indication

#### BASES

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#### BACKGROUND

The full-in position indication channel for each control rod provides necessary information to the refueling interlocks to prevent inadvertent criticalities during refueling operations. During refueling, the refueling interlocks (LCO 3.9.1, "Refueling Equipment Interlocks," and LCO 3.9.2, "Refuel Position One-Rod-Out Interlock") use the full-in position indication channel to limit the operation of the refueling equipment and the movement of the control rods. Two full-in position indication switches (S51 and S52) provide input to the all-rods-in logic for each control rod. Switch S51 provides full core display beyond full-in (scram) position indication (double dashes - no number) and switch S52 provides full core display normal green full-in position indication. Switch S52 is set slightly beyond switch S00, which provides the digital "00" full-in position readout (switch S00 does not provide input to the all-rods-in logic and is not considered a full-in channel). When switch S52 is actuated, the color of the full core display "00" readout is changed from amber to green, indicating the control rod is full-in and latched. Switches S51 and S52 are wired in parallel, such that, if either switch indicates full-in, the all-rods-in logic will receive a full-in signal for that control rod. Therefore, each control rod is considered to have only one "full-in" position indication channel. The absence of the full-in position indication channel signal for any control rod removes the all-rods-in permissive for the refueling equipment interlocks and prevents fuel loading. Also, this condition causes the refuel position one-rod-out interlock to not allow the selection of any other control rod. The all-rods-in logic provides two signals, one to each of the two Reactor Manual Control System rod block circuits.

UFSAR, Sections 3.1.5.3 and 3.1.5.4, requires that one of the two required independent reactivity control systems be capable of holding the reactor core subcritical under cold conditions (Ref. 1). The control rods serve as the system capable of maintaining the reactor subcritical in cold conditions.

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(continued)

BASES (continued)

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APPLICABLE SAFETY ANALYSES      Prevention and mitigation of prompt reactivity excursions during refueling are provided by the refueling interlocks (LCO 3.9.1 and LCO 3.9.2), the SDM (LCO 3.1.1, "SHUTDOWN MARGIN (SDM)"), the intermediate range monitor neutron flux scram (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation"), and the control rod block instrumentation (LCO 3.3.2.1, "Control Rod Block Instrumentation").

The safety analysis for the control rod removal error during refueling (Ref. 2) assumes the functioning of the refueling interlocks and adequate SDM. The full-in position indication channel is required to be OPERABLE so that the refueling interlocks can ensure that fuel cannot be loaded with any control rod withdrawn and that no more than one control rod can be withdrawn at a time.

Control rod position indication satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

---

LCO      The control rod full-in position indication channel for each control rod must be OPERABLE to provide the required input to the refueling interlocks. A channel is OPERABLE if it provides correct position indication to the refueling equipment interlock all-rods-in logic (LCO 3.9.1) and the refuel position one-rod-out interlock logic (LCO 3.9.2).

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APPLICABILITY      During MODE 5, the control rods must have OPERABLE full-in position indication channels to ensure the applicable refueling interlocks will be OPERABLE.

In MODES 1 and 2, requirements for control rod position are specified in LCO 3.1.3, "Control Rod OPERABILITY." In MODES 3 and 4, with the reactor mode switch in the shutdown position, a control rod block (LCO 3.3.2.1) ensures all control rods are inserted, thereby preventing criticality during shutdown conditions.

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ACTIONS      A Note has been provided to modify the ACTIONS related to control rod position indication channels. Section 1.3, Completion Times, specifies that once a Condition has been

(continued)

BASES

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ACTIONS  
(continued)

entered, subsequent divisions, subsystems, components, or variables expressed in the Condition, discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable control rod position indication channels provide appropriate compensatory measures for separate inoperable channels. As such, this Note has been provided, which allows separate Condition entry for each inoperable control rod position indication channel.

A.1.1, A.1.2, A.1.3, A.2.1 and A.2.2

With one or more full-in position indication channels inoperable, compensating actions must be taken to protect against potential reactivity excursions from fuel assembly insertions or control rod withdrawals. This may be accomplished by immediately suspending in-vessel fuel movement and control rod withdrawal, and immediately initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Actions must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and, therefore, do not have to be inserted. Suspension of in-vessel fuel movements and control rod withdrawal shall not preclude moving a component to a safe position.

Alternatively, actions must be immediately initiated to fully insert the control rod(s) associated with the inoperable full-in position indicator(s) and disarm (electrically or hydraulically) the drive(s) to ensure that the control rod is not withdrawn. A control rod can be hydraulically disarmed by closing the drive water and exhaust water isolation valves. A control rod can be electrically disarmed by disconnecting power from all four directional control valve solenoids. Actions must continue until all associated control rods are fully inserted and drives are disarmed. Under these conditions (control rod fully inserted and disarmed), an inoperable full-in channel

(continued)

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BASES

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ACTIONS

A.1.1, A.1.2, A.1.3, A.2.1 and A.2.2 (continued)

may be bypassed to allow refueling operations to proceed. An alternate method must be used to ensure the control rod is fully inserted (e.g., use the "00" notch position indication).

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.4.1

The full-in position indication channels provide input to the one-rod-out interlock and other refueling interlocks that require an all-rods-in permissive. The interlocks are actuated when the full-in position indication for any control rod is not present, since this indicates that all rods are not fully inserted. Therefore, testing of the full-in position indication channels is performed to ensure that when a control rod is withdrawn, the full-in position indication is not present. The full-in position indication channel is considered inoperable even with the control rod fully inserted, if it would continue to indicate full-in with the control rod withdrawn. Performing the SR each time a control rod is withdrawn from the full-in position is considered adequate because of the procedural controls on control rod withdrawals and the visual indications available in the control room to alert the operator to control rods not fully inserted.

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REFERENCES

1. UFSAR, Sections 3.1.5.3 and 3.1.5.4.
  2. UFSAR, Section 15.4.1.
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B 3.9 REFUELING OPERATIONS

B 3.9.5 Control Rod OPERABILITY – Refueling

BASES

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**BACKGROUND** Control rods are components of the Control Rod Drive (CRD) System, the primary reactivity control system for the reactor. In conjunction with the Reactor Protection System, the CRD System provides the means for the reliable control of reactivity changes during refueling operation. In addition, the control rods provide the capability to maintain the reactor subcritical under all conditions and to limit the potential amount and rate of reactivity increase caused by a malfunction in the CRD System.

UFSAR, Sections 3.1.5.3 and 3.1.5.4, requires that one of the two required independent reactivity control systems be capable of holding the reactor core subcritical under cold conditions (Ref. 1). The CRD System is the system capable of maintaining the reactor subcritical in cold conditions.

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**APPLICABLE SAFETY ANALYSES** Prevention and mitigation of prompt reactivity excursions during refueling are provided by refueling interlocks (LCO 3.9.1, "Refueling Equipment Interlocks," and LCO 3.9.2, "Refuel Position One Rod-Out Interlock"), the SDM (LCO 3.1.1, SHUTDOWN MARGIN (SDM)), the intermediate range monitor neutron flux scram (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation"), and the control rod block instrumentation (LCO 3.3.2.1, "Control Rod Block Instrumentation").

The safety analysis for the control rod removal error during refueling (Ref. 2) evaluates the consequences of control rod withdrawal during refueling. A prompt reactivity excursion during refueling could potentially result in fuel failure with subsequent release of radioactive material to the environment. Control rod scram provides protection should a prompt reactivity excursion occur.

Control rod OPERABILITY during refueling satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

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(continued)

BASES (continued)

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LCO Each withdrawn control rod must be OPERABLE. The withdrawn control rod is considered OPERABLE if the scram accumulator pressure is  $\geq 940$  psig and the control rod is capable of being automatically inserted upon receipt of a scram signal. Inserted control rods have already completed their reactivity control function, and therefore are not required to be OPERABLE.

---

APPLICABILITY During MODE 5, withdrawn control rods must be OPERABLE to ensure that when a scram occurs the control rods will insert and provide the required negative reactivity to maintain the reactor subcritical.

For MODES 1 and 2, control rod requirements are found in LCO 3.1.2, "Reactivity Anomalies," LCO 3.1.3, "Control Rod OPERABILITY," LCO 3.1.4, "Control Rod Scram Times," and LCO 3.1.5, "Control Rod Scram Accumulators." During MODES 3 and 4, control rods are not able to be withdrawn since the reactor mode switch is in shutdown and a control rod block is applied. This provides adequate requirements for control rod OPERABILITY during these conditions.

---

ACTIONS

A.1

With one or more withdrawn control rods inoperable, action must be immediately initiated to fully insert the inoperable control rod(s). Inserting the control rod(s) ensures the shutdown and scram capabilities are not adversely affected. Actions must continue until the inoperable control rod(s) is fully inserted.

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.5.1 and SR 3.9.5.2

During MODE 5, the OPERABILITY of control rods is primarily required to ensure a withdrawn control rod will automatically insert if a signal requiring a reactor shutdown occurs. Because no explicit analysis exists for automatic shutdown during refueling, the shutdown function is satisfied if the withdrawn control rod is capable of automatic insertion and the associated CRD scram accumulator pressure is  $\geq 940$  psig.

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.5.1 and SR 3.9.5.2 (continued)

The 7 day Frequency takes into consideration equipment reliability, procedural controls over the scram accumulators, and control room alarms and indicating lights that indicate low accumulator charge pressures.

SR 3.9.5.1 is modified by a Note that allows 7 days after withdrawal of the control rod to perform the Surveillance. This acknowledges that the control rod must first be withdrawn before performance of the Surveillance, and therefore avoids potential conflicts with SR 3.0.1.

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REFERENCES

1. UFSAR, Sections 3.1.5.3 and 3.1.5.4.
  2. UFSAR, Section 15.4.1.
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## B 3.9 REFUELING OPERATIONS

### B 3.9.6 Reactor Pressure Vessel (RPV) Water Level - Irradiated Fuel

#### BASES

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**BACKGROUND** The movement of irradiated fuel assemblies within the RPV requires a minimum water level of 23 ft above the top of the RPV flange. During refueling, this maintains a sufficient water level in the reactor vessel cavity and spent fuel pool. Sufficient water is necessary to retain iodine fission product activity in the water in the event of a fuel handling accident (Refs. 1 and 2). Sufficient iodine activity would be retained to limit offsite doses from the accident to  $\leq 25\%$  of 10 CFR 100 limits, as provided by the guidance of Reference 3.

---

**APPLICABLE SAFETY ANALYSES** During movement of irradiated fuel assemblies, the water level in the RPV is an initial condition design parameter in the analysis of a fuel handling accident in containment postulated by Safety Guide 25 (Ref. 1). A minimum water level of 23 ft (Regulatory Position C.1.c of Ref. 1) allows a decontamination factor of 100 (Regulatory Position C.1.g of Ref. 1) to be used in the accident analysis for iodine. This relates to the assumption that 99% of the total iodine released from the pellet to cladding gap of all the dropped fuel assembly rods is retained by the water. The fuel pellet to cladding gap is assumed to contain 10% of the total fuel rod iodine inventory (Ref. 1).

Analysis of the fuel handling accident inside containment is described in Reference 2. With a minimum water level of 23 ft and a minimum decay time of 24 hours prior to fuel handling, the analysis and test programs demonstrate that the iodine release due to a postulated fuel handling accident is adequately captured by the water and that offsite doses are maintained within allowable limits (Ref. 4). While the worst case assumptions include the dropping of the irradiated fuel assembly being handled onto the reactor core, the possibility exists of the dropped assembly striking the RPV flange and releasing fission products. Therefore, the minimum depth for water coverage to ensure acceptable radiological consequences is specified from the RPV flange. Since the worst case event results in

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BASES

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APPLICABLE SAFETY ANALYSES (continued) failed fuel assemblies seated in the core, as well as the dropped assembly, dropping an assembly on the RPV flange will result in reduced releases of fission gases.

RPV water level satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

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LCO A minimum water level of 23 ft above the top of the RPV flange is required to ensure that the radiological consequences of a postulated fuel handling accident are within acceptable limits, as provided by the guidance of Reference 3.

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APPLICABILITY LCO 3.9.6 is applicable when moving irradiated fuel assemblies within the RPV. The LCO minimizes the possibility of a fuel handling accident in containment that is beyond the assumptions of the safety analysis. If irradiated fuel is not present within the RPV, there can be no significant radioactivity release as a result of a postulated fuel handling accident. Requirements for handling of new fuel assemblies or control rods (where water depth to the RPV flange is not of concern) are covered by LCO 3.9.7, "RPV Water Level – New Fuel or Control Rods." Requirements for fuel handling accidents in the spent fuel storage pool are covered by LCO 3.7.8, "Spent Fuel Storage Pool Water Level."

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ACTIONS

A.1

If the water level is < 23 ft above the top of the RPV flange, all operations involving movement of irradiated fuel assemblies within the RPV shall be suspended immediately to ensure that a fuel handling accident cannot occur. The suspension of irradiated fuel movement shall not preclude completion of movement of a component to a safe position.

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(continued)

BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.6.1

Verification of a minimum water level of 23 ft above the top of the RPV flange ensures that the design basis for the postulated fuel handling accident analysis during refueling operations is met. Water at the required level limits the consequences of damaged fuel rods, which are postulated to result from a fuel handling accident in containment (Ref. 2).

The Frequency of 24 hours is based on engineering judgment and is considered adequate in view of the large volume of water and the normal procedural controls on valve positions, which make significant unplanned level changes unlikely.

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REFERENCES

1. Safety Guide 25, March 23, 1972.
  2. UFSAR, Section 15.7.2.
  3. NUREG-0800, Section 15.7.4.
  4. 10 CFR 100.11.
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B 3.9 REFUELING OPERATIONS

B 3.9.7 Reactor Pressure Vessel (RPV) Water Level - New Fuel or Control Rods

BASES

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**BACKGROUND** The movement of new fuel assemblies or handling of control rods within the RPV when fuel assemblies seated within the reactor vessel are irradiated requires a minimum water level of 23 ft above the top of irradiated fuel assemblies seated within the RPV. During refueling, this maintains a sufficient water level above the irradiated fuel. Sufficient water is necessary to retain iodine fission product activity in the water in the event of a fuel handling accident (Refs. 1 and 2). Sufficient iodine activity would be retained to limit offsite doses from the accident to  $\leq 25\%$  of 10 CFR 100 limits, as provided by the guidance of Reference 3.

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**APPLICABLE SAFETY ANALYSES** During movement of new fuel assemblies or handling of control rods over irradiated fuel assemblies, the water level in the RPV is an initial condition design parameter in the analysis of a fuel handling accident in containment postulated by Regulatory Guide 1.25 (Ref. 1). A minimum water level of 23 ft (Regulatory Position C.1.c of Ref. 1) allows a decontamination factor of 100 (Regulatory Position C.1.g of Ref. 1) to be used in the accident analysis for iodine. This relates to the assumption that 99% of the total iodine released from the pellet to cladding gap of all the dropped fuel assembly rods is retained by the water. The fuel pellet to cladding gap is assumed to contain 10% of the total fuel rod iodine inventory (Ref. 1).

Analysis of the fuel handling accident inside containment is described in Reference 2. With a minimum water level of 23 ft and a minimum decay time of 24 hours prior to fuel handling, the analysis and test programs demonstrate that the iodine release due to a postulated fuel handling accident is adequately captured by the water and that offsite doses are maintained within allowable limits (Ref. 4). The related assumptions include the worst case dropping of an irradiated fuel assembly onto the reactor core loaded with irradiated fuel assemblies.

RPV water level satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

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(continued)

BASES (continued)

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LCO A minimum water level of 23 ft above the top of irradiated fuel assemblies seated within the RPV is required to ensure that the radiological consequences of a postulated fuel handling accident are within acceptable limits, as provided by the guidance of Reference 3.

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APPLICABILITY LCO 3.9.7 is applicable when moving new fuel assemblies or handling control rods (i.e., movement with other than the normal control rod drive) when irradiated fuel assemblies are seated within the RPV. The LCO minimizes the possibility of a fuel handling accident in containment that is beyond the assumptions of the safety analysis. If irradiated fuel is not present within the RPV, there can be no significant radioactivity release as a result of a postulated fuel handling accident. Requirements for fuel handling accidents in the spent fuel storage pool are covered by LCO 3.7.8, "Spent Fuel Storage Pool Water Level." Requirements for handling irradiated fuel over the RPV are covered by LCO 3.9.6, "Reactor Pressure Vessel (RPV) Water Level – Irradiated Fuel."

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ACTIONS A.1

If the water level is < 23 ft above the top of irradiated fuel assemblies seated within the RPV, all operations involving movement of new fuel assemblies and handling of control rods within the RPV shall be suspended immediately to ensure that a fuel handling accident cannot occur. The suspension of fuel movement and control rod handling shall not preclude completion of movement of a component to a safe position.

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SURVEILLANCE REQUIREMENTS SR 3.9.7.1

Verification of a minimum water level of 23 ft above the top of irradiated fuel assemblies seated within the RPV ensures that the design basis for the postulated fuel handling accident analysis during refueling operations is met. Water at the required level limits the consequences of damaged fuel rods, which are postulated to result from a fuel handling accident in containment (Ref. 2).

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(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.7.1 (continued)

The Frequency of 24 hours is based on engineering judgment and is considered adequate in view of the large volume of water and the normal procedural controls on valve positions, which make significant unplanned level changes unlikely.

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REFERENCES

1. Regulatory Guide 1.25, March 23, 1972.
  2. UFSAR, Section 15.7.2.
  3. NUREG-0800, Section 15.7.4.
  4. 10 CFR 100.11.
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B 3.9 REFUELING OPERATIONS

B 3.9.8 Residual Heat Removal (RHR)—High Water Level

BASES

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**BACKGROUND** The purpose of the RHR System in MODE 5 is to remove decay heat and sensible heat from the reactor coolant, as described by UFSAR, Section 5.4.7 (Ref. 1). Each of the two shutdown cooling loops of the RHR System can provide the required decay heat removal. Each loop consists of two motor driven pumps, a heat exchanger, and associated piping and valves. Both loops have a common suction from the same recirculation loop. Each pump discharges the reactor coolant, after it has been cooled by circulation through the respective heat exchangers, to the reactor via the associated recirculation loop. The RHR heat exchangers transfer heat to the RHR Service Water System. The RHR shutdown cooling mode is manually controlled.

In addition to the RHR subsystems, the volume of water above the reactor pressure vessel (RPV) flange provides a heat sink for decay heat removal.

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**APPLICABLE SAFETY ANALYSES** With the unit in MODE 5, the RHR Shutdown Cooling System is not required to mitigate any events or accidents evaluated in the safety analyses. The RHR Shutdown Cooling System is required for removing decay heat to maintain the temperature of the reactor coolant.

The RHR Shutdown Cooling System satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

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**LCO** Only one RHR shutdown cooling subsystem is required to be OPERABLE in MODE 5 with irradiated fuel in the RPV and the water level  $\geq$  23 ft above the RPV flange. Only one subsystem is required to be OPERABLE because the volume of water above the RPV flange provides backup decay heat removal capability.

An OPERABLE RHR shutdown cooling subsystem consists of an RHR pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path. In addition, the

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BASES

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LCO  
(continued)

necessary portions of the RHR Service Water System must be capable of providing cooling water to the RHR heat exchanger.

Additionally, the RHR shutdown cooling subsystem is considered OPERABLE if it can be manually aligned (remote or local) in the shutdown cooling mode for removal of decay heat. Operation (either continuous or intermittent) of one subsystem can maintain and reduce the reactor coolant temperature as required.

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APPLICABILITY

One RHR shutdown cooling subsystem must be OPERABLE in MODE 5, with irradiated fuel in the RPV and with the water level  $\geq$  23 feet above the top of the RPV flange, to provide decay heat removal. RHR shutdown cooling subsystem requirements in other MODES are covered by LCOs in Section 3.4, Reactor Coolant System (RCS). RHR shutdown cooling subsystem requirements in MODE 5 with irradiated fuel in the RPV and with the water level  $<$  23 ft above the RPV flange are given in LCO 3.9.9, "Residual Heat Removal (RHR) - Low Water Level."

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ACTIONS

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

With no RHR shutdown cooling subsystem OPERABLE, an alternate method of decay heat removal must be provided within 1 hour. In this condition, the volume of water above the RPV flange provides adequate capability to remove decay heat from the reactor core. However, the overall reliability is reduced because loss of water level could result in reduced decay heat removal capability. The 1 hour Completion Time is based on decay heat removal function and the probability of a loss of the available decay heat removal capabilities. Furthermore, verification of the functional availability of the alternate method must be reconfirmed every 24 hours thereafter. This will ensure continued heat removal capability.

Alternate decay heat removal methods are available to the operators for review and preplanning in the unit operating procedures. The required cooling capacity of the alternate method should be ensured by verifying (by calculation or

(continued)

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BASES

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ACTIONS

A.1, A.2, and A.3 (continued)

demonstration) its capability to maintain or reduce temperature. For example, this may include the use of the Fuel Pool Cooling or Reactor Water Cleanup System operating with the regenerative heat exchanger bypassed or in combination with the Control Rod Drive System or Condensate/Feed System. The method used to remove the decay heat should be the most prudent choice based on unit conditions.

Additionally, if no RHR Shutdown Cooling System is OPERABLE, an alternate method of coolant circulation is required to be established within 1 hour. The 1 hour Completion Time is based on the importance of the coolant circulation function. Furthermore, verification of the functioning of the alternate method must be reconfirmed every 12 hours thereafter. This will provide assurance of continued temperature monitoring capability.

During the period when the reactor coolant is being circulated by an alternate method (other than by the required RHR shutdown cooling subsystem), the reactor coolant temperature must be periodically monitored to ensure proper functioning of the alternate method. The once per hour Completion Time is deemed appropriate.

B.1, B.2, B.3, and B.4

If no RHR shutdown cooling subsystem is OPERABLE and an alternate method of decay heat removal is not available in accordance with Required Action A.1, actions shall be taken immediately to suspend operations involving an increase in reactor decay heat load by suspending loading of irradiated fuel assemblies into the RPV.

Additional actions are required to minimize any potential fission product release to the environment. This includes ensuring secondary containment is OPERABLE; one standby gas treatment subsystem is OPERABLE; and secondary containment isolation capability is available in each associated penetration flow path not isolated that is assumed to be isolated to mitigate radioactive releases (i.e., one

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(continued)

BASES

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ACTIONS

B.1, B.2, B.3, and B.4 (continued)

secondary containment isolation valve and associated instrumentation are OPERABLE or other acceptable administrative controls to assure isolation capability. These administrative controls consist of stationing a dedicated operator, who is in continuous communication with the control room, at the controls of the isolation device. In this way, the penetration can be rapidly isolated when a need for secondary containment isolation is indicated). This may be performed as an administrative check, by examining logs or other information to determine whether the components are out of service for maintenance or other reasons. It is not necessary to perform the Surveillances needed to demonstrate the OPERABILITY of the components. If, however, any required component is inoperable, then it must be restored to OPERABLE status. In this case, a surveillance may need to be performed to restore the component to OPERABLE status. Actions must continue until all required components are OPERABLE.

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.8.1

Periodic monitoring of reactor coolant temperature ensures the need to establish decay heat removal, to maintain or reduce the reactor coolant temperature, is identified in a timely manner. The 1 hour Frequency is based on the importance of the decay heat removal and coolant circulation function.

SR 3.9.8.2

Verifying the correct alignment for manual and power operated valves in the RHR shutdown cooling flow path provides assurance that the proper flow paths will exist for RHR operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that can be manually (from the control room or locally) aligned is allowed to be in a non-RHR shutdown cooling position provided the valve can be repositioned. This SR does not require any testing

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.8.2 (continued)

or valve manipulation; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

The Frequency of 12 hours is sufficient in view of other visual and audible indications available to the operator for monitoring the RHR shutdown cooling subsystem in the control room.

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REFERENCES

1. UFSAR, Section 5.4.7.
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B 3.9 REFUELING OPERATIONS

B 3.9.9 Residual Heat Removal (RHR) - Low Water Level

BASES

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**BACKGROUND** The purpose of the RHR System in MODE 5 is to remove decay heat and sensible heat from the reactor coolant, as described by UFSAR, Section 5.4.7 (Ref. 1). Each of the two shutdown cooling loops of the RHR System can provide the required decay heat removal. Each loop consists of two motor driven pumps, a heat exchanger, and associated piping and valves. Both loops have a common suction from the same recirculation loop. Each pump discharges the reactor coolant, after it has been cooled by circulation through the respective heat exchangers, to the reactor via the associated recirculation loop. The RHR heat exchangers transfer heat to the RHR Service Water System. The RHR shutdown cooling mode is manually controlled.

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**APPLICABLE SAFETY ANALYSES** With the unit in MODE 5, the RHR Shutdown Cooling System is not required to mitigate any events or accidents evaluated in the safety analyses. The RHR Shutdown Cooling System is required for removing decay heat to maintain the temperature of the reactor coolant.

The RHR Shutdown Cooling System satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

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**LCO** In MODE 5 with irradiated fuel in the reactor pressure vessel (RPV) and the water level < 23 ft above the reactor pressure vessel (RPV) flange both RHR shutdown cooling subsystems must be OPERABLE.

An OPERABLE RHR shutdown cooling subsystem consists of an RHR pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path. To meet the LCO, both pumps in one loop or one pump in each of the two loops must be OPERABLE. In addition the necessary portions of the RHR Service Water System must be capable of providing cooling water to the RHR heat exchanger.

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BASES

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LCO  
(continued)                      Additionally, each RHR shutdown cooling subsystem is considered OPERABLE if it can be manually aligned (remote or local) in the shutdown cooling mode for removal of decay heat. Operation (either continuous or intermittent) of one subsystem can maintain and reduce the reactor coolant temperature as required.

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APPLICABILITY                      Two RHR shutdown cooling subsystems are required to be OPERABLE in MODE 5, with irradiated fuel in the RPV and with the water level < 23 ft above the top of the RPV flange, to provide decay heat removal. RHR shutdown cooling subsystem requirements in other MODES are covered by LCOs in Section 3.4, Reactor Coolant System (RCS). RHR shutdown cooling subsystem requirements in MODE 5 with irradiated fuel in the RPV and with the water level  $\geq$  23 ft above the RPV flange are given in LCO 3.9.8, "Residual Heat Removal (RHR)—High Water Level."

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ACTIONS

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

With one of the two required RHR shutdown cooling subsystems inoperable, the remaining subsystem is capable of providing the required decay heat removal. However, the overall reliability is reduced. Therefore, an alternate method of decay heat removal must be provided. With both required RHR shutdown cooling subsystems inoperable, an alternate method of decay heat removal must be provided in addition to that provided for the initial RHR shutdown cooling subsystem inoperability. This re-establishes backup decay heat removal capabilities, similar to the requirements of the LCO. The 1 hour Completion Time is based on the decay heat removal function and the probability of a loss of the available decay heat removal capabilities. Furthermore, verification of the functional availability of the alternate method(s) must be reconfirmed every 24 hours thereafter. This will ensure continued heat removal capability.

Alternate decay heat removal methods are available to the operators for review and preplanning in the unit operating procedures. The required cooling capacity of the alternate method(s) should be ensured by verifying (by calculation or

(continued)

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BASES

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ACTIONS

A.1, A.2, and A.3 (continued)

demonstration) their capability to maintain or reduce temperature. For example, this may include the use of the Fuel Pool Cooling or Reactor Water Cleanup System operating with the regenerative heat exchanger bypassed or in combination with the Control Rod Drive System/Feed System. The method used to remove decay heat should be the most prudent choice based on unit conditions.

In addition, with both required RHR subsystems inoperable, an alternate method of coolant circulation is required to be established within 1 hour (Required Action A.2). This will provide necessary circulation for monitoring temperature. The 1 hour Completion Time is based on the importance of the coolant circulation function. Furthermore, verification of the functioning of the alternate method must be reconfirmed every 12 hours thereafter. This will provide assurance of continued temperature monitoring capability.

During the period when the reactor coolant is being circulated by an alternate method (other than by an RHR shutdown cooling subsystem), the reactor coolant temperature must be periodically monitored to ensure proper functioning of the alternate method (Required Action A.3). The once per hour Completion Time is deemed appropriate.

Condition A is modified by a Note allowing separate Condition entry for each inoperable required RHR shutdown cooling subsystem. This is acceptable since the Required Actions for this Condition provide appropriate compensatory actions for each inoperable required RHR shutdown cooling subsystem. Complying with the Required Actions allow for continued operation. A subsequent inoperable required RHR shutdown cooling subsystem is governed by subsequent entry into the Condition and application of the Required Actions. Required Actions A.2 and A.3 are modified by Notes that clarify that the Required Actions are only applicable when both required RHR shutdown cooling subsystems are inoperable since the Condition is applicable when one or two required RHR shutdown cooling subsystems are inoperable.

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(continued)

BASES

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ACTIONS  
(continued)

B.1, B.2, and B.3

With the required decay heat removal subsystem(s) inoperable and the required alternate method(s) of decay heat removal not available in accordance with Required Action A.1, additional actions are required to minimize any potential fission product release to the environment. This includes ensuring secondary containment is OPERABLE; one standby gas treatment subsystem is OPERABLE; and secondary containment isolation capability is available in each associated penetration flow path not isolated that is assumed to be isolated to mitigate radioactive releases (i.e., one secondary containment isolation valve and associated instrumentation are OPERABLE or other acceptable administrative controls to assure isolation capability. These administrative controls consist of stationing a dedicated operator, who is in continuous communication with the control room, at the controls of the isolation device. In this way, the penetration can be rapidly isolated when a need for secondary containment isolation is indicated). This may be performed as an administrative check, by examining logs or other information to determine whether the components are out of service for maintenance or other reasons. It is not necessary to perform the Surveillances needed to demonstrate the OPERABILITY of the components. If, however, any required component is inoperable, then it must be restored to OPERABLE status. In this case, the surveillance may need to be performed to restore the component to OPERABLE status. Actions must continue until all required components are OPERABLE.

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SURVEILLANCE  
REQUIREMENTS

SR 3.9.9.1

Periodic monitoring of reactor coolant temperature ensures the need to establish decay heat removal, to maintain or reduce the reactor coolant temperature, is identified in a timely manner. The 1 hour Frequency is based on the importance of the decay heat removal and coolant circulation function.

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BASES

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SURVEILLANCE  
REQUIREMENTS

(continued)

SR 3.9.9.2

Verifying the correct alignment for manual and power operated valves in the required RHR shutdown cooling flow paths provides assurance that the proper flow paths will exist for RHR operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that can be manually (from the control room or locally) aligned is allowed to be in a non-RHR shutdown cooling position provided the valve can be repositioned. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

The Frequency of 12 hours is sufficient in view of other visual and audible indications available to the operator for monitoring the RHR subsystems in the control room.

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REFERENCES

1. UFSAR, Section 5.4.7.
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## B 3.10 SPECIAL OPERATIONS

### B 3.10.1 Reactor Mode Switch Interlock Testing

#### BASES

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#### BACKGROUND

The purpose of this Special Operations LCO is to permit operation of the reactor mode switch from one position to another to confirm certain aspects of associated interlocks during periodic tests and calibrations in MODES 3, 4, and 5.

The reactor mode switch is a conveniently located, multiposition, keylock switch provided to select the necessary scram functions for various plant conditions (Ref. 1). The reactor mode switch selects the appropriate trip relays for scram functions and provides appropriate bypasses. The mode switch positions and related scram interlock functions are summarized as follows:

- a. Shutdown—Initiates a reactor scram; bypasses main steam line isolation and low turbine condenser vacuum scrams;
- b. Refuel—Selects Neutron Monitoring System (NMS) scram function for low neutron flux level operation (but does not disable the average power range monitor scram); bypasses main steam line isolation and low turbine condenser vacuum scrams;
- c. Startup/Hot Standby—Selects NMS scram function for low neutron flux level operation (intermediate range monitors and average power range monitors); bypasses main steam line isolation and low turbine condenser vacuum scrams; and
- d. Run—Selects NMS scram function for power range operation.

The reactor mode switch also provides interlocks for such functions as control rod blocks, scram discharge volume trip bypass, refueling interlocks, and main steam isolation valve isolations.

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#### APPLICABLE SAFETY ANALYSES

The purpose for reactor mode switch interlock testing is to prevent fuel failure by precluding reactivity excursions or core criticality. The interlock functions of the shutdown

(continued)

BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

and refuel positions normally maintained for the reactor mode switch in MODES 3, 4, and 5 are provided to preclude reactivity excursions that could potentially result in fuel failure. Interlock testing that requires moving the reactor mode switch to other positions (run, startup/hot standby, or refuel) while in MODE 3, 4, or 5, requires administratively maintaining all control rods inserted and no CORE ALTERATIONS in progress. With all control rods inserted in core cells containing one or more fuel assemblies, and no CORE ALTERATIONS in progress, there are no credible mechanisms for unacceptable reactivity excursions during the planned interlock testing.

For postulated accidents, such as control rod removal error during refueling, the accident analysis demonstrates that fuel failure will not occur (Ref. 2). The withdrawal of a single control rod will not result in criticality when adequate SDM is maintained. Also, loading fuel assemblies into the core with a single control rod withdrawn will not result in criticality, thereby preventing fuel failure.

As described in LCO 3.0.7, compliance with Special Operations LCOs is optional, and therefore, no criteria of 10 CFR 50.36(c)(2)(ii) apply. Special Operations LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria satisfied for the other LCOs is provided in their respective Bases.

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LCO

As described in LCO 3.0.7, compliance with this Special Operations LCO is optional. MODES 3, 4, and 5 operations not specified in Table 1.1-1 can be performed in accordance with other Special Operations LCOs (i.e., LCO 3.10.2, "Single Control Rod Withdrawal - Hot Shutdown," LCO 3.10.3, "Single Control Rod Withdrawal - Cold Shutdown," and LCO 3.10.7, "SDM Test - Refueling") without meeting this LCO or its ACTIONS. If any testing is performed that involves the reactor mode switch interlocks and requires repositioning beyond that specified in Table 1.1-1 for the current MODE of operation, the testing can be performed, provided all interlock functions potentially defeated are administratively controlled. In MODES 3, 4, and 5 with the reactor mode switch in shutdown as specified in Table 1.1-1,

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BASES

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LCO  
(continued)      all control rods are fully inserted and a control rod block is initiated. Therefore, all control rods in core cells that contain one or more fuel assemblies must be verified fully inserted while in MODES 3, 4, and 5, with the reactor mode switch in other than the shutdown position. The additional LCO requirement to preclude CORE ALTERATIONS is appropriate for MODE 5 operations, as discussed below, and is inherently met in MODES 3 and 4 by the definition of CORE ALTERATIONS, which cannot be performed with the vessel head in place.

In MODE 5, with the reactor mode switch in the refuel position, only one control rod can be withdrawn under the refuel position one-rod-out interlock (LCO 3.9.2, "Refuel Position One-Rod-Out Interlock"). The refueling equipment interlocks (LCO 3.9.1, "Refueling Equipment Interlocks") appropriately control other CORE ALTERATIONS. Due to the increased potential for error in controlling these multiple interlocks, and the limited duration of tests involving the reactor mode switch position, conservative controls are required, consistent with MODES 3 and 4. The additional controls of administratively not permitting other CORE ALTERATIONS will adequately ensure that the reactor does not become critical during these tests.

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APPLICABILITY      Any required periodic interlock testing involving the reactor mode switch, while in MODES 1 and 2, can be performed without the need for Special Operations exceptions. Mode switch manipulations in these MODES would likely result in unit trips. In MODES 3, 4, and 5, this Special Operations LCO is only permitted to be used to allow reactor mode switch interlock testing that cannot conveniently be performed without this allowance or testing that must be performed prior to entering another MODE. Such interlock testing may consist of required Surveillances, or may be the result of maintenance, repair, or troubleshooting activities. In MODES 3, 4, and 5, the interlock functions provided by the reactor mode switch in shutdown (i.e., all control rods inserted and incapable of withdrawal) and refueling (i.e., refueling interlocks to prevent inadvertent criticality during CORE ALTERATIONS) positions can be administratively controlled adequately during the performance of certain tests.

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(continued)

BASES (continued)

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ACTIONS A.1, A.2, A.3.1, and A.3.2

These Required Actions are provided to restore compliance with the Technical Specifications overridden by this Special Operations LCO. Restoring compliance will also result in exiting the Applicability of this Special Operations LCO.

All CORE ALTERATIONS, except control rod insertion, if in progress, are immediately suspended in accordance with Required Action A.1, and all insertable control rods in core cells that contain one or more fuel assemblies are fully inserted within 1 hour, in accordance with Required Action A.2. This will preclude potential mechanisms that could lead to criticality. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and, therefore, do not have to be inserted. Suspension of CORE ALTERATIONS shall not preclude the completion of movement of a component to a safe condition. Placing the reactor mode switch in the shutdown position will ensure that all inserted control rods remain inserted and result in operating in accordance with Table 1.1-1. Alternatively, if in MODE 5, the reactor mode switch may be placed in the refuel position, which will also result in operating in accordance with Table 1.1-1. A Note is added to Required Action A.3.2 to indicate that this Required Action is not applicable in MODES 3 and 4, since only the shutdown position is allowed in these MODES. The allowed Completion Time of 1 hour for Required Action A.2, Required Action A.3.1, and Required Action A.3.2 provides sufficient time to normally insert the control rods and place the reactor mode switch in the required position, based on operating experience, and is acceptable given that all operations that could increase core reactivity have been suspended.

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SURVEILLANCE  
REQUIREMENTS

SR 3.10.1.1 and SR 3.10.1.2

Meeting the requirements of this Special Operations LCO maintains operation consistent with or conservative to operating with the reactor mode switch in the shutdown position (or the refuel position for MODE 5). The functions of the reactor mode switch interlocks that are not in effect, due to the testing in progress, are adequately compensated for by the Special Operations LCO requirements.

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BASES

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SURVEILLANCE  
REQUIREMENTS

SR 3.10.1.1 and SR 3.10.1.2 (continued)

The administrative controls are to be periodically verified to ensure that the operational requirements continue to be met. In addition, the all rods fully inserted Surveillance (SR 3.10.1.1) must be verified by a second licensed operator (Reactor Operator or Senior Reactor Operator) or other task qualified member of the technical staff (e.g., a shift technical advisor or reactor engineer). The Surveillances performed at the 12 hour and 24 hour Frequencies are intended to provide appropriate assurance that each operating shift is aware of and verifies compliance with these Special Operations LCO requirements.

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REFERENCES

1. UFSAR, Chapter 7.2.
  2. UFSAR, Section 15.4.1.
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B 3.10 SPECIAL OPERATIONS

B 3.10.2 Single Control Rod Withdrawal - Hot Shutdown

BASES

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BACKGROUND            The purpose of this MODE 3 Special Operations LCO is to permit the withdrawal of a single control rod for testing while in hot shutdown, by imposing certain restrictions. In MODE 3, the reactor mode switch is in the shutdown position, and all control rods are inserted and blocked from withdrawal. Many systems and functions are not required in these conditions, due to the other installed interlocks that are actuated when the reactor mode switch is in the shutdown position. However, circumstances may arise while in MODE 3 that present the need to withdraw a single control rod for various tests (e.g., rod exercising, friction tests, scram timing, and coupling integrity checks). These single control rod withdrawals are normally accomplished by selecting the refuel position for the reactor mode switch. This Special Operations LCO provides the appropriate additional controls to allow a single control rod withdrawal in MODE 3.

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APPLICABLE SAFETY ANALYSES    With the reactor mode switch in the refuel position, the analyses for control rod removal error during refueling are applicable and, provided the assumptions of these analyses are satisfied in MODE 3, these analyses will bound the consequences of an accident. Explicit safety analyses in the UFSAR (Ref. 1) demonstrate that the functioning of the refueling interlocks and adequate SDM will preclude unacceptable reactivity excursions.

Refueling interlocks restrict the movement of control rods to reinforce operational procedures that prevent the reactor from becoming critical. These interlocks prevent the withdrawal of more than one control rod. Under these conditions, since only one control rod can be withdrawn, the core will always be shut down even with the highest worth control rod withdrawn if adequate SDM exists.

The control rod scram function provides backup protection to normal refueling procedures and the refueling interlocks, which prevent inadvertent criticalities during refueling.

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BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

Alternate backup protection can be obtained by ensuring that a five by five array of control rods, centered on the withdrawn control rod, are inserted and incapable of withdrawal.

As described in LCO 3.0.7, compliance with Special Operations LCOs is optional, and therefore, no criteria of 10 CFR 50.36(c)(2)(ii) apply. Special Operations LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria satisfied for the other LCOs is provided in their respective Bases.

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LCO

As described in LCO 3.0.7, compliance with this Special Operations LCO is optional. Operation in MODE 3 with the reactor mode switch in the refuel position can be performed in accordance with other Special Operations LCOs (i.e., LCO 3.10.1, "Reactor Mode Switch Interlock Testing," without meeting this Special Operations LCO or its ACTIONS. However, if a single control rod withdrawal is desired in MODE 3, controls consistent with those required during refueling must be implemented and this Special Operations LCO applied. "Withdrawal" in this application includes the actual withdrawal of the control rod as well as maintaining the control rod in a position other than the full-in position, and reinserting the control rod. The refueling interlocks of LCO 3.9.2, "Refuel Position One-Rod-Out Interlock," required by this Special Operations LCO, will ensure that only one control rod can be withdrawn.

To back up the refueling interlocks (LCO 3.9.2), the ability to scram the withdrawn control rod in the event of an inadvertent criticality is provided by this Special Operations LCO's requirements in Item d.1. Alternately, provided a sufficient number of control rods in the vicinity of the withdrawn control rod are known to be inserted and incapable of withdrawal (Item d.2), the possibility of criticality on withdrawal of this control rod is sufficiently precluded, so as not to require the scram capability of the withdrawn control rod. Also, once this alternate (Item d.2) is completed, the SDM requirement to account for both the withdrawn-untrippable control rod and the highest worth control rod may be changed to allow the withdrawn-untrippable control rod to be the single highest worth control rod.

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(continued)

BASES (continued)

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APPLICABILITY Control rod withdrawals are adequately controlled in MODES 1, 2, and 5 by existing LCOs. In MODES 3 and 4, control rod withdrawal is only allowed if performed in accordance with this Special Operations LCO or Special Operations LCO 3.10.3, and if limited to one control rod. This allowance is only provided with the reactor mode switch in the refuel position. For these conditions, the one-rod-out interlock (LCO 3.9.2), control rod position indication (LCO 3.9.4, "Control Rod Position Indication"), full insertion requirements for all other control rods and scram functions (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," LCO 3.3.8.2, "Reactor Protection System (RPS) Electric Power Monitoring," and LCO 3.9.5, "Control Rod OPERABILITY-Refueling"), or the added administrative controls in Item d.2 of this Special Operations LCO, minimize potential reactivity excursions.

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ACTIONS A Note has been provided to modify the ACTIONS related to a single control rod withdrawal while in MODE 3. Section 1.3, Completion Times, specifies once a Condition has been entered, subsequent divisions, subsystems, components or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for each requirement of the LCO not met provide appropriate compensatory measures for separate requirements that are not met. As such, a Note has been provided that allows separate Condition entry for each requirement of the LCO.

A.1

If one or more of the requirements specified in this Special Operations LCO are not met, the ACTIONS applicable to the stated requirements of the affected LCOs are immediately entered as directed by Required Action A.1. Required Action A.1 has been modified by a Note that clarifies the intent of any other LCO's Required Action, to insert all control rods. This Required Action includes exiting this Special Operations Applicability by returning the reactor mode switch to the shutdown position. A second Note has

(continued)

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BASES

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ACTIONS

A.1 (continued)

been added, which clarifies that this Required Action is only applicable if the requirements not met are for an affected LCO.

A.2.1 and A.2.2

Required Actions A.2.1 and A.2.2 are alternate Required Actions that can be taken instead of Required Action A.1 to restore compliance with the normal MODE 3 requirements, thereby exiting this Special Operations LCO's Applicability. Actions must be initiated immediately to insert all insertable control rods. Actions must continue until all such control rods are fully inserted. Placing the reactor mode switch in the shutdown position will ensure all inserted rods remain inserted and restore operation in accordance with Table 1.1-1. The allowed Completion Time of 1 hour to place the reactor mode switch in the shutdown position provides sufficient time to normally insert the control rods.

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SURVEILLANCE  
REQUIREMENTS

SR 3.10.2.1, SR 3.10.2.2, and SR 3.10.2.3

The other LCOs made applicable in this Special Operations LCO are required to have their Surveillances met to establish that this Special Operations LCO is being met. If the local array of control rods is inserted and disarmed while the scram function for the withdrawn rod is not available, periodic verification in accordance with SR 3.10.2.2 is required to preclude the possibility of criticality. The control rods can be hydraulically disarmed by closing the drive water and exhaust water isolation valves. Electrically, the control rods can be disarmed by disconnecting power from all four directional control valve solenoids. SR 3.10.2.2 has been modified by a Note, which clarifies that this SR is not required to be met if SR 3.10.2.1 is satisfied for LCO 3.10.2.d.1 requirements, since SR 3.10.2.2 demonstrates that the alternative LCO 3.10.2.d.2 requirements are satisfied. Also, SR 3.10.2.3 verifies that all control rods other than the control rod being withdrawn are fully inserted. The 24 hour Frequency is acceptable because of the administrative

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BASES

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SURVEILLANCE      SR 3.10.2.1, SR 3.10.2.2, and SR 3.10.2.3 (continued)  
REQUIREMENTS  
                     controls on control rod withdrawal, the protection afforded  
                     by the LCOs involved, and hardwire interlocks that preclude  
                     additional control rod withdrawals.

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REFERENCES        1.    UFSAR, Section 15.4.1.

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B 3.10 SPECIAL OPERATIONS

B 3.10.3 Single Control Rod Withdrawal - Cold Shutdown

BASES

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**BACKGROUND** The purpose of this MODE 4 Special Operations LCO is to permit the withdrawal of a single control rod for testing or maintenance, while in cold shutdown, by imposing certain restrictions. In MODE 4, the reactor mode switch is in the shutdown position, and all control rods are inserted and blocked from withdrawal. Many systems and functions are not required in these conditions, due to the installed interlocks associated with the reactor mode switch in the shutdown position. Circumstances may arise while in MODE 4, however, that present the need to withdraw a single control rod for various tests (e.g., rod exercising, friction tests, scram time testing, and coupling integrity checks). Certain situations may also require the removal of the associated control rod drive (CRD). These single control rod withdrawals and possible subsequent removals are normally accomplished by selecting the refuel position for the reactor mode switch.

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**APPLICABLE SAFETY ANALYSES** With the reactor mode switch in the refuel position, the analyses for control rod removal error during refueling are applicable and, provided the assumptions of these analyses are satisfied in MODE 4, these analyses will bound the consequences of an accident. Explicit safety analyses in the UFSAR (Ref. 1) demonstrate that the functioning of the refueling interlocks and adequate SDM will preclude unacceptable reactivity excursions.

Refueling interlocks restrict the movement of control rods to reinforce operational procedures that prevent the reactor from becoming critical. These interlocks prevent the withdrawal of more than one control rod. Under these conditions, since only one control rod can be withdrawn, the core will always be shut down even with the highest worth control rod withdrawn if adequate SDM exists.

The control rod scram function provides backup protection in the event normal refueling procedures and the refueling interlocks fail to prevent inadvertent criticalities during refueling. Alternate backup protection can be obtained by

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BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

ensuring that a five by five array of control rods, centered on the withdrawn control rod, are inserted and incapable of withdrawal. This alternate backup protection is required when removing a CRD because this removal renders the withdrawn control rod incapable of being scrammed.

As described in LCO 3.0.7, compliance with Special Operations LCOs is optional, and therefore, no criteria of 10 CFR 50.36(c)(2)(ii) apply. Special Operations LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria satisfied for the other LCOs is provided in their respective Bases.

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LCO

As described in LCO 3.0.7, compliance with this Special Operations LCO is optional. Operation in MODE 4 with the reactor mode switch in the refuel position can be performed in accordance with other LCOs (i.e., Special Operations LCO 3.10.1, "Reactor Mode Switch Interlock Testing") without meeting this Special Operations LCO or its ACTIONS. If a single control rod withdrawal is desired in MODE 4, controls consistent with those required during refueling must be implemented and this Special Operations LCO applied. "Withdrawal" in this application includes the actual withdrawal of the control rod as well as maintaining the control rod in a position other than the full-in position, and reinserting the control rod.

The refueling interlocks of LCO 3.9.2, "Refuel Position One-Rod-Out Interlock," required by this Special Operations LCO will ensure that only one control rod can be withdrawn. At the time CRD removal begins, the disconnection of the position indication probe will cause LCO 3.9.4, "Control Rod Position Indication," and therefore, LCO 3.9.2 to fail to be met. Therefore, prior to commencing CRD removal, a control rod withdrawal block is required to be inserted to ensure that no additional control rods can be withdrawn and that compliance with this Special Operations LCO is maintained.

To back up the refueling interlocks (LCO 3.9.2) or the control rod withdrawal block, the ability to scram the withdrawn control rod in the event of an inadvertent criticality is provided by the Special Operations LCO requirements in Item c.1. Alternatively, when the scram

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(continued)

BASES

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LCO  
(continued)      function is not OPERABLE, or when the CRD is to be removed, a sufficient number of rods in the vicinity of the withdrawn control rod are required to be inserted and made incapable of withdrawal by electrically or hydraulically disarming the CRD (Item c.2). This precludes the possibility of criticality upon withdrawal of this control rod. Also, once this alternate (Item c.2) is completed, the SDM requirement to account for both the withdrawn-untrippable control rod and the highest worth control rod may be changed to allow the withdrawn-untrippable control rod to be the single highest worth control rod.

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APPLICABILITY      Control rod withdrawals are adequately controlled in MODES 1, 2, and 5 by existing LCOs. In MODES 3 and 4, control rod withdrawal is only allowed if performed in accordance with Special Operations LCO 3.10.2, or this Special Operations LCO, and if limited to one control rod. This allowance is only provided with the reactor mode switch in the refuel position.

During these conditions, the full insertion requirements for all other control rods, the one-rod-out interlock (LCO 3.9.2), control rod position indication (LCO 3.9.4), and scram functions (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," LCO 3.3.8.2, "Reactor Protection System (RPS) Electric Power Monitoring," and LCO 3.9.5, "Control Rod OPERABILITY—Refueling"), or the added administrative controls in Item b.2 and Item c.2 of this Special Operations LCO, provide mitigation of potential reactivity excursions.

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ACTIONS      A Note has been provided to modify the ACTIONS related to a single control rod withdrawal while in MODE 4. Section 1.3, Completion Times, specifies that once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for each requirement of the LCO not met provide appropriate

(continued)

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BASES

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ACTIONS (continued)      compensatory measures for separate requirements that are not met. As such, a Note has been provided that allows separate Condition entry for each requirement of the LCO.

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

If one or more of the requirements of this Special Operations LCO are not met with the affected control rod insertable, these Required Actions restore operation consistent with normal MODE 4 conditions (i.e., all rods inserted) or with the exceptions allowed in this Special Operations LCO. Required Action A.1 has been modified by a Note that clarifies the intent of any other LCO's Required Action to insert all control rods. This Required Action includes exiting this Special Operations LCO Applicability by returning the reactor mode switch to the shutdown position. A second Note has been added to Required Action A.1 to clarify that this Required Action is only applicable if the requirements not met are for an affected LCO.

Required Actions A.2.1 and A.2.2 are specified, based on the assumption that the control rod is being withdrawn. If the control rod is still insertable, actions must be immediately initiated to fully insert all insertable control rods and within 1 hour place the reactor mode switch in the shutdown position. Actions must continue until all such control rods are fully inserted. The allowed Completion Time of 1 hour for placing the reactor mode switch in the shutdown position provides sufficient time to normally insert the control rods.

B.1, B.2.1, and B.2.2

If one or more of the requirements of this Special Operations LCO are not met with the affected control rod not insertable, withdrawal of the control rod and removal of the associated CRD must be immediately suspended. If the CRD has been removed, such that the control rod is not insertable, the Required Actions require the most expeditious action be taken to either initiate action to restore the CRD and insert its control rod, or initiate action to restore compliance with this Special Operations LCO.

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(continued)

BASES (continued)

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SURVEILLANCE REQUIREMENTS      SR 3.10.3.1, SR 3.10.3.2, SR 3.10.3.3, and SR 3.10.3.4

The other LCOs made applicable by this Special Operations LCO are required to have their associated surveillances met to establish that this Special Operations LCO is being met. If the local array of control rods is inserted and disarmed while the scram function for the withdrawn rod is not available, periodic verification is required to ensure that the possibility of criticality remains precluded. The control rods can be hydraulically disarmed by closing the drive water and exhaust water isolation valves. Electrically, the control rods can be disarmed by disconnecting power from all four directional control valve solenoids. Verification that all the other control rods are fully inserted is required to meet the SDM requirements. Verification that a control rod withdrawal block has been inserted ensures that no other control rods can be inadvertently withdrawn under conditions when position indication instrumentation is inoperable for the affected control rod. The 24 hour Frequency is acceptable because of the administrative controls on control rod withdrawals, the protection afforded by the LCOs involved, and hardwire interlocks to preclude an additional control rod withdrawal.

SR 3.10.3.2 and SR 3.10.3.4 have been modified by Notes, which clarify that these SRs are not required to be met if the alternative requirements demonstrated by SR 3.10.3.1 are satisfied.

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REFERENCES                      1.    UFSAR, Section 15.4.1.

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B 3.10 SPECIAL OPERATIONS

B 3.10.4 Single Control Rod Drive (CRD) Removal - Refueling

BASES

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BACKGROUND

The purpose of this MODE 5 Special Operations LCO is to permit the removal of a single CRD during refueling operations by imposing certain administrative controls. Refueling interlocks restrict the movement of control rods and the operation of the refueling equipment to reinforce operational procedures that prevent the reactor from becoming critical during refueling operations. During refueling operations, no more than one control rod, in a core cell containing one or more fuel assemblies is permitted to be withdrawn. The refueling interlocks use the "full-in" position indicators to determine the position of all control rods. If the "full-in" position signal is not present for every control rod, then the all rods in permissive for the refueling equipment interlocks is not present and fuel loading is prevented. Also, the refuel position one-rod-out interlock will not allow the withdrawal of a second control rod.

The control rod scram function provides backup protection in the event normal refueling procedures, and the refueling interlocks described above fail to prevent inadvertent criticalities during refueling. The requirement for the refueling interlocks to be OPERABLE precludes the possibility of removing the CRD once a control rod is withdrawn from a core cell containing one or more fuel assemblies. This Special Operations LCO provides controls sufficient to ensure the possibility of an inadvertent criticality is precluded, while allowing a single CRD to be removed from a core cell containing one or more fuel assemblies. The removal of the CRD involves disconnecting the position indication probe, which causes noncompliance with LCO 3.9.4, "Control Rod Position Indication," and, therefore, LCO 3.9.1, "Refueling Equipment Interlocks," and LCO 3.9.2, "Refueling Position One-Rod-Out Interlock." The CRD removal also requires isolation of the CRD from the CRD Hydraulic System, thereby causing inoperability of the control rod (LCO 3.9.5, "Control Rod OPERABILITY - Refueling").

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(continued)

BASES (continued)

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APPLICABLE  
SAFETY ANALYSES

With the reactor mode switch in the refuel position, the analyses for control rod removal error during refueling are applicable and, provided the assumptions of these analyses are satisfied, these analyses will bound the consequences of accidents. Explicit safety analyses in the UFSAR (Ref. 1) demonstrate that proper operation of the refueling interlocks and adequate SDM will preclude unacceptable reactivity excursions.

Refueling interlocks restrict the movement of control rods and the operation of the refueling equipment to reinforce operational procedures that prevent the reactor from becoming critical. These interlocks prevent the withdrawal of more than one control rod. Under these conditions, since only one control rod can be withdrawn, the core will always be shut down even with the highest worth control rod withdrawn if adequate SDM exists. By requiring all other control rods to be inserted and a control rod withdrawal block initiated, the function of the inoperable one-rod-out interlock (LCO 3.9.2) is adequately maintained. This Special Operations LCO requirement that no other CORE ALTERATIONS are in progress adequately compensates for the inoperable all-rods-in permissive for the refueling equipment interlocks (LCO 3.9.1).

The control rod scram function provides backup protection to normal refueling procedures and the refueling interlocks, which prevent inadvertent criticalities during refueling. Since the scram function and refueling interlocks may be suspended, alternate backup protection required by this Special Operations LCO is obtained by ensuring that a five by five array of control rods, centered on the withdrawn control rod, are inserted and are incapable of being withdrawn, and all other control rods are inserted and incapable of being withdrawn by insertion of a control rod block.

As described in LCO 3.0.7, compliance with Special Operations LCOs is optional, and therefore, no criteria of 10 CFR 50.36(c)(2)(ii) apply. Special Operations LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria satisfied for the other LCOs is provided in their respective Bases.

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BASES (continued)

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LCO As described in LCO 3.0.7, compliance with this Special Operations LCO is optional. Operation in MODE 5 with any of the following LCOs, LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," LCO 3.3.8.2, "Reactor Protection System (RPS) Electric Power Monitoring," LCO 3.9.1, LCO 3.9.2, LCO 3.9.4, or LCO 3.9.5 not met, can be performed in accordance with the Required Actions of these LCOs without meeting this Special Operations LCO or its ACTIONS. However, if a single CRD removal from a core cell containing one or more fuel assemblies is desired in MODE 5, controls consistent with those required by LCO 3.3.1.1, LCO 3.3.8.2, LCO 3.9.1, LCO 3.9.2, LCO 3.9.4, and LCO 3.9.5 must be implemented, and this Special Operations LCO applied.

By requiring all other control rods to be inserted and a control rod withdrawal block initiated, the function of the inoperable one-rod-out interlock (LCO 3.9.2) is adequately maintained. This Special Operations LCO requirement that no other CORE ALTERATIONS are in progress adequately compensates for the inoperable all-rods-in permissive for the refueling equipment interlocks (LCO 3.9.1). Ensuring that the five by five array of control rods, centered on the withdrawn control rod, are inserted and incapable of withdrawal (by electrically or hydraulically disarming the CRD) adequately satisfies the backup protection that LCO 3.3.1.1 and LCO 3.9.2 would have otherwise provided. Also, once these requirements (Items a, b, and c) are completed, the SDM requirement to account for both the withdrawn-untrippable control rod and the highest worth control rod may be changed to allow the withdrawn-untrippable control rod to be the single highest worth control rod.

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APPLICABILITY Operation in MODE 5 is controlled by existing LCOs. The allowance to comply with this Special Operations LCO in lieu of the ACTIONS of LCO 3.3.1.1, LCO 3.3.8.2, LCO 3.9.1, LCO 3.9.2, LCO 3.9.4, and LCO 3.9.5 is appropriately controlled with the additional administrative controls required by this Special Operations LCO, which reduce the potential for reactivity excursions.

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(continued)

BASES (continued)

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ACTIONS

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

If one or more of the requirements of this Special Operations LCO are not met, the immediate implementation of these Required Actions restores operation consistent with the normal requirements for failure to meet LCO 3.3.1.1, LCO 3.9.1, LCO 3.9.2, LCO 3.9.4, and LCO 3.9.5 (i.e., all control rods inserted) or with the allowances of this Special Operations LCO. The Completion Times for Required Action A.1, Required Action A.2.1, and Required Action A.2.2 are intended to require that these Required Actions be implemented in a very short time and carried through in an expeditious manner to either initiate action to restore the CRD and insert its control rod, or initiate action to restore compliance with this Special Operations LCO. Actions must continue until either Required Action A.2.1 or Required Action A.2.2 is satisfied.

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SURVEILLANCE  
REQUIREMENTS

SR 3.10.4.1, SR 3.10.4.2, SR 3.10.4.3, SR 3.10.4.4,  
and SR 3.10.4.5

Verification that all the control rods, other than the control rod withdrawn for the removal of the associated CRD, are fully inserted is required to ensure the SDM is within limits. Verification that the local five by five array of control rods, other than the control rod withdrawn for removal of the associated CRD, is inserted and disarmed, while the scram function for the withdrawn rod is not available, is required to ensure that the possibility of criticality remains precluded. The control rods can be hydraulically disarmed by closing the drive water and exhaust water isolation valves. Electrically, the control rods can be disarmed by disconnecting power from all four directional control valve solenoids. Verification that a control rod withdrawal block has been inserted ensures that no other control rods can be inadvertently withdrawn under conditions when position indication instrumentation is inoperable for the withdrawn control rod. The Surveillance for LCO 3.1.1, which is made applicable by this Special Operations LCO, is required in order to establish that this Special Operations LCO is being met. Verification that no other CORE ALTERATIONS are being made is required to ensure the assumptions of the safety analysis are satisfied.

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BASES

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SURVEILLANCE      SR 3.10.4.1, SR 3.10.4.2, SR 3.10.4.3, SR 3.10.4.4,  
REQUIREMENTS      and SR 3.10.4.5 (continued)

Periodic verification of the administrative controls established by this Special Operations LCO is prudent to preclude the possibility of an inadvertent criticality. The 24 hour Frequency is acceptable, given the administrative controls on control rod removal and hardwire interlock to block an additional control rod withdrawal.

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REFERENCES          1.    UFSAR, Section 15.4.1.

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B 3.10 SPECIAL OPERATIONS

B 3.10.5 Multiple Control Rod Withdrawal - Refueling

BASES

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BACKGROUND            The purpose of this MODE 5 Special Operations LCO is to permit multiple control rod withdrawal during refueling by imposing certain administrative controls.

Refueling interlocks restrict the movement of control rods and the operation of the refueling equipment to reinforce operational procedures that prevent the reactor from becoming critical during refueling operations. During refueling operations, no more than one control rod, in a core cell containing one or more fuel assemblies is permitted to be withdrawn. When all four fuel assemblies are removed from a cell, the control rod may be withdrawn with no restrictions. Any number of control rods may be withdrawn and removed from the reactor vessel if their cells contain no fuel.

The refueling interlocks use the "full-in" position indicators to determine the position of all control rods. If the "full-in" position signal is not present for every control rod, then the all rods in permissive for the refueling equipment interlocks is not present and fuel loading is prevented. Also, the refuel position one-rod-out interlock will not allow the withdrawal of a second control rod.

To allow more than one control rod to be withdrawn during refueling, these interlocks must be defeated. This Special Operations LCO establishes the necessary administrative controls to allow bypassing the "full-in" position indicators.

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APPLICABLE SAFETY ANALYSES    Explicit safety analyses in the UFSAR (Ref. 1) demonstrate that the functioning of the refueling interlocks and adequate SDM will prevent unacceptable reactivity excursions during refueling. To allow multiple control rod withdrawals, control rod removals, associated control rod drive (CRD) removal, or any combination of these, the "full-in" position indication is allowed to be bypassed for each withdrawn control rod if all fuel has been removed from

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BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

the cell. With no fuel assemblies in the core cell, the associated control rod has no reactivity control function and is not required to remain inserted. Prior to reloading fuel into the cell, however, the associated control rod must be inserted to ensure that an inadvertent criticality does not occur, as evaluated in the Reference 1 analysis.

As described in LCO 3.0.7, compliance with Special Operations LCOs is optional, and therefore, no criteria of 10 CFR 50.36(c)(2)(ii) apply. Special Operations LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria satisfied for the other LCOs is provided in their respective Bases.

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LCO

As described in LCO 3.0.7, compliance with this Special Operations LCO is optional. Operation in MODE 5 with either LCO 3.9.3, "Control Rod Position," LCO 3.9.4, "Control Rod Position Indication," or LCO 3.9.5, "Control Rod OPERABILITY – Refueling," not met, can be performed in accordance with the Required Actions of these LCOs without meeting this Special Operations LCO or its ACTIONS. If multiple control rod withdrawal or removal, or CRD removal is desired, all four fuel assemblies are required to be removed from the associated cells. Prior to entering this LCO, any fuel remaining in a cell whose CRD was previously removed under the provisions of another LCO must be removed. "Withdrawal" in this application includes the actual withdrawal of the control rod as well as maintaining the control rod in a position other than the full-in position, and reinserting the control rod.

When fuel is loaded into the core with multiple control rods withdrawn, special spiral reload sequences are used to ensure that reactivity additions are minimized. Spiral reloading encompasses reloading a cell (four fuel locations immediately adjacent to a control rod) on the edge of a continuous fueled region (the cell can be loaded in any sequence). Otherwise, all control rods must be fully inserted before loading fuel.

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APPLICABILITY

Operation in MODE 5 is controlled by existing LCOs. The exceptions from other LCO requirements (e.g., the ACTIONS of LCO 3.9.3, LCO 3.9.4, or LCO 3.9.5) allowed by this Special

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BASES

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APPLICABILITY (continued) Operations LCO are appropriately controlled by requiring all fuel to be removed from cells whose "full-in" indicators are allowed to be bypassed.

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ACTIONS A.1, A.2, A.3.1, and A.3.2

If one or more of the requirements of this Special Operations LCO are not met, the immediate implementation of these Required Actions restores operation consistent with the normal requirements for refueling (i.e., all control rods inserted in core cells containing one or more fuel assemblies) or with the exceptions granted by this Special Operations LCO. The Completion Times for Required Action A.1, Required Action A.2, Required Action A.3.1, and Required Action A.3.2 are intended to require that these Required Actions be implemented in a very short time and carried through in an expeditious manner to either initiate action to restore the affected CRDs and insert their control rods, or initiate action to restore compliance with this Special Operations LCO.

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SURVEILLANCE REQUIREMENTS SR 3.10.5.1, SR 3.10.5.2, and SR 3.10.5.3

Periodic verification of the administrative controls established by this Special Operations LCO is prudent to preclude the possibility of an inadvertent criticality. The 24 hour Frequency is acceptable, given the administrative controls on fuel assembly and control rod removal, and takes into account other indications of control rod status available in the control room.

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REFERENCES 1. UFSAR, Section 15.4.1.

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B 3.10 SPECIAL OPERATIONS

B 3.10.6 Control Rod Testing—Operating

BASES

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BACKGROUND

The purpose of this Special Operations LCO is to permit control rod testing, while in MODES 1 and 2, by imposing certain administrative controls. Control rod patterns during startup conditions are controlled by the operator and the rod worth minimizer (RWM) (LCO 3.3.2.1, "Control Rod Block Instrumentation"), such that only the specified control rod sequences and relative positions required by LCO 3.1.6, "Rod Pattern Control," are allowed over the operating range from all control rods inserted to the low power setpoint (LPSP) of the RWM. The sequences effectively limit the potential amount and rate of reactivity increase that could occur during a control rod drop accident (CRDA). During these conditions, control rod testing is sometimes required that may result in control rod patterns not in compliance with the prescribed sequences of LCO 3.1.6. These tests include SDM demonstrations, control rod scram time testing, and control rod friction testing. This Special Operations LCO provides the necessary exemption to the requirements of LCO 3.1.6 and provides additional administrative controls to allow the deviations in such tests from the prescribed sequences in LCO 3.1.6.

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APPLICABLE  
SAFETY ANALYSES

The analytical methods and assumptions used in evaluating the CRDA are summarized in References 1, 2, 3, 4, and 5. CRDA analyses assume the reactor operator follows prescribed withdrawal sequences. These sequences define the potential initial conditions for the CRDA analyses. The RWM provides backup to operator control of the withdrawal sequences to ensure the initial conditions of the CRDA analyses are not violated. For special sequences developed for control rod testing, the initial control rod patterns assumed in the safety analysis of References 1, 2, 3, 4, and 5 may not be preserved. Therefore special CRDA analyses are required to demonstrate that these special sequences will not result in unacceptable consequences, should a CRDA occur during the testing. These analyses, performed in accordance with an NRC approved methodology, are dependent on the specific test being performed.

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BASES

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APPLICABLE SAFETY ANALYSES (continued) As described in LCO 3.0.7, compliance with Special Operations LCOs is optional, and therefore, no criteria of 10 CFR 50.36(c)(2)(ii) apply. Special Operations LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria satisfied for the other LCOs is provided in their respective Bases.

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LCO As described in LCO 3.0.7, compliance with this Special Operations LCO is optional. Control rod testing may be performed in compliance with the prescribed sequences of LCO 3.1.6, and during these tests, no exceptions to the requirements of LCO 3.1.6 are necessary. For testing performed with a sequence not in compliance with LCO 3.1.6, the requirements of LCO 3.1.6 may be suspended, provided additional administrative controls are placed on the test to ensure that the assumptions of the special safety analysis for the test sequence are satisfied. Assurances that the test sequence is followed can be provided by either programming the test sequence into the RWM, with conformance verified as specified in SR 3.3.2.1.8 and allowing the RWM to monitor control rod withdrawal and provide appropriate control rod blocks if necessary, or by verifying conformance to the approved test sequence by a second licensed operator (Reactor Operator or Senior Reactor Operator) or other task qualified member of the technical staff (e.g., shift technical advisor or reactor engineer). These controls are consistent with those normally applied to operation in the startup range as defined in the SRs and ACTIONS of LCO 3.3.2.1, "Control Rod Block Instrumentation."

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APPLICABILITY Control rod testing, while in MODES 1 and 2, with THERMAL POWER greater than 10% RTP, is adequately controlled by the existing LCOs on power distribution limits and control rod block instrumentation. Control rod movement during these conditions is not restricted to prescribed sequences and can be performed within the constraints of LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)," LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)," LCO 3.2.3, "LINEAR HEAT GENERATION RATE (LHGR)," and LCO 3.3.2.1. With THERMAL POWER less than or equal to 10% RTP, the provisions of this

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BASES

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APPLICABILITY  
(continued)

Special Operations LCO are necessary to perform special tests that are not in conformance with the prescribed sequences of LCO 3.1.6.

While in MODES 3 and 4, control rod withdrawal is only allowed if performed in accordance with Special Operations LCO 3.10.2, "Single Control Rod Withdrawal - Hot Shutdown," or Special Operations LCO 3.10.3, "Single Control Rod Withdrawal - Cold Shutdown," which provide adequate controls to ensure that the assumptions of the safety analysis of References 1, 2, 3, 4, and 5 are satisfied. During these Special Operations and while in MODE 5, the one-rod-out interlock (LCO 3.9.2, "Refuel Position One-Rod-Out Interlock,") and scram functions (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," and LCO 3.9.5, "Control Rod OPERABILITY - Refueling"), or the added administrative controls prescribed in the applicable Special Operations LCOs, provide mitigation of potential reactivity excursions.

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ACTIONS

A.1

With the requirements of the LCO not met (e.g., the control rod pattern is not in compliance with the special test sequence, the sequence is improperly loaded in the RWM) the testing is required to be immediately suspended. Upon suspension of the special test, the provisions of LCO 3.1.6 are no longer excepted, and appropriate actions are to be taken to restore the control rod sequence to the prescribed sequence of LCO 3.1.6, or to shut down the reactor, if required by LCO 3.1.6.

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SURVEILLANCE  
REQUIREMENTS

SR 3.10.6.1

With the special test sequence not programmed into the RWM, a second licensed operator (Reactor Operator or Senior Reactor Operator) or other task qualified member of the technical staff (e.g., shift technical advisor or reactor engineer) is required to verify conformance with the approved sequence for the test. This verification must be performed during control rod movement to prevent deviations from the specified sequence. A Note is added to indicate that this Surveillance does not need to be met if SR 3.10.6.2 is satisfied.

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(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS  
(continued)

SR 3.10.6.2

When the RWM provides conformance to the special test sequence, the test sequence must be verified to be correctly loaded into the RWM prior to control rod movement. This Surveillance demonstrates compliance with SR 3.3.2.1.8, thereby demonstrating that the RWM is OPERABLE. A Note has been added to indicate that this Surveillance does not need to be met if SR 3.10.6.1 is satisfied.

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REFERENCES

1. UFSAR, Section 15.4.10.
  2. XN-NF-80-19(P)(A), Volume 1, Supplement 2, Section 7.1, Exxon Nuclear Methodology for Boiling Water Reactor Neutronics Methods for Design Analysis, (as specified in Technical Specification 5.6.5).
  3. NEDE-24011-P-A-US, General Electric Standard Application for Reactor Fuel, (as specified in Technical Specification 5.6.5).
  4. Letter from T. Pickens (BWROG) to G.C. Lainas (NRC) "Amendment 17 to General Electric Licensing Topical Report NEDE-24011-P-A," BWROG-8644, August 15, 1986.
  5. NFSR-0091, Benchmark of CASMO/MICROBURN BWR Nuclear Design Methods, Commonwealth Edison Topical Report, (as specified in Technical Specification 5.6.5).
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B 3.10 SPECIAL OPERATIONS

B 3.10.7 SHUTDOWN MARGIN (SDM) Test – Refueling

BASES

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BACKGROUND The purpose of this MODE 5 Special Operations LCO is to permit SDM testing to be performed for those plant configurations in which the reactor pressure vessel (RPV) head is either not in place or the head bolts are not fully tensioned.

LCO 3.1.1, "SHUTDOWN MARGIN (SDM)," requires that adequate SDM be demonstrated following fuel movements or control rod replacement within the RPV. The demonstration must be performed prior to or within 4 hours after criticality is reached. This SDM test may be performed prior to or during the first startup following the refueling. Performing the SDM test prior to startup requires the test to be performed while in MODE 5, with the vessel head bolts less than fully tensioned (and possibly with the vessel head removed). While in MODE 5, the reactor mode switch is required to be in the shutdown or refuel position, where the applicable control rod blocks ensure that the reactor will not become critical. The SDM test requires the reactor mode switch to be in the startup/hot standby position, since more than one control rod will be withdrawn for the purpose of demonstrating adequate SDM. This Special Operations LCO provides the appropriate additional controls to allow withdrawing more than one control rod from a core cell containing one or more fuel assemblies when the reactor vessel head bolts are less than fully tensioned.

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APPLICABLE SAFETY ANALYSES Prevention and mitigation of unacceptable reactivity excursions during control rod withdrawal, with the reactor mode switch in the startup/hot standby position while in MODE 5, is provided by the intermediate range monitor (IRM) neutron flux scram (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation"), and control rod block instrumentation (LCO 3.3.2.1, "Control Rod Block Instrumentation"). The limiting reactivity excursion during startup conditions while in MODE 5 is the control rod drop accident (CRDA).

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BASES

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APPLICABLE  
SAFETY ANALYSES  
(continued)

CRDA analyses assume that the reactor operator follows prescribed withdrawal sequences. For SDM tests performed within these defined sequences, the analyses of References 1, 2, 3, 4, and 5 are applicable. However, for some sequences developed for the SDM testing, the control rod patterns assumed in the safety analyses of References 1, 2, 3, 4, and 5 may not be met. Therefore, special CRDA analyses, performed in accordance with an NRC approved methodology, are required to demonstrate the SDM test sequence will not result in unacceptable consequences should a CRDA occur during the testing. For the purpose of this test, the protection provided by the normally required MODE 5 applicable LCOs, in addition to the requirements of this LCO, will maintain normal test operations as well as postulated accidents within the bounds of the appropriate safety analyses (Refs. 1, 2, 3, 4, and 5). In addition to the added requirements for the RWM, APRM, and control rod coupling, the notch out mode is specified for out of sequence withdrawals. Requiring the notch out mode limits withdrawal steps to a single notch, which limits inserted reactivity, and allows adequate monitoring of changes in neutron flux, which may occur during the test.

As described in LCO 3.0.7, compliance with Special Operations LCOs is optional, and therefore, no criteria of 10 CFR 50.36(c)(2)(ii) apply. Special Operations LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria satisfied for the other LCOs is provided in their respective Bases.

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LCO

As described in LCO 3.0.7, compliance with this Special Operations LCO is optional. SDM tests may be performed while in MODE 2, in accordance with Table 1.1-1, without meeting this Special Operations LCO or its ACTIONS. For SDM tests performed while in MODE 5, additional requirements must be met to ensure that adequate protection against potential reactivity excursions is available. To provide additional scram protection, beyond the normally required IRMs, the APRMs are also required to be OPERABLE (LCO 3.3.1.1, Functions 2.a and 2.d as though the reactor were in MODE 2. Because multiple control rods will be withdrawn and the reactor will potentially become critical, the approved control rod withdrawal sequence must be enforced by the RWM

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BASES

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LCO (continued) (LCO 3.3.2.1, Function 2, MODE 2), or must be verified by a second licensed operator (Reactor Operator or Senior Reactor Operator) or other task qualified member of the technical staff (e.g., a shift technical advisor or reactor engineer). To provide additional protection against an inadvertent criticality, control rod withdrawals that do not conform to the analyzed rod position sequence specified in LCO 3.1.6, "Rod Pattern Control," (i.e., out of sequence control rod withdrawals) must be made in the individual notched withdrawal mode to minimize the potential reactivity insertion associated with each movement. Coupling integrity of withdrawn control rods is required to minimize the probability of a CRDA and ensure proper functioning of the withdrawn control rods, if they are required to scram. Because the reactor vessel head may be removed during these tests, no other CORE ALTERATIONS may be in progress. Furthermore, since the control rod scram function with the RCS at atmospheric pressure relies solely on the CRD accumulator, it is essential that the CRD charging water header remain pressurized. This Special Operations LCO then allows changing the Table 1.1-1 reactor mode switch position requirements to include the startup/hot standby position, such that the SDM tests may be performed while in MODE 5.

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APPLICABILITY These SDM test Special Operations requirements are only applicable if the SDM tests are to be performed while in MODE 5 with the reactor vessel head removed or the head bolts not fully tensioned. Additional requirements during these tests to enforce control rod withdrawal sequences and restrict other CORE ALTERATIONS provide protection against potential reactivity excursions. Operations in all other MODES are unaffected by this LCO.

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ACTIONS A.1 and A.2

With one or more control rods discovered uncoupled during this Special Operation, a controlled insertion of each uncoupled control rod is required; either to attempt recoupling, or to preclude a control rod drop. This controlled insertion is preferred since, if the control rod fails to follow the drive as it is withdrawn (i.e., is "stuck" in an inserted position), placing the reactor mode

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BASES

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ACTIONS                    A.1 and A.2 (continued)

switch in the shutdown position per Required Action B.1 could cause substantial secondary damage. If recoupling is not accomplished, operation may continue, provided the control rods are fully inserted within 3 hours and disarmed (electrically or hydraulically) within 4 hours. Inserting a control rod ensures the shutdown and scram capabilities are not adversely affected. The control rod is disarmed to prevent inadvertent withdrawal during subsequent operations. The control rods can be hydraulically disarmed by closing the drive water and exhaust water isolation valves. Electrically the control rods can be disarmed by disconnecting power from all four directional control valve solenoids. Required Action A.1 is modified by a Note that allows the RWM to be bypassed if required to allow insertion of the inoperable control rods and continued operation. LCO 3.3.2.1, "Control Rod Block Instrumentation," Actions provide additional requirements when the RWM is bypassed to ensure compliance with the CRDA analysis.

The allowed Completion Times are reasonable, considering the small number of allowed inoperable control rods, and provide time to insert and disarm the control rods in an orderly manner and without challenging plant systems.

Condition A is modified by a Note allowing separate Condition entry for each uncoupled control rod. This is acceptable since the Required Actions for this Condition provide appropriate compensatory actions for each uncoupled control rod. Complying with the Required Actions may allow for continued operation. Subsequent uncoupled control rods are governed by subsequent entry into the Condition and application of the Required Actions.

B.1

With one or more of the requirements of this LCO not met for reasons other than an uncoupled control rod, the testing should be immediately stopped by placing the reactor mode switch in the shutdown or refuel position. This results in a condition that is consistent with the requirements for MODE 5 where the provisions of this Special Operations LCO are no longer required.

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BASES (continued)

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SURVEILLANCE  
REQUIREMENTS

SR 3.10.7.1, SR 3.10.7.2, and SR 3.10.7.3

LCO 3.3.1.1, Functions 2.a and 2.d, made applicable in this Special Operations LCO, are required to have applicable Surveillances met to establish that this Special Operations LCO is being met (SR 3.10.7.1). However, the control rod withdrawal sequences during the SDM tests may be enforced by the RWM (LCO 3.3.2.1, Function 2, MODE 2 requirements) or by a second licensed operator (Reactor Operator or Senior Reactor Operator) or other task qualified member of the technical staff (e.g., a shift technical advisor or reactor engineer). As noted, either the applicable SRs for the RWM (LCO 3.3.2.1) must be satisfied according to the applicable Frequencies (SR 3.10.7.2), or the proper movement of control rods must be verified (SR 3.10.7.3). This latter verification (i.e., SR 3.10.7.3) must be performed during control rod movement to prevent deviations from the specified sequence. These surveillances provide adequate assurance that the specified test sequence is being followed.

SR 3.10.7.4

Periodic verification of the administrative controls established by this LCO will ensure that the reactor is operated within the bounds of the safety analysis. The 12 hour Frequency is intended to provide appropriate assurance that each operating shift is aware of and verifies compliance with these Special Operations LCO requirements.

SR 3.10.7.5

Coupling verification is performed to ensure the control rod is connected to the control rod drive mechanism and will perform its intended function when necessary. The verification is required to be performed any time a control rod is withdrawn to the "full-out" notch position, or prior to declaring the control rod OPERABLE after work on the control rod or CRD System that could affect coupling. This Frequency is acceptable, considering the low probability that a control rod will become uncoupled when it is not being moved as well as operating experience related to uncoupling events.

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(continued)

BASES

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SURVEILLANCE  
REQUIREMENTS  
(continued)

SR 3.10.7.6

CRD charging water header pressure verification is performed to ensure the motive force is available to scram the control rods in the event of a scram signal. Since the reactor is depressurized in MODE 5, there is insufficient reactor pressure to scram the control rods. Verification of charging water header pressure ensures that if a scram were required, capability for rapid control rod insertion would exist. The minimum pressure of 940 psig is well below the expected pressure of approximately 1500 psig while still ensuring sufficient pressure for rapid control rod insertion. The 7 day Frequency has been shown to be acceptable through operating experience and takes into account indications available in the control room.

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REFERENCES

1. UFSAR, Section 15.4.10.
  2. XN-NF-80-19(P)(A), Volume 1, Supplement 2, Section 7.1, Exxon Nuclear Methodology for Boiling Water Reactor Neutronics Methods for Design Analysis, (as specified in Technical Specification 5.6.5).
  3. NEDE-24011-P-A-US, General Electric Standard Application for Reactor Fuel, (as specified in Technical Specification 5.6.5).
  4. Letter from T. Pickens (BWROG) to G.C. Lainas, NRC, "Amendment 17 to General Electric Licensing Topical Report NEDE-24011-P-A," BWROG-8644, August 15, 1986.
  5. NFSR-0091, Benchmark of CASMO/MICROBURN BWR Nuclear Design Methods, Commonwealth Edison Topical Report, (as specified in Technical Specification 5.6.5).
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