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January 29, 2002

United States Nuclear Regulatory Commission  
ATTENTION: Document Control Desk  
Washington, DC 20555-0001

SUBJECT: Duke Energy Corporation  
McGuire Nuclear Station Units 1 and 2  
Docket Nos. 50-369 and 50-370  
Technical Specification Bases Changes

Attached is a revision to McGuire Technical Specification (TS) Bases Manual Section 3.1.5 (Shutdown Bank Insertion Limits), Section 3.8.4 (DC Sources - Operating), and Section 3.8.7 (Inverters - Operating). These revisions have been implemented in accordance with the TS Bases Control Program as described in TS 5.5.14. The following summarizes the revisions.

Bases Section 3.1.5: A change was incorporated into the Background Section to clarify the operation of the shutdown banks.

Bases Section 3.8.4: Information was added to the Bases of Surveillance Requirement 3.8.4.7 (Battery Service Test) to clarify that the test can be performed with a unit in any Mode.

Bases Section 3.8.7: A change was made to the Bases of Action A.1 to correct the time for re-energizing an AC vital bus from 8 hours to 2 hours.

Attachment 1 contains the revised Bases List of Effective Sections. Attachment 2 contains revised Bases 3.1.5, 3.8.4, and 3.8.7.

Please contact P.T. Vu at (704) 875-4302 if you have any questions.

Very truly yours,

H. B. Barron

Attachments

A001

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Xc w/attachments:

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McGuire Nuclear Station

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Bc w/attachments:

Mike Cash (EC050)  
ELL (EC050)  
Kay Crane  
McGuire Master File 1.3.2.12

**ATTACHMENT 1**

**REVISED TECHNICAL SPECIFICATION BASES  
LIST OF EFFECTIVE SECTIONS**

**McGuire Nuclear Station Technical Specifications**  
**List of Effective Pages and Bases List of Effective Sections**

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#### **BASES**

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B 3.4.4	Revision 0	9/30/98
B 3.4.5	Revision 0	9/30/98
B 3.4.6	Revision 0	9/30/98
B 3.4.7	Revision 0	9/30/98
B 3.4.8	Revision 0	9/30/98
B 3.4.9	Revision 0	9/30/98
B 3.4.10	Revision 0	9/30/98
B 3.4.11	Revision 0	9/30/98
B 3.4.12	Revision 12	8/23/00
B 3.4.13	Revision 0	9/30/98
B 3.4.14	Revision 0	9/30/98



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B 3.4.15	Revision 0	9/30/98
B 3.4.16	Revision 0	9/30/98
B 3.4.17	Revision 0	9/30/98
B 3.5.1	Revision 10	9/22/00
B 3.5.2	Revision 10	9/22/00
B 3.5.3	Revision 0	9/30/98
B 3.5.4	Revision 0	9/30/98
B 3.5.5	Revision 0	9/30/98
B 3.6.1	Revision 0	9/30/98
B 3.6.2	Revision 17	10/08/01
B 3.6.3	Revision 18	10/23/01
B 3.6.4	Revision 0	9/30/98
B 3.6.5	Revision 0	9/30/98
B 3.6.6	Revision 0	9/30/98
B 3.6.7	Revision 0	9/30/98
B 3.6.8	Revision 0	9/30/98
B 3.6.9	Revision 0	9/30/98
B 3.6.10	Revision 0	9/30/98
B 3.6.11	Revision 0	9/30/98
B 3.6.12	Revision 0	9/30/98
B 3.6.13	Revision 0	9/30/98
B 3.6.14	Revision 0	9/30/98
B 3.6.15	Revision 0	9/30/98
B 3.6.16	Revision 0	9/30/98
B 3.7.1	Revision 0	9/30/98
B 3.7.2	Revision 0	9/30/98
B 3.7.3	Revision 0	9/30/98
B 3.7.4	Revision 0	9/30/98
B 3.7.5	Revision 0	9/30/98
B 3.7.6	Revision 0	9/30/98
B 3.7.7	Revision 0	9/30/98
B 3.7.8	Revision 0	9/30/98
B 3.7.9	Revision 0	9/30/98

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B 3.7.10	Revision 0	9/30/98
B 3.7.11	Revision 0	9/30/98
B 3.7.12	Revision 6	10/6/99
B 3.7.13	Revision 0	9/30/98
B 3.7.14	Revision 14	11/27/00
B 3.7.15	Revision 14	11/27/00
B 3.7.16	Revision 0	9/30/98
B 3.8.1	Revision 13	1/18/01
B 3.8.2	Revision 21	1/8/02
B 3.8.3	Revision 0	9/30/98
B 3.8.4	Revision 22	1/10/02
B 3.8.5	Revision 0	9/30/98
B 3.8.6	Revision 0	9/30/98
B 3.8.7	Revision 20	1/10/02
B 3.8.8	Revision 0	9/30/98
B 3.8.9	Revision 0	9/30/98
B 3.8.10	Revision 0	9/30/98
B 3.9.1	Revision 0	9/30/98
B 3.9.2	Revision 0	9/30/98
B 3.9.3	Revision 0	9/30/98
B 3.9.4	Revision 0	9/30/98
B 3.9.5	Revision 0	9/30/98
B 3.9.6	Revision 0	9/30/98
B 3.9.7	Revision 0	9/30/98

**ATTACHMENT 2**

**REVISED TECHNICAL SPECIFICATION BASES  
3.1.5, 3.8.4, 3.8.7**

BASES

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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.5 Shutdown Bank Insertion Limits

BASES

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BACKGROUND

The insertion limits of the shutdown and control rods are initial assumptions in all safety analyses that assume rod insertion upon reactor trip. The insertion limits directly affect core power and fuel burnup distributions and assumptions of available ejected rod worth, SDM and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," GDC 26, "Reactivity Control System Redundancy and Protection," GDC 28, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2). Limits on control rod insertion have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

The rod cluster control assemblies (RCCAs) are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. The plant has four control banks and five shutdown banks. See LCO 3.1.4, "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.7, "Rod Position Indication," for position indication requirements.

The shutdown banks must be maintained above designed shutdown bank insertion limits and are typically near the fully withdrawn position during normal full power operations. Hence, they are not capable of adding a large amount of positive reactivity. Boration or dilution of the Reactor Coolant System (RCS) compensates for the reactivity changes associated with large changes in RCS temperature. The design calculations are performed with the assumption that the shutdown banks are withdrawn first. The shutdown banks can be fully withdrawn without the core going critical. This provides available negative reactivity in the event of boration errors. The shutdown banks are controlled manually by the control room operator. During normal unit operation, the shutdown

BASES

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BACKGROUND (continued)

banks are either fully withdrawn or fully inserted. The shutdown banks are withdrawn above insertion limits specified in the COLR before withdrawing any control banks during an approach to criticality. The shutdown banks remain above the insertion limits specified in the COLR until the reactor is shutdown, except for surveillance testing required by SR 3.1.4.2. Since the shutdown banks are fully withdrawn while this Specification is applicable, they do not affect core power and burnup distribution, but merely add negative reactivity to shut down the reactor upon receipt of a reactor trip signal.

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**APPLICABLE SAFETY ANALYSES** On a reactor trip, all RCCAs (shutdown banks and control banks), except the most reactive RCCA, are assumed to insert into the core. The shutdown banks shall be at or above their insertion limits and available to insert the maximum amount of negative reactivity on a reactor trip signal. The control banks may be partially inserted in the core, as allowed by LCO 3.1.6, "Control Bank Insertion Limits." The shutdown bank and control bank insertion limits are established to ensure that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM (see LCO 3.1.1, "SHUTDOWN MARGIN (SDM)") following a reactor trip from full power. The combination of control banks and shutdown banks (less the most reactive RCCA, which is assumed to be fully withdrawn) is sufficient to take the reactor from full power conditions at rated temperature to zero power, and to maintain the required SDM at rated no load temperature (Ref. 3). The shutdown bank insertion limit also makes the reactivity worth of an ejected shutdown rod negligible.

The acceptance criteria for addressing shutdown and control rod bank insertion limits and inoperability or misalignment is that:

- a. There be no violations of:
  1. specified acceptable fuel design limits, or
  2. RCS pressure boundary integrity; and
- b. The core remains subcritical after accident transients.

As such, the shutdown bank insertion limits affect safety analysis involving core reactivity and SDM (Ref. 3).

The shutdown bank insertion limits preserve an initial condition assumed in the safety analyses and, as such, satisfy Criterion 2 of 10 CFR 50.36 (Ref. 4).

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BASES

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LCO                      The shutdown banks must be within their insertion limits any time the reactor is critical or approaching criticality. This ensures that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM following a reactor trip.

The shutdown bank insertion limits are defined in the COLR.

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APPLICABILITY        The shutdown banks must be within their insertion limits, with the reactor in MODES 1 and 2. The applicability in MODE 2 begins prior to initial control bank withdrawal, during an approach to criticality, and continues throughout MODE 2, until all control bank rods are again fully inserted by reactor trip or by shutdown. This ensures that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM following a reactor trip. The shutdown banks do not have to be within their insertion limits in MODE 3, unless an approach to criticality is being made. In MODE 3, 4, 5, or 6, the shutdown banks may be fully inserted in the core and contribute to the SDM. Refer to LCO 3.1.1 for SDM requirements in MODES 3, 4, and 5. LCO 3.9.1, "Boron Concentration," ensures adequate SDM in MODE 6.

The Applicability requirements have been modified by a Note indicating the LCO requirement is suspended during SR 3.1.4.2. This SR verifies the freedom of the rods to move, and requires the shutdown bank to move below the LCO limits, which would normally violate the LCO.

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ACTIONS                A.1.1, A.1.2 and A.2

When one or more shutdown banks is not within insertion limits, 2 hours is allowed to restore the shutdown banks to within the insertion limits. This is necessary because the available SDM may be significantly reduced, with one or more of the shutdown banks not within their insertion limits. Also, verification of SDM or initiation of boration within 1 hour is required, since the SDM in MODES 1 and 2 is ensured by adhering to the control and shutdown bank insertion limits (see LCO 3.1.1). If shutdown banks are not within their insertion limits, then SDM will be verified by performing a reactivity balance calculation, considering the effects listed in the BASES for SR 3.1.1.1.

The allowed Completion Time of 2 hours provides an acceptable time for evaluating and repairing minor problems without allowing the plant to remain in an unacceptable condition for an extended period of time.

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BASES

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ACTIONS (continued)

B.1

If the shutdown banks cannot be restored to within their insertion limits within 2 hours, the unit must be brought to a MODE where the LCO is not applicable. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full power conditions in an orderly manner and without challenging plant systems.

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SURVEILLANCE  
REQUIREMENTS

SR 3.1.5.1

Verification that the shutdown banks are within their insertion limits prior to an approach to criticality ensures that when the reactor is critical, or being taken critical, the shutdown banks will be available to shut down the reactor, and the required SDM will be maintained following a reactor trip. This SR and Frequency ensure that the shutdown banks are withdrawn before the control banks are withdrawn during a unit startup.

Since the shutdown banks are positioned manually by the control room operator, a verification of shutdown bank position at a Frequency of 12 hours, after the reactor is taken critical, is adequate to ensure that they are within their insertion limits. Also, the 12 hour Frequency takes into account other information available in the control room for the purpose of monitoring the status of shutdown rods.

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REFERENCES

1. 10 CFR 50, Appendix A, GDC 10, GDC 26, and GDC 28.
2. 10 CFR 50.46.
3. UFSAR, Section 15.4.
4. 10 CFR 50.36, Technical Specification, (c)(2)(ii).

## B 3.8 ELECTRICAL POWER SYSTEMS

### B 3.8.4 DC Sources—Operating

#### BASES

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##### BACKGROUND

The station DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment and preferred AC vital bus power (via inverters). As required by 10 CFR 50, Appendix A, GDC 17 (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 also conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The 125 VDC electrical power system consists of two independent and redundant safety related Class 1E DC electrical power subsystems (Train A and Train B). Each subsystem consists of two channels of 125 VDC batteries (each battery 100% capacity), the associated battery charger(s) for each battery, and all the associated control equipment and interconnecting cabling.

Additionally there is one spare battery charger, which provides backup service in the event that the preferred battery charger is out of service. If the spare battery charger is substituted for one of the preferred battery chargers, then the requirements of independence and redundancy between subsystems are maintained.

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

The Train A and Train B DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, 4.16 kV switchgear, and 600 V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC vital buses.

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



## BASES

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### BACKGROUND (continued)

Each battery (EVCA, EVCB, EVCC, EVCD) has adequate storage capacity to carry the required duty cycle for one hour after the loss of the battery charger output. In addition, the battery is capable of supplying power for the operation of anticipated momentary loads during the one hour period.

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each channel is located in an area separated physically and electrically from the other channel 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 panels.

The batteries for the channels of DC are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. Battery size is based on 125% of required capacity and, after selection of an available commercial battery, results in a battery capacity in excess of 150% of required capacity. The voltage limit is 2.17 V per cell, which corresponds to a total minimum voltage output of 128 V per battery discussed in the UFSAR, Chapter 8 (Ref. 4). The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5).

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

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APPLICABLE SAFETY ANALYSES	The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 6), and in the UFSAR, Chapter 15 (Ref. 7), assume that Engineered Safety Feature (ESF) systems are OPERABLE.
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The OPERABILITY of the DC sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining the DC sources OPERABLE during accident conditions in the event of:

## BASES

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### APPLICABLE SAFETY ANALYSES (continued)

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

The DC sources satisfy Criterion 3 of 10 CFR 50.36 (Ref. 8).

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### LCO

Each DC channel consisting of one battery, battery charger for each battery and the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the train is 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 channel of DC does not prevent the minimum safety function from being performed (Ref. 4).

An OPERABLE channel of DC requires the battery and respective charger to be operating and connected to the associated DC bus.

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### APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe unit operation and to ensure that:

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

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

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### ACTIONS

#### A.1 and A.2

Condition A represents one channel of DC with a loss of ability to fully respond to a DBA with the worst case single failure. Two hours is provided to restore the channel of DC to OPERABLE status and is consistent with the allowed time for an inoperable channel of DC distribution system requirement.

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## BASES

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### ACTIONS (continued)

If one of the required channels of DC is inoperable (e.g., inoperable battery, inoperable battery charger(s), or inoperable battery charger and associated inoperable battery), the remaining DC channels have the capacity to support a safe shutdown and to mitigate an accident condition. If the channel of DC cannot be restored to OPERABLE status, Action A.2 must be entered and the DC channel must be energized from an OPERABLE channel, from the same train, within 2 hours. The capacity of the redundant channel is sufficient to supply its normally supplied channel and cross tied channel for the required time, in case of a DBA event. The inoperable channel of DC must be returned to OPERABLE status within 72 hours and the cross ties to the other channel open. The 72 hour Completion Time reflects a reasonable time to assess unit status as a function of the inoperable channel of DC and, if the DC channel is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

#### B.1 and B.2

If the inoperable channel of DC cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 9).

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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 (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 10).

## BASES

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### SURVEILLANCE REQUIREMENTS (continued)

#### SR 3.8.4.2

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

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

#### SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical 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). Operating experience has shown that these components usually pass the SR when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

#### SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of intercell, interrack, intertier, and terminal connections provide an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anticorrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection. The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR provided visible corrosion is removed during performance of SR 3.8.4.4. Operating experience has shown that these components usually pass the SR when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

## BASES

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### SURVEILLANCE REQUIREMENTS (continued)

#### SR 3.8.4.6

This SR requires that each battery charger be capable of supplying 400 amps and 125 V for  $\geq 1$  hour. These requirements are based on the design requirements of the chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 11), 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 Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 18 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

#### SR 3.8.4.7

A battery service test is a special test of battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length of 1 hour should correspond to the design duty cycle requirements as specified in Reference 4.

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 11) with the exception that it is allowable to perform the battery service test with a unit in any Mode.

This SR is modified by a Note. The Note allows the performance of a modified performance discharge test in lieu of a service test once per 60 months.

The modified performance discharge test, as defined by IEEE-450 (Ref. 12) is a simulated duty cycle consisting of just two rates; the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Since the ampere-hours removed by a rated one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance

## BASES

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### SURVEILLANCE REQUIREMENTS (continued)

discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.

A modified discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will often confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

#### SR 3.8.4.8

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

A battery modified performance discharge test is described in the Bases for SR 3.8.4.7 and in IEEE-450 (Ref. 12). Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 12). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected 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 ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 10), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is ≥ 10% below the manufacturer's rating. These Frequencies are consistent with the recommendations in IEEE-450 (Ref. 10).

## BASES

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### REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-1971.
4. UFSAR, Chapter 8.
5. IEEE-485-1983, June 1983.
6. UFSAR, Chapter 6.
7. UFSAR, Chapter 15.
8. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).
9. Regulatory Guide 1.93, December 1974.
10. IEEE-450-1995.
11. Regulatory Guide 1.32, February 1977.
12. IEEE-450-1980.

## B 3.8 ELECTRICAL POWER SYSTEMS

### B 3.8.7 Inverters—Operating

#### BASES

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**BACKGROUND** The inverters are the preferred source of power for the AC vital buses because of the stability and reliability they achieve. The function of the inverter is to provide AC electrical power to the vital buses. The inverters can be powered from a station battery charger or from the station battery. The station battery provides an uninterruptible power source for the instrumentation and controls for the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS). Specific details on inverters and their operating characteristics are found in the UFSAR, Chapter 8 (Ref. 1).

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**APPLICABLE** The initial conditions of Design Basis Accident (DBA) and transient

**SAFETY ANALYSES** analyses in the UFSAR, Chapter 6 (Ref. 2) and Chapter 15 (Ref. 3), assume Engineered Safety Feature systems are OPERABLE. The inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the RPS and ESFAS instrumentation and controls so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the unit. This includes maintaining required AC vital buses OPERABLE during accident conditions in the event of:

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

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BASES

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SAFETY ANALYSES (continued)

Inverters are a part of the distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36 (Ref. 4).

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LCO

The inverters ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.

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

Operable inverters require the associated vital bus to be powered by the inverter with output voltage and frequency within tolerances, and power input to the inverter from a 125 VDC station battery.

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APPLICABILITY

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

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

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

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ACTIONS

A.1

With a required inverter inoperable, its associated AC vital bus becomes inoperable until it is manually re-energized from its voltage regulated transformer.

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

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## BASES

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### ACTIONS (continued)

Required Action A.1 allows 24 hours to fix the inoperable inverter and return it to service. The 24 hour limit is based upon engineering judgment, taking into consideration the time required to repair an inverter and the additional risk to which the unit is exposed because of the inverter inoperability. This has to be balanced against the risk of an immediate shutdown, along with the potential challenges to safety systems such a shutdown might entail. When the AC vital bus is powered from its regulated voltage transformer, it is relying upon interruptible AC electrical power sources (offsite and onsite). The uninterruptible inverter source to the AC vital buses is the preferred source for powering instrumentation trip setpoint devices.

#### B.1 and B.2

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

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### SURVEILLANCE REQUIREMENTS

#### SR 3.8.7.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and AC vital bus energized from the inverter. The verification of proper voltage output ensures that the required power is readily available for the instrumentation of the RPS and ESFAS connected to the AC vital buses. The 7 day Frequency takes into account the redundant capability of the inverters and other indications available in the control room that alert the operator to inverter malfunctions.

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### REFERENCES

1. UFSAR, Chapter 8.
2. UFSAR, Chapter 6.
3. UFSAR, Chapter 15.
4. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).