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PG&E Letter DCL-03-084

U.S. Nuclear Regulatory Commission
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Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
License Amendment Request 03-11
Revision to Technical Specifications Associated with DC Electrical Power Systems

Dear Commissioners and Staff:

In accordance with 10 CFR 50.90, enclosed is an application for amendment to Facility Operating License Nos. DPR-80 and DPR-82 for Units 1 and 2 of the Diablo Canyon Power Plant (DCPP) respectively. This License Amendment Request (LAR) proposes changes to Technical Specification (TS) Section 3.8.4, "DC Sources - Operating," TS Section 3.8.5, "DC Sources - Shutdown," and TS Section 3.8.6, "Battery Cell Parameters," and adds a new TS Section 5.0, "Administrative Controls," program for the maintenance and monitoring of the station safety-related batteries that is based on the recommendations of Institute of Electrical and Electronics Engineers (IEEE) Standard 450-1995. Upon approval, corresponding changes will be made to the associated TS Bases sections and are included here for information.

Except where modified to account for plant-specific differences, the changes proposed in this amendment request are in accordance with those provided in NRC approved Industry/Technical Specifications Task Force (TSTF) Standard Technical Specification Change Traveler, TSTF-360, Revision 1, "DC Electrical Rewrite," and incorporated in NUREG-1431, "Standard Technical Specifications, Westinghouse Plants," Revision 2. A table summarizing the differences between the changes proposed in TSTF-360, Revision 1, and those proposed in this LAR is provided for reviewer information.

The changes proposed in this LAR are consistent with similar changes previously approved by the NRC for Clinton Power Station Unit 1 in Amendment 142 to Facility Operating License No. NPF-62, "Clinton Power Station, Unit 1 - Issuance of Amendment (TAC No. MB3071)," dated February 15, 2002, and also for Byron Station Units 1 and 2 in Amendment No. 129 to Facility Operating License Nos. NPF-37 and NPF-66 and Braidwood Station Units 1 and 2 in Amendment No. 124 to

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Facility Operating License Nos. NPF-72 and NPF-77, "Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 - Issuance of Amendments (TAC Nos MB4450, MB4451, MB4448, and MB4449)," dated September 19, 2002.

This LAR proposes changes that would adopt the current NUREG-1431, Revision 2, Standard Technical Specifications model for the direct current (DC) electrical power systems. These changes include new Conditions and Required Actions allowing inoperable DC subsystem batteries and battery chargers to be addressed separately. The proposed changes also provide new actions for the restoration of inoperable battery chargers, as well as providing alternate battery charger testing criteria. These changes are being proposed to support performance of periodic on-line battery maintenance and post-maintenance testing. This potentially reduces demands on plant refueling outages, improving battery availability during shutdown.

Changes are also proposed that reorganize and revise the TS associated with the monitoring and maintenance of the station batteries. These changes include the addition of specific required actions and surveillance requirements associated with out-of-limits conditions for battery cell float voltage, float current (in lieu of specific gravity monitoring), electrolyte level, and electrolyte temperature, and the relocation of battery maintenance and monitoring activities to owner-controlled programs based on the recommendations of industry standard IEEE 450-1995. These changes will provide for better control of these requirements, assure that each battery is maintained at acceptable levels of performance, allow flexibility to monitor and control these limits to values directly related to the battery's ability to perform its assumed function, and allow the TS to focus on parameter value degradations that approach levels that may impact battery operability.

In summary, the proposed changes support performance of periodic on-line battery maintenance and post-maintenance testing and will provide increased operational flexibility and allow more efficient application of plant resources to safety significant activities.

PG&E is submitting this LAR in conjunction with an industry consortium of six plants as a result of a mutual agreement known as Strategic Teaming and Resource Sharing (STARS). The STARS group consists of the six plants operated by TXU Energy, Union Electric Company, Wolf Creek Nuclear Operating Corporation, Pacific Gas and Electric Company, STP Nuclear Operating Company, and Arizona Public Service Company.

Comanche Peak Station is the lead STARS plant for this amendment request. TXU will also submit a similar LAR for Comanche Peak in parallel with this request. The parallel submittal of these LARs is intended to reduce the overall NRC resources required to evaluate and approve the requests. As an aid to the reviewers, brackets have been included in the proposed changes section, Enclosure 1, to indicate where differences exist between the lead plant submittal and the parallel STARS group

LARs. The submittal cover letter and the proposed TS Bases changes are each plant-specific.

Enclosure 1 to this LAR provides a detailed description of the proposed changes, a technical analysis of the proposed changes, a no significant hazards consideration determination, a regulatory analysis of the proposed changes, and an environmental evaluation. Enclosure 2 provides the affected TS pages marked-up to reflect the proposed changes. Enclosure 3 provides retyped (clean copy) TS pages.

Enclosure 4 provides the affected TS Bases pages marked-up to reflect the corresponding changes to the Bases. TS Bases changes are provided for reviewer information and will be implemented pursuant to TS 5.5.14, "Technical Specifications (TS) Bases Control Program." Enclosure 5 contains the retyped TS Bases pages for information only that incorporate the proposed changes. Enclosure 6 provides a table of plant-specific LAR differences from the changes provided in TSTF-360, Revision 1. Enclosure 7 is a single line diagram of the DCPP 125 Volt DC System.

This LAR proposes a change to TS 3.8.4, "DC Sources - Operating," surveillance requirement (SR) 3.8.4.8. A change to TS 3.8.4 SR 3.8.4.8 has also been proposed in PG&E Letter DCL-03-061, "License Amendment Request 03-07, Revision to Technical Specifications (TS) 3.8.1 'AC Sources – Operating' & 3.8.4 'DC Sources – Operating' Surveillance Requirements," dated May 29, 2003.

The changes in this LAR are not required to address an immediate safety concern. PG&E requests approval of the proposed License Amendment by August 1, 2004. PG&E requests the License Amendments be made effective upon NRC issuance, to be implemented within 60 days from the date of issuance.

Sincerely,

for DHO

David H. Oatley
Vice President and General Manager - Diablo Canyon

kjs/4328
Enclosures
cc: Edgar Bailey, DHS
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of PACIFIC GAS AND ELECTRIC COMPANY	)	Docket No. 50-275 Facility Operating License No. DPR-80
Diablo Canyon Power Plant Units 1 and 2	)	Docket No. 50-323 Facility Operating License No. DPR-82

AFFIDAVIT

James R. Becker, of lawful age, first being duly sworn upon oath says that he is Vice President - Diablo Canyon Operations and Station Director of Pacific Gas and Electric Company; that he has executed LAR 03-11 on behalf of said company with full power and authority to do so; that he is familiar with the content thereof; and that the facts stated therein are true and correct to the best of his knowledge, information, and belief.

James R. Becker
Vice President - Diablo Canyon Operations and Station Director

Subscribed and sworn to before me this 24th day of July, 2003.

Notary Public
County of San Luis Obispo
State of California

CHUCK MACKEY
Commission # 1397547
Notary Public - California
San Luis Obispo County
My Comm. Expires Feb 1, 2007

PROPOSED REVISION TO TECHNICAL SPECIFICATIONS ASSOCIATED WITH DC ELECTRICAL POWER SYSTEMS

1.0 DESCRIPTION

PG&E requests an amendment to Facility Operating License Nos. DPR-80 and DPR-82 for Units 1 and 2 of the Diablo Canyon Power Plant (DCPP) respectively. The proposed amendment will revise the DCPP Units 1 and 2 Technical Specifications (TS) Section 3.8.4, "DC Sources - Operating," TS Section 3.8.5, "DC Sources - Shutdown," and TS Section 3.8.6, "Battery Cell Parameters," and add a new TS Section 5.0 Administrative Control Program, "Battery Monitoring and Maintenance Program," which is based on the recommendations of Institute of Electrical and Electronics Engineers (IEEE) Standard 450, 1995 (IEEE 450-1995).

The proposed changes provide new Conditions and Required Actions allowing inoperable direct current (DC) subsystem batteries and battery chargers to be addressed separately. The proposed changes also provide new actions for the restoration of inoperable battery chargers, as well as providing alternate battery charger testing criteria.

In addition, changes are proposed that revise the TS associated with the monitoring and maintenance of the station batteries. These include the addition of specific Required Actions and Surveillance Requirements associated with out-of-limits conditions for battery cell float voltage, float current (in lieu of specific gravity monitoring), electrolyte level, and electrolyte temperature, and the relocation of battery maintenance and monitoring activities to a new program based on the recommendations of IEEE 450-1995. These changes will provide for better control of these requirements, assure that each battery is maintained at acceptable levels of performance, allow flexibility to monitor and control these limits to values directly related to the battery's ability to perform its assumed function, and allow the TS to focus on parameter value degradations that approach levels that may impact battery operability.

Except where modified to account for plant-specific differences, the proposed changes are based on NRC-approved Industry/Technical Specifications Task Force (TSTF) Standard Technical Specification Change Traveler, TSTF-360, "DC Electrical Rewrite," Revision 1, as incorporated in NUREG-1431, Revision 2, "Standard Technical Specifications, Westinghouse Plants," dated June 2001. A table of plant-specific differences from the proposed changes approved in TSTF-360, Revision 1, is provided in Enclosure 6.

Any changes to the Final Safety Analysis Report Update (FSARU) required as a result of this license amendment request (LAR) will be incorporated in accordance with 10 CFR 50.71(e).

2.0 PROPOSED CHANGE

The following list summarizes the overall proposed changes to the DC electrical power systems TS. For ease of reference, this list is numbered to correspond with the list of changes included in TSTF-360, Revision 1, and is referred to throughout this section:

(1) Provide new Conditions and Required Actions specific to the battery chargers and batteries in each DC electrical power subsystem.
(2) Relocate preventive maintenance-type Surveillance Requirements (SR) to licensee-controlled programs.
(3) Add alternate criteria for battery charger testing.
(4) Replace battery specific gravity monitoring with float current monitoring.
(5) Relocate the following to a licensee-controlled program based on IEEE 450, and/or to the TS Bases, including:
    (a) Category A and B limits for battery cell float voltage and electrolyte level, along with the associated compensatory actions;
    (b) Category C specific value limit for electrolyte level;
    (c) Specific value limit for electrolyte temperature; and
    (d) Specific value for the minimum battery charging float voltage, and
    (e) New TS Administrative Control Program [5.5.17] to reference actions for cell voltage and electrolyte level.
(6) Add specific Required Actions and increased Completion Times for out-of-limits conditions for battery cell float voltage, float current, electrolyte level, and electrolyte temperature and the associated SRs.
(7) Provide enhanced Bases for the proposed changes.
(8) Eliminate the "once per 60 month" restriction on replacing the battery service test with the battery modified performance test. [Note: this change was previously incorporated into the DCPP TS during implementation of the improved TS (ITS) by amendments 135/135 and is included here for information only]

Additional administrative, renumbering, and editorial changes are also associated with the above list of proposed changes and include:

(9) Relocate SR 3.8.4.8 to TS Section 3.8.6 on battery operability.
(10) Delete reference to "Cell" from Section Headings of Limiting Condition for Operation (LCO) 3.8.6.

The following paragraphs describe the proposed changes as they apply to individual TS sections 3.8.4 "DC Sources – Operating," TS 3.8.5 "DC Sources – Shutdown," TS 3.8.6 "Battery Cell Parameters," and TS Section 5.5 "Programs and Manuals." As an aid to the reviewers, brackets have been included to indicate where differences exist between this LAR and that submitted by TXU Energy for Comanche Peak Station.

TS 3.8.4 "DC Sources – Operating"

Proposed Change (1)

New Conditions and their associated Required Actions are added to TS LCO 3.8.4. These Conditions and Required Actions will provide compensatory actions specific to the battery chargers and batteries in each DC electrical power subsystem.

a) New TS 3.8.4 Condition A addresses the condition where [one battery charger] in one DC electrical power subsystem becomes inoperable. Required Actions are proposed that provide a tiered response that focuses on returning the [battery affected by the inoperable charger] to the fully charged state and restoring a fully qualified charger to operable status in a reasonable time.

   TS 3.8.4 Required Action A.1 requires that the battery terminal voltage [associated with the inoperable battery charger] be restored to greater than or equal to the minimum established float voltage within 2 hours.

   TS 3.8.4 Required Action A.2 requires verification that the battery float current [associated with the inoperable battery charger] be less than or equal to 2 amps within 12 hours.

   The final TS 3.8.4 Required Action A.3 limits the restoration time for the [inoperable battery charger] to [14 days].

b) New TS 3.8.4 Condition B is added to address the condition where [one battery] in one DC electrical power subsystem becomes inoperable. The associated Required Action B.1 to restore the [affected battery] to operable status is unchanged from the actions necessary to meet the current TS 3.8.4 Required Action A.1, to restore the inoperable DC electrical power subsystem to operable status within 2 hours.

c) The current TS 3.8.4 Condition A is renumbered to new TS 3.8.4 Condition C to reflect the addition of the proposed 2 new Conditions discussed above, and is clarified by adding the stipulation "for reasons other than Condition A or B." [Current TS 3.8.4 Condition B is renumbered to new Condition D. The current Condition B statement "Any DC bus not receiving power from its associated alternating current (AC) electrical power distribution subsystem" is deleted since it is replaced by new Condition A for an inoperable battery charger. Current TS 3.8.4 Condition C is renumbered to Condition E consistent with the changes above.]

Proposed Change (2)

Preventative maintenance type Surveillance Requirements SR 3.8.4.2, SR 3.8.4.3, SR 3.8.4.4, and SR 3.8.4.5 are relocated to licensee-controlled programs based on IEEE 450 practices.

Proposed Change (3)

Alternate battery charger acceptance criteria are added to current SR 3.8.4.6 which is renumbered to be SR 3.8.4.2. This change allows an actual in-service demonstration that the charger can recharge the associated battery to the fully charged state within [12] hours while supplying the largest combined demands of the various continuous steady state loads after a battery discharge to the bounding design basis event discharge state.

Proposed Change (5 d)

Surveillance Requirement SR 3.8.4.1 is revised to "Verify battery terminal voltage is greater than or equal to the minimum established float voltage." The current SR 3.8.4.1 specific value of "≥ [130] V" while on float charge will be relocated to the TS Bases.

[Surveillance Requirement SR 3.8.4.6 (renumbered to be SR 3.8.4.2) is revised to "Verify each battery charger supplies ≥ 400 amps at greater than or equal to the minimum established float voltage for ≥ 4 hours". The current SR 3.8.4.6 specific value of "≥ 130 V" on float charge will be relocated to the TS Bases.]

Proposed Change (8)

TSTF-360, Revision 1, includes a proposed change to NOTE 1 of SR 3.8.4.7 (renumbered to be SR 3.8.4.3) that would eliminate the "once per 60 month" restriction on replacing the battery service test with the battery modified performance discharge test. However, this specific TSTF-360 change is not included in this submittal because it has been previously incorporated in SR 3.8.4.7 by [Amendments 135/135 to the DCPP TS approved by the NRC in the letter "Conversion to Improved Technical Specifications for Diablo Canyon Power Plant, Units 1 and 2 - Amendment No. 135 to Facility Operating License Nos. DPR-80 and DPR-82 (TAC Nos. M98984 and M98985)," dated May 28, 1999].

Proposed Change (9)

The current SR 3.8.4.8, which is a test of battery capacity, is moved to TS Section 3.8.6 on "Battery Parameters", and renumbered to be SR 3.8.6.6.

Renumbering changes to TS 3.8.4

SR 3.8.4.6 is renumbered to be SR 3.8.4.2, and SR 3.8.4.7 is renumbered to be SR 3.8.4.3 due to the relocation of the preventative maintenance type SRs from TS as described in Proposed Change (2). Similarly, the references to SR 3.8.4.8 and SR 3.8.4.7 in NOTE 1 accompanying current SR 3.8.4.7 are renumbered to be SR 3.8.6.6 and SR 3.8.4.3, respectively.

TS 3.8.5 "DC Sources – Shutdown"

Proposed Change (1)

[TSTF-360, Revision 1, includes changes to TS LCO 3.8.5 that are similar to those in Proposed Change (1) to TS 3.8.4. These changes would add new Conditions and Required Actions specific to inoperable battery chargers during shutdown conditions. However, in accordance with the "Reviewer's Note" provided for LCO 3.8.5 in NUREG-1431, Revision 2, the option to adopt this change to LCO 3.8.5 does not apply to plants having a pre-ITS licensing basis for electrical power requirements during shutdown conditions that required only one DC electrical power subsystem to be operable. Prior to implementation of the ITS for DCPP in License Amendments 135/135, TS 3.8.2.2 required, as a minimum during Modes 5 and 6, one 125 V DC bus energized from its associated battery bank and full-capacity charger supplied from its associated operable AC vital bus. In addition, TS 3.8.3.2 required, as a minimum during Modes 5 and 6, one 125 V battery bank and an associated full capacity charger to be operable. Therefore, this change is not applicable to DCPP and is not included in this submittal.]

Renumbering changes to TS 3.8.5

Current SR 3.8.5.1 is revised to delete references to the SRs relocated from TS 3.8.4 and to update the references contained in the NOTE accompanying SR 3.8.5.1 to correspond to the renumbering changes made in TS 3.8.4.

TS 3.8.6 "Battery Cell Parameters"

Proposed Change (4)

The proposed change replaces the current TS 3.8.6 and Table 3.8.6-1 battery specific gravity monitoring activities and limits with float current monitoring by adding new TS 3.8.6 Condition B and new SR 3.8.6.1.

Proposed Changes (5 a, b, c, d, and e)

The current TS Table 3.8.6-1 specific Category A and B limits for electrolyte level and float voltage along with their associated compensatory actions, the Category C specific limiting value for electrolyte level, and the specific limiting value for pilot cell electrolyte temperature from the current SR 3.8.6.3, are relocated to licensee-controlled programs based on IEEE 450-1995. The Category C specific value for the minimum battery charging float voltage is relocated to the TS Bases. The associated compensatory actions for battery cell float voltage and electrolyte level not within limits are specified by new TS [5.5.17] administrative control program requirements to be included in a licensee-controlled program based on the recommendations of IEEE 450-1995 or the battery manufacturer. (Category A, B, and C limits on specific gravity are replaced with float current monitoring requirements as described in Proposed Change (4).)

Proposed Change (6)

New Conditions are added to TS LCO 3.8.6 to provide compensatory actions for a specific abnormal battery condition. The proposed changes provide specific Required Actions and increased Completion Times for out-of-limit conditions for cell float voltage, float current, electrolyte level, and electrolyte temperature.

a) TS 3.8.6 Condition A is added to address the condition where [one battery] on one DC electrical power subsystem has one or more battery cells with float voltage less than 2.07 V.

b) TS 3.8.6 Condition B is added to address the condition where [one battery] on one DC electrical power subsystem has float current greater than 2 amps.

c) TS 3.8.6 Condition C is added to address the condition where [one battery] on one DC electrical power subsystem has one or more battery cells with electrolyte level less than the minimum established design limits.

d) TS 3.8.6 Condition D is added to address the condition where [one battery] on one DC electrical power subsystem has pilot cell electrolyte temperature less than the minimum established design limits.

e) TS 3.8.6 Condition E is added to address the condition where [two or more batteries] in redundant DC electrical power subsystems have battery parameters not within limits.

f) Current TS 3.8.6 Condition B is renumbered to be Condition F. The current Condition B consists of three separate entry conditions. As part of this proposed change, the last two entry conditions of one or more batteries found

with an average electrolyte temperature of less than [60°F], or one or more batteries found with battery cell parameters not within Category C limits, are replaced with a new condition requiring entry when [one battery] on one DC electrical power subsystem has one or more battery cells with float voltage of less than 2.07 V and float current greater than 2 amps.

Also, current Surveillance Requirements SR 3.8.6.1, SR 3.8.6.2, and SR 3.8.6.3 are replaced by the following five new surveillance requirements:

SR 3.8.6.1 Verify each battery float current is ≤ 2 amps. Frequency: 7 days

SR 3.8.6.2 Verify each battery pilot cell voltage is ≥ 2.07 V. Frequency: 31 days

SR 3.8.6.3 Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits. Frequency: 31 days

SR 3.8.6.4 Verify each battery pilot cell temperature is greater than or equal to minimum established design limits. Frequency: 31 days

SR 3.8.6.5 Verify each battery connected cell voltage is ≥ 2.07 V. Frequency: 92 days

Proposed Change (10)

To reflect the above changes, the word "Cell" is deleted from TS 3.8.6 and the LCO is revised to delete its reference to Table 3.8.6-1, "Battery Cell Parameters Requirements," which is also deleted.

TS Administrative Controls Section 5.5

Proposed Change (5 e)

A new TS [5.5.17] administrative controls program requirement is added to reference actions for battery cell float voltage and electrolyte level and to create a TS "Battery Monitoring and Maintenance Program." This program will provide for restoration and maintenance actions consistent with the recommendations of IEEE 450-1995, or of the battery manufacturer.

In addition, the mark-up of the TS Section 5.5 administrative control program description provided by TSTF-360, Revision 1, is modified in this submittal by substituting the phrase "below the top of the plates" in paragraph b. for required actions for battery cells discovered with electrolyte level "below the minimum established design limit."

The mark-up of the TS Section 5.5 administrative control program description provided by TSTF-360, Revision 1, is also modified in this submittal by removing the specific reference to the version (year) of IEEE 450. This modification to the proposed change is reasonable based on the specific commitment to IEEE 450-1995 that is provided in this LAR, and that the committed to version of IEEE 450-1995 is included as a specific reference in the revised Bases. This modification to the proposed Battery Monitoring and Maintenance Program description is also consistent with the TSTF Response to NRC Comment number 4 on TSTF-360, Revision 0, dated August 11, 2000, which is included in TSTF-360, Revision 1, as Attachment 3. This change will allow for future programmatic upgrades to approved standards without necessitating a license amendment.

Enclosure 2 provides the affected TS pages marked-up to reflect the proposed changes. Enclosure 3 provides retyped (clean copy) TS pages.

Enhanced Bases for the proposed changes

Proposed Change (7)

The proposed changes to TS 3.8.4, TS 3.8.5, and TS 3.8.6 and the accompanying Bases sections incorporate the information and descriptions provided in TSTF-360, Revision 1, as applicable to the plant-specific configuration. The DC electrical systems Bases have undergone revisions to include substantial information and basis in support of the proposed changes to the specifications. Enclosure 4 provides the affected TS Bases pages marked-up to reflect the corresponding changes to the Bases. Enclosure 5 provides retyped TS Bases pages which incorporate the proposed changes. The revised Bases sections are provided for information only. Changes to the associated Bases will be implemented pursuant to TS 5.5.14, TS Bases Control Program.

3.0 BACKGROUND

3.1 Bases for the Current Requirements

TS 3.8.4 "DC Sources – Operating"

[The Class 1E DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment and backup 120 V AC vital bus power via inverters. As required by 10 CFR 50, Appendix A, General Design Criterion 17, the Class 1E DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also

conforms to the recommendations of Regulatory Guide 1.6, "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems," dated March 10, 1971, and IEEE Standard 308-1971, "Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," dated 1971.

The 125 V DC electrical power system consists of 3 independent safety related Class 1E DC electrical power subsystems. Each subsystem consists of 1 dedicated 60-cell 125 V DC battery (Batteries 11(21), 12(22), and 13(23)), 1 dedicated battery charger (Battery Chargers 11(21), 12(22), and 132(232)), a backup charger, and all the associated switchgear, control equipment, and interconnecting cabling. A single line diagram of the DCPP 125 V DC system is contained in Enclosure 7.

The backup chargers provide backup service in the event that the dedicated battery charger is out of service. There are two backup chargers for the three Class 1E DC subsystems. One backup charger (Backup Charger 121(221)) is shared between 2 Class 1E DC subsystems and supplies either Battery 11(21) or Battery 12(22). The other backup charger (Backup Charger 131(231)) is dedicated to the third Class 1E DC subsystem and supplies Battery 13(23). For each battery, the backup charger is supplied from a different 480 V vital AC bus than the dedicated charger is supplied from. There are certain backup battery charger alignments wherein one of the 480 V vital AC busses supplies 2 battery chargers, aligned to different DC busses. During these backup battery charger alignments, the requirements of independence and redundancy between subsystems are not maintained. As a result, operation with more than 1 charger receiving power simultaneously from a single 480 V vital AC bus or any DC bus not receiving power from its associated AC electrical power distribution subsystem is limited to 14 days by current TS 3.8.4 Condition B.

During normal operation, the 125 V DC 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. Each battery has adequate storage capacity to carry the required load continuously for at least 2 hours.

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

Each 125 V DC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area

separated physically and electrically from the other subsystem to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem.

The batteries for the 3 DC electrical power subsystems are sized to produce required capacity at 80 percent of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100 percent design demand. The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 128 V per battery. Surveillance 3.8.4.1 verifies that the battery terminal voltage is greater than or equal to 130 V on float charge.

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

The initial conditions of design basis accident (DBA) and transient analyses assume that engineered safety feature (ESF) systems are operable. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation.

The operability of the DC sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining the DC sources operable during accident conditions in the event of an assumed loss of all offsite AC power or all onsite AC power; and a worst case single failure.

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

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

TS 3.8.5 "DC Sources – Shutdown"

[The DC electrical power subsystems, each subsystem consisting of one battery, 1 battery charger per battery, and the corresponding control equipment and interconnecting class 1E cabling within the subsystem, are required to be operable in Modes 5 and 6, and during movement of irradiated fuel assemblies, to support required trains of the distribution systems required operable by LCO 3.8.10, "Distribution Systems-Shutdown." An operable subsystem consists of a DC bus connected to a battery with an operable battery charger which is fed from an operable AC vital bus.

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

TS 3.8.6 "Battery Cell Parameters"

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

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.

The battery cell parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery operability is only required when the DC power source is required to be operable. Refer to the Applicability discussion in Bases for LCO 3.8.4 and LCO 3.8.5.

3.2 Need for Revision of the Requirements

The current TS for the DC electrical power subsystem does not contain a separate Action for an inoperable battery. The changes proposed in this LAR are in accordance with those provided in NRC approved Industry/TSTF

Standard TS Change Traveler, TSTF-360, Revision 1, "DC Electrical Rewrite," and incorporated in NUREG-1431, Revision 2. The changes provide new actions for the restoration of an inoperable battery charger and an inoperable battery, as well as alternate battery charger testing criteria. These changes are being proposed to support performance of periodic on-line battery maintenance and post-maintenance testing. This potentially reduces demands on plant refueling outages, improving battery availability during shutdown.

The proposed changes also provide for the relocation of battery maintenance and monitoring activities to owner-controlled programs based on the recommendations of IEEE 450-1995. This will provide for better control of these requirements, assure that each battery is maintained at acceptable levels of performance, allow flexibility to monitor and control these limits to values directly related to the battery's ability to perform its assumed function, and allow the TS to focus on parameter value degradations that approach levels that may impact battery operability.

Overall, these changes will provide increased operational flexibility and allow more efficient application of plant resources to safety significant activities.

4.0 TECHNICAL ANALYSES

4.1 TS Changes

The following subsections provide an analysis of the proposed changes.

Proposed Change (1), New Conditions and Required Actions for battery chargers and batteries

a) [TS 3.8.4 Condition A currently applies to "One DC electrical power subsystem inoperable" and Condition B applies to "More than one full capacity charger receiving power simultaneously from a single 480 V vital bus OR Any DC bus not receiving power from its associated AC electrical power distribution system." Current TS 3.8.4 Condition B applies if there is an inoperable dedicated battery charger. TS 3.8.4 does not currently contain an action for one battery inoperable.] To allow for a range of possible degradations to the DC System, the proposed change revises the current TS 3.8.4 format to add two new Conditions; Condition A that is specific to an inoperable [battery charger], and Condition B that is specific to an inoperable [battery].

The proposed wording of new TS 3.8.4 Condition A, ["One battery charger inoperable," incorporates the plant specific wording recommended in TSTF-360, Revision 1 for a DC electrical subsystem

design which during normal operation has one battery charger per subsystem. The phrase "on one train" recommended by TSTF-360, Revision 1 is not included in Condition A since one battery charger is equivalent to one dedicated battery charger on one subsystem (train) for the DCPP DC electrical subsystem design.]

[With any DC bus not receiving power from its associated AC electrical power distribution system, the proposed new Condition A for one battery charger inoperable will apply. Therefore, new Condition A replaces the portion of current Condition B which applies to any DC bus not receiving power from its associated AC electrical power distribution subsystem.]

[The current TS 3.8.4 Condition B Required Action B.1 for an inoperable battery charger requires that the DC electrical subsystem be restored to a configuration wherein each charger is powered from its associated 480 volt vital bus within 14 days. The primary role of the battery charger is in support of maintaining the operability of its associated battery. This is accomplished by the charger being of sufficient size to carry the normal steady state DC loads, with sufficient additional capacity to provide some minimal over-potential to the battery. A secondary safety significant function can be attributed to carrying the post-accident DC load after restoration of AC power (typically 10-13 seconds, the time required for the emergency diesel generator to tie on to its emergency bus). In analyzed post-accident scenarios, there is no safety related criteria for recharging a fully discharged battery in any specific time period.]

The new proposed TS 3.8.4 Required Action A.3 provides a [14-day] allowed restoration time to restore the battery charger to operable status similar to current TS 3.8.4 Condition B which allows continued operation with an inoperable battery charger for up to [14 days]. However, this time is now contingent on a focused three-tiered approach to assuring adequate battery capability is maintained.

With an inoperable battery charger, the first priority for the operator is to minimize the associated battery discharge. Proposed TS 3.8.4 Required Action A.1 provides a first tier action that ensures that the associated battery discharge is terminated within 2 hours by requiring that battery terminal voltage be restored to a value greater than or equal to the battery minimum established float voltage within 2 hours. This assumes that the battery is still capable of performing its required function. During this 2 hours, if the affected DC electrical power subsystem battery is not capable of performing its required function, the remaining DC electrical power subsystems are available to perform the required function. This time allows for restoring the inoperable battery charger or for providing an

alternate means of restoring battery terminal voltage to a value greater than or equal to the minimum established float voltage. Since the focus of the proposed allowance is that battery capacity be preserved and assured, the means of accomplishing this is left to plant capabilities. In most cases, the backup battery charger would be employed within the initial 2-hours. In other cases, other means, including a degraded normally in service dedicated charger or a non-Class-1E charger, would be employed to float the battery. Presuming that the associated battery discharge, if occurring, is terminated and that its DC bus remains energized, as required by separate LCO 3.8.9, then there is reasonable basis for extending the restoration time for an inoperable battery charger beyond the Required Action A.1 2-hour limit to [14 days]. [The addition of this first tier Action is acceptable since it is a new Action which is not required by current TS 3.8.4 Required Action B.1 for an inoperable battery charger.]

The second tier TS 3.8.4 Required Action A.2 proposes that within 12 hours, it is established that the battery has sufficient capacity to perform its assumed duty cycle as measured by float current less than or equal to 2 amps. This allows time for some recharging of lost capacity that may have occurred during the initial 2 hours. A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion of its recharge cycle. The time to return a battery to its fully charged state under this condition is a function of the amount of the previous discharge and the recharge characteristic of the battery. In this condition, there is good assurance of fully recharging the battery within the proposed 12 hours. [The Completion Time of "once every 12 hours" recommended by TSTF-360, Revision 1 is changed to "12 hours." A battery with float current greater than 2 amps for greater than 12 hours would be inoperable per new TS 3.8.6 Condition B and new TS 3.8.6 Condition F would require entry into new TS 3.8.4 Condition B. New TS 3.8.4 Condition B would require the current to be restored to less than 2 amps within an additional 2 hours or a unit shutdown to Mode 3 would have to be initiated per new TS 3.8.4 Condition E. Therefore, a unit shutdown will be initiated within 14 hours for a battery with float current greater than 2 amps whether the TS 3.8.4 Condition A Completion Time is once every 12 hours or within 12 hours. Therefore, verification of the battery float current only once within 12 hours is acceptable since it results in the same required shutdown time as if the battery float current is verified every 12 hours for a battery with float current greater than 2 amps. The addition of this second tier Action is acceptable since it is a new Action which is not required by current TS 3.8.4 Required Action B.1 for an inoperable battery charger.]

The third tier TS 3.8.4 Required Action A.3 would provide [14] days for the battery charger to be restored to operable status. [The Completion Time of 7 days recommended by TSTF-360, Revision 1 is changed to 14 days since current TS 3.8.4 Condition B allows continued operation with an inoperable dedicated battery charger for 14 days. The 14-day completion time for an inoperable battery charger was approved for DCCP in Amendment 6 to Facility Operating License DPR-80 and Amendment 4 to Facility Operating License DPR-82 in an NRC letter dated April 18, 1986, based on PG&E letter DCL-85-278, "License Amendment Request 85-07, Revision 1; Combined Technical Specification Changes, Specifications 3.8.2.1 and 3.8.2.2," dated August 27, 1985, and information provided in PG&E letter DCL-85-214, "Supplemental Information to License Amendment Request 85-07," dated June 14, 1985. The staff found the 14-day Completion Time to be acceptable since it ensures that the independence required by 10 CFR 50 Appendix A General Design Criterion 17 is not unduly compromised with the battery chargers operated in a cross-aligned configuration (i.e. a dedicated battery charger inoperable with the associated backup charger providing current to the DC bus).]

b) The proposed wording of new TS 3.8.4 Condition B, ["One battery inoperable]," similarly incorporates the plant specific wording recommended in TSTF-360, Revision 1 for a DC electrical subsystem design which during normal operation has one battery per subsystem.] [The phrase "on one train" recommended by TSTF-360, Revision 1 is not included in Condition A since 1 battery is equivalent to 1 battery on 1 subsystem (train) for the DCPP DC electrical subsystem design.

The proposed new TS 3.8.4 Condition B is added to separately address the condition of [one battery] in one DC electrical power subsystem inoperable. For an inoperable battery, the associated DC bus is being supplied by its associated dedicated battery charger. Any event that results in a loss of the AC bus supporting the associated dedicated battery charger will also result in a loss of DC power to the loads fed from the affected DC bus. Recovery of the AC bus, especially if it is due to a loss of offsite power, will be hampered by the fact that many of the components necessary for the recovery (e.g., diesel generator control and field flash, AC load shed, and diesel generator output circuit breakers, etc.) may rely upon one of the batteries of the affected DC subsystem. The proposed Completion Time for restoration of the inoperable batteries is unchanged from the existing 2-hour limit for restoration of the DC electrical power subsystem (even assuming the dedicated charger associated with the battery is operable) and allows sufficient time to effect restoration of the inoperable [battery], given that the majority of the conditions that lead to [battery] inoperability (e.g., loss

of the associated battery charger or battery cell voltages less than 2.07 V) are identified, along with specific actions and completion times, in the DC electrical power systems TS Sections 3.8.4, 3.8.5, and 3.8.6.

c) The existing TS 3.8.4 Condition A is renumbered to Condition C and revised to "One DC electrical power subsystem inoperable for reasons other than Condition A or B." Because the combined scope of the proposed new and revised Conditions is the same as currently addressed by TS 3.8.4 Conditions A, B, and C, the proposed change to reformat the existing Condition A is considered editorial. The 2-hour Completion Time for new Condition C is unchanged from the current TS 3.8.4 Condition A Completion Time which is based on Regulatory Guide 1.93, "Availability of Electric Power Sources."

[Current TS 3.8.4 Condition B is renumbered to new Condition D and the portion of current Condition B which applies to "Any DC bus not receiving power from its associated AC electrical power distribution subsystem" is removed. This is acceptable since this portion of current Condition B is replaced by the new Condition A for an inoperable battery charger and the 14-day Completion Time to restore the battery charger to operable status is unchanged.]

Current TS 3.8.4 Condition [C] is renumbered to Condition [E] consistent with the changes above. This change is an editorial change.

Proposed Change (2), Relocation of preventive maintenance Surveillance Requirements to a licensee-controlled program

In accordance with SR 3.0.1, when any SR is not met, the LCO is not met. This is based on the premise that SRs represent the minimum acceptable requirements for operability of the required equipment. However, for current SR 3.8.4.2, SR 3.8.4.3, SR 3.8.4.4, and SR 3.8.4.5, failure to meet the SR does not necessarily mean that the equipment is not capable of performing its safety function, and the corrective action is generally a routine or preventive maintenance activity. For example, the Bases of SR 3.8.4.4 identify removal of visible corrosion and tightening of terminal connections as a preventive maintenance SR. SR 3.8.4.3, requiring visible inspection for physical damage or deterioration that could potentially degrade battery performance, is not required for the battery to perform its safety function, but again reflects ongoing preventive maintenance activities. Although excessive corrosion or loose terminals could impact battery operability, the maintenance activities will prevent degradation which could affect battery operability. These activities are inappropriate for operability SRs and are generally better controlled under the maintenance programs for batteries. With regard to the resistance verifications of SR 3.8.4.2 and SR 3.8.4.5, the

values are nominal values and represent values at which some action should be taken, not necessarily when the operability of the battery is in question. The safety analyses do not assume a specific battery resistance value, but typically assume the batteries will supply adequate power. Therefore, the key issue is the overall battery resistance. Between surveillances, the resistance of each connection varies independently from all the others. Some of these connection resistances may be higher or lower than others, and the battery may still be able to perform its function and should not be considered inoperable solely because one connector's resistance is high. Overall resistance is a direct impact on operability and is adequately determined as acceptable through completion of the battery service and discharge tests. Therefore, these activities are more appropriately controlled under the maintenance program for batteries. Furthermore, these surveillances are recommended by IEEE 450, and as such, will continue to be addressed by the plant program based on IEEE 450 practices that is being committed to with the adoption of these changes (but not detailed by the new TS Section 5.0 program).

The new battery monitoring and maintenance program described in proposed TS Section [5.5.17] is discussed under Proposed Change (5 e).

The proposed changes also include renumbering of the SRs remaining in TS Section 3.8.4 and revising current SR 3.8.5.1 to similarly renumber the references to the TS Section 3.8.4 SRs. These changes are editorial and do not alter the existing requirements.

Proposed Change (3), Addition of alternate criteria for battery charger testing

Current SR 3.8.4.6 (renumbered to be SR 3.8.4.2) requires verification of specific parameters for battery charger performance testing. This test is intended to confirm the charger design capacity. Alternate acceptance criteria are proposed that allow an actual in-service demonstration that the charger can recharge the battery to the fully charged state within [12] hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state. This meets the intent of the existing test and allows for a normal in-place demonstration of the charger capability thereby minimizing the time when the charger would be disconnected from the DC bus.

Proposed Change (4), Replacement of battery specific gravity monitoring with float current monitoring

This change proposes to replace the requirements of current TS 3.8.6 battery specific gravity monitoring with new TS 3.8.6 conditions and

surveillance requirements utilizing a suitable operability limit based on float current monitoring to ensure the battery state-of-charge is sufficient to perform its design duty cycle. This has been the focus of significant discussions within the IEEE 450 committee and the NRC technical staff. Due to the technical nature of the rationale, specific justification has been written to address this change. TSTF-360, Revision 1, provides this justification in Attachment 1, "Battery Primer," and Attachment 2, "White Paper by Kyle Floyd." These attachments to TSTF-360 and the details included in the proposed Bases provide the justification supporting this change. In summary, the justification discusses the use of battery float current as an indicator of full charge and the charging characteristics of lead-acid batteries. It concludes that the level of charge may be evaluated by measuring current at a specific voltage, typically the float voltage in normal operation, and that at low float voltage, 2 amps is appropriate for cells with 8-hour capacities of 1000 amp-hours or larger.

Proposed Change (5), Relocation of the following to a licensee-controlled program based on IEEE 450, and/or to the TS Bases

(a) Category A and B limits for battery cell float voltage and electrolyte level, along with the associated compensatory actions

Current TS Table 3.8.6-1 contains categories of limitations on battery cell float voltage, electrolyte level, and specific gravity parameters. The Category A and B limits reflect nominal fully charged battery parameter values. Significant margin above that required for declaration of an operable battery is provided in these values. These Category A and B values represent appropriate monitoring levels and appropriate preventive maintenance level for long term battery quality and extended battery life. As such, they do not reflect the 10 CFR 50.36, "Technical Specifications," criteria for LCOs of the "the lowest functional capability or performance levels of equipment required for the safe operation of the facility." This change proposes that these values and the actions associated with restoration be relocated to a licensee controlled program that is under the control of 10 CFR 50.59, "Changes, tests, and experiments." This program complies with the recommendations of IEEE 450-1995. The battery parameter values will continue to be controlled at an acceptable level, and required remedial actions will be implemented in accordance with the plant corrective action program. Furthermore, the batteries and their preventive maintenance and monitoring are under the regulatory requirements of the maintenance rule, 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants." This relocation will continue to assure the batteries are maintained at acceptable levels of performance, and allow

the TS to focus on battery parameter degradations that approach levels that may impact battery operability.

(b) Category C specific value limit for electrolyte level, and;
(c) The specific value limit for electrolyte temperature

These changes propose that the specific limiting values from current TS 3.8.6 Condition B and Table 3.8.6-1 for battery electrolyte temperature and level be relocated to a licensee-controlled program that is under the control of 10 CFR 50.59. New TS 3.8.6 Conditions C and D will require the electrolyte level and temperature to be greater than or equal to minimum established design limits. Depending on the available excess capacity of the associated battery, the minimum electrolyte level and temperature necessary to support operability of the battery can vary. As such, these values do not reflect the 10 CFR 50.36 criteria for LCOs of "the lowest functional capability or performance levels of equipment required for safe operation of the facility," and relocation to a licensee controlled program will allow the flexibility to monitor and control this limit at values directly related to the battery's ability to perform its assumed function.

(d) Specific value for the minimum battery charging float voltage

This change proposes to relocate the current TS Table 3.8.6-1 specific limiting value for the minimum battery cell float voltage to the Bases, which are under the change control of 10 CFR 50.59. This change also applies to the relocation to the Bases of the specific limiting value for the minimum operating battery charging float voltage monitored by current SR 3.8.4.1. TS 3.8.4 Condition A will require the battery charger to supply battery terminal voltage greater than or equal to the minimum established float voltage. The battery manufacturer establishes a float voltage range to provide the optimum charge on the battery. The minimum battery cell float voltage will maintain the battery plates in a condition that supports maintaining the grid life of the battery cells. As such, the minimum established float voltage does not reflect the 10 CFR 50.36 criteria for LCOs of "the lowest functional capability or performance levels of equipment required for safe operation of the facility," and can be adequately controlled outside of the TS.

(e) New TS administrative controls program [5.5.17] with actions for cell voltage and electrolyte level

This change proposes that the TS 3.8.6 Actions related to cell voltage and electrolyte level be specified by a new administrative controls program TS [5.5.17], "Battery Monitoring and Maintenance Program." This program complies with the recommendations of IEEE 450-1995, and includes actions to (1) restore battery cells with float voltage less than 2.13 V, and (2) equalize and test battery cells that had been discovered with electrolyte level below the top of the plates.

Paragraph b. of the new TS [5.5.17] administrative controls program description provided in TSTF-360, Revision 1, is modified in this submittal for required actions for battery cells discovered with electrolyte level below the "minimum established design limit." The phrase "below the top of the plates" is substituted for "minimum established design limit" to provide consistency with IEEE 450-1995, Annex D, section D.1. This change is appropriate because the recommended actions of IEEE 450 include that an equalizing charge be performed if electrolyte level is below the top of the plates, while the minimum established design limit is a level which is above the top of the plates.

The specific reference to the version of IEEE 450 is not included in the TS [5.5.17] program description to allow future programmatic upgrades to approved standards without necessitating a license amendment. PG&E is presently committed to IEEE 450-1995 as documented in the TS Bases. Changes to the TS Bases are evaluated in accordance with the provisions of 10 CFR 50.59, "Changes, tests, and experiments." Thus, adequate control over changes to the applicable IEEE 450 exists to allow the specific IEEE 450 reference to be contained in the TS Bases. Eliminating the "year" reference to the applicable IEEE 450 in the TS and maintaining it in the TS Bases is consistent with similar changes previously approved by the NRC in Amendment No. 129 to Facility Operating License No. NPF-37 and Amendment No. 129 to Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2, respectively, and Amendment No. 124 to Facility Operating License No. NPF-72 and Amendment No. 124 to Facility Operating License No. NPF-77 for the Braidwood Station, Unit Nos. 1 and 2, respectively, in letter "Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 - Issuance of Amendments (TAC NOS. MB4450, MB4451, MB4448, AND MB4449)," dated September 19, 2002, and in TSTF-363, "Revise Topical Report References in ITS 5.6.5, COLR."

Proposed Change (6), Addition of specific Required Actions and increased Completion Times for out-of-limits conditions for battery cell float voltage, float current, electrolyte level, and electrolyte temperature and the associated SRs

New TS 3.8.6 specific Required Actions are proposed for parameters that have a unique impact on the battery and its continued operability. The proposed change provides specific TS 3.8.6 Required Actions and increased Completion Times for out-of-limit conditions for cell voltage, float current, electrolyte level, and electrolyte temperature. These allowed times recognize the margins available, the minimal impact on the battery capacity and the capability to perform its intended function, and the likelihood of effecting restoration in a timely fashion avoiding an unnecessary plant shutdown. In addition, SRs are proposed to verify that the batteries are maintained within the established limitations.

The bases for the specific TS 3.8.6 Required Actions, Completion Times, and Surveillance Requirements are as follows.

a) New TS 3.8.6 Condition A addresses a condition where [one battery] has one or more battery cells with float voltage less than 2.07 V. [The proposed wording of new TS 3.8.6 Condition A, "One battery," incorporates the plant specific wording recommended in TSTF-360, Revision 1 for a DC electrical subsystem design which has one battery per subsystem. The phrase "on one train" recommended by TSTF-360, Revision 1 is not included in Condition A since one battery is equivalent to one battery on one subsystem (train) for the DCPP DC electrical subsystem design.]

   If a battery cell is found to be less than 2.07 V, the battery cell must be considered degraded. This is consistent with the recommendations of IEEE 450 which states that a cell voltage of 2.07 V (typical for nominal 1.215 specific gravity cells) or below under float conditions and not caused by elevated temperature of the cell indicates internal cell problems and may require cell replacement. Cell voltage by itself, however, is not an indication of the state of charge of the battery. Hence, verification within 2 hours of the required battery charger operability by monitoring the battery terminal voltage (i.e., performance of SR 3.8.4.1), and determining the overall battery state of charge by monitoring the battery float charge current (i.e., performance of SR 3.8.6.1), is considered a reasonable allowed time to complete these actions and assure that there is still sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells being less than 2.07 V, and continued operation is permitted for a limited

period up to 24 hours. Twenty-four hours is considered a reasonable time to effect restoration of the out-of-limit condition.

b) New TS 3.8.6 Condition B addresses a condition where a battery is found with a float current of greater than 2 amps, and indicates that a partial discharge of the battery capacity has occurred. [The proposed wording of new TS 3.8.6 Condition B, "One battery," incorporates the plant specific wording recommended in TSTF-360, Revision 1 for a DC electrical subsystem design which has one battery per subsystem. The phrase "on one train" recommended by TSTF-360, Revision 1 is not included in Condition B since one battery is equivalent to one battery on one subsystem (train) for the DCPP DC electrical subsystem design.]

A battery with a float current of greater than 2 amps may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours, verification of the required battery charger operability is performed by monitoring the battery terminal voltage (i.e., performance of SR 3.8.4.1). If the terminal voltage is found to be less than the minimum established float voltage there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. If the battery charger is found to be inoperable, LCO 3.8.4 Condition A would be entered. If the battery charger is operating in the current limit mode after 2 hours, this is an indication that the battery has been substantially discharged and likely cannot perform its required design functions. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of previous discharge, and the recharge characteristic of the battery. Because the charge time can be extensive, if the battery cannot be recharged within the 12 hours allowed by Required Action B.2, the battery must be declared inoperable.

c) New TS 3.8.6 Condition C addresses a condition where a battery is found with the electrolyte level in 1 or more cells to be less than the minimum established design limits. [The proposed wording of new TS 3.8.6 Condition C, "One battery," incorporates the plant specific wording recommended in TSTF-360, Revision 1 for a DC electrical subsystem design which has 1 battery per subsystem. The phrase "on one train" recommended by TSTF-360, Revision 1 is not included in Condition C since 1 battery is equivalent to 1 battery on 1 subsystem (train) for the DCPP DC electrical subsystem design.]

With the electrolyte level in one or more cells found above the top of the battery plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function.

Therefore, the affected battery is not required to be considered inoperable solely as a result of electrolyte level not met. Within 31 days, the minimum established design limits for electrolyte level must be restored in order to restore its margin.

With electrolyte level below the top of the plates a potential exists for dryout and plate degradation. TS 3.8.6 Required Actions C.1 and C.2 restore the level and ensure that the cause of the loss of electrolyte level is not due to a leak in the battery casing. These actions are only required if the level in the battery is found below the top of the battery plates.

In addition, the battery monitoring and maintenance program described in the proposed TS Section [5.5.17] will require actions, consistent with IEEE 450-1995, to equalize and test battery cells that have been discovered with an electrolyte level below the minimum established level limit.

d) New TS 3.8.6 Condition D addresses the condition where a battery is found with a pilot cell electrolyte temperature less than the minimum established design limits. [The proposed wording of new TS 3.8.6 Condition D, "One battery," incorporates the plant specific wording recommended in TSTF-360, Revision 1 for a DC electrical subsystem design which has 1 battery per subsystem. The phrase "on one train" recommended by TSTF-360, Revision 1 is not included in Condition D since 1 battery is equivalent to 1 battery on 1 subsystem (train) for the DCPP DC electrical subsystem design.]

A low electrolyte temperature limits the current and power available from the battery. However, since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended functions. Therefore, the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not being met, and the proposed 12 hours provides a reasonable time to restore the temperature within established limits.

e) New TS 3.8.6 Condition E addresses the condition where [2 or more batteries] in redundant DC electrical power subsystems are found with battery parameters not within established design limits. [The proposed wording of new TS 3.8.6 Condition E, "Two or more batteries," incorporates the plant specific wording recommended in TSTF-360, Revision 1 for a DC electrical subsystem design which has 1 battery per subsystem and 3 Class 1E DC electrical power subsystems.]

Given this condition, there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function. With redundant DC electrical power subsystems batteries involved, this potentially could result in a total loss of function on multiple systems that rely upon the batteries. The longer completion times specified for battery parameters when only [1 DC electrical power subsystem has a battery with parameters not within limits] are therefore not appropriate, and the parameters must be restored to within limits in at least 1 DC electrical power subsystem within 2 hours.

f) New TS 3.8.6 Condition F revises current Condition B to address the condition where the Required Actions for Condition A, B, C, D, or E are not met. Given this condition, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding battery must be declared inoperable. Additionally, upon discovering [1 battery] with 1 or more battery cells float voltage less than 2.07 V and float current greater than 2 amps indicates that the battery capacity may not be sufficient to perform the intended functions and the corresponding battery must be declared inoperable immediately.

New SR 3.8.6.1 will require verification of each battery float current to be less than or equal to 2 amps every 7 days, and is used to determine the state of charge of the battery. 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 charged state. The float current requirements are based on the float current indicative of a charged battery. The use of float current to determine the state of charge of the battery and the 7-day frequency for performance of this verification is consistent with TSTF-360, Revision 1.

New SR 3.8.6.2 and SR 3.8.6.5 verify that the float voltage of pilot cells and all connected cells, respectively, are equal to or greater than the short term absolute minimum voltage of 2.07 V, representing the point where battery operability is in question. Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to a minimum established float voltage, which is established and controlled in accordance with the proposed battery monitoring and maintenance program specified in TS Section [5.5.17]. The battery monitoring and maintenance program will provide necessary actions if the battery is found at a float voltage less than the minimum established float voltage but greater than the short term absolute minimum voltage of 2.07 V. The Frequency for cell voltage verification every 31 days for pilot cells and 92 days for each connected cell is consistent with IEEE 450-1995.

SR 3.8.6.3 verifies the connected cell electrolyte level of each battery to be greater than or equal to minimum established design limits established in the proposed battery monitoring and maintenance program provided in TS Section [5.5.17]. Operation of the batteries at electrolyte levels greater than the minimum established design limit ensures that the plates do not suffer physical damage and continue to maintain adequate electron transfer capability. The Frequency of every 31 days is consistent with IEEE 450-1995.

SR 3.8.6.4 verifies the temperature of each battery pilot cell to be greater than or equal to the minimum established design limits established in the proposed battery monitoring and maintenance program provided in TS Section [5.5.17]. Maintaining the electrolyte temperature above this level ensures that the battery can provide the required current and voltage to meet the design requirements, since temperatures lower than assumed in the battery sizing calculations act to inhibit or reduce the overall battery capacity. The Frequency of every 31 days is consistent with IEEE 450-1995.

Proposed Change (7), Enhanced Bases for the proposed changes

The accompanying Bases section for the proposed changes to TS 3.8.4, TS 3.8.5, and TS 3.8.6 are provided for information. The Bases sections have been revised to incorporate the information and discussion presented in TSTF-360, Revision 1, with the exceptions noted and described previously in this enclosure. Changes to the associated Bases will be implemented pursuant to TS 5.5.14, "Technical Specifications Bases Control Program."

Proposed Change (8), Elimination of the "once per 60 month" restriction on replacing the battery service test with the battery modified performance test

[TSTF-360, Revision 1, includes a proposed change to NOTE 1 of SR 3.8.4.7 (renumbered to be SR 3.8.4.3) that would eliminate the "once per 60 month" restriction on replacing the battery service test with the battery modified performance discharge test. However, this specific TSTF-360 change is not included in this submittal because it has been previously incorporated in SR 3.8.4.7 by Amendments 135/135 to the DCPP TS.]

Proposed Change (9), Relocation of SR 3.8.4.8 to TS Section 3.8.6 on battery operability

This proposed change is an administrative change that will move current surveillance requirement SR 3.8.4.8, which is a test of battery capacity, to be directly associated with new TS Section 3.8.6 on battery parameters, which defines the operability requirements of the DC electrical power subsystem

batteries. The proposed change is acceptable because movement of this SR does not alter the test requirements or test performance frequency. Failure to satisfy the test will be addressed by the conditions and required actions of DC electrical power subsystem TS LCOs 3.8.4, 3.8.5 and 3.8.6.

Proposed Change (10), Deletion of the reference to "Cell" in LCO 3.8.6

This proposed change to TS LCO 3.8.6 is an editorial change. This LCO is intended to require and define the operability requirements of the DC electrical power subsystem batteries, and is not limited to battery cell parameters or performance.

4.2 Summary

The proposed changes to the DC electrical power subsystems specifications TS 3.8.4, TS 3.8.5, and TS 3.8.6, and the addition of new TS administrative control program [5.5.17] requirements for a "Battery Maintenance and Monitoring Program" based on the recommendations of IEEE 450-1995, are consistent, except for noted plant-specific differences, with the considerations and proposed changes provided in NRC-approved Industry/TSTF Standard TS Change Traveler, TSTF-360, "DC Electrical Rewrite," Revision 1, as incorporated in recently issued NUREG-1431, "Standard Technical Specifications, Westinghouse Plants," Revision 2. Each of these proposed changes have been evaluated and determined not to adversely affect nuclear safety or continued safe plant operations.

5.0 REGULATORY ANALYSIS

5.1 No Significant Hazards Consideration

PG&E has evaluated whether or not a significant hazards consideration is involved with the proposed amendments by focusing on the 3 standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed change affects Technical Specification (TS) sections 3.8.4 "DC Sources – Operating," TS 3.8.5 "DC Sources – Shutdown," TS 3.8.6 "Battery Cell Parameters," and TS Administrative Controls section 5.5.

The proposed change restructures the TS for the direct current (DC) electrical power subsystem and adds new Conditions and Required

Actions with increased Completion Times to address battery charger inoperability. Neither the DC electrical power subsystem nor associated battery chargers are initiators of any accident sequence analyzed in the Final Safety Analysis Report Update (FSARU). Operation in accordance with the proposed TS ensures that the DC electrical power subsystem is capable of performing its function as described in the FSARU. Therefore the mitigating functions supported by the DC electrical power subsystem will continue to provide the protection assumed by the analysis.

The relocation of preventive maintenance surveillances, and certain operating limits and actions to a newly-created, licensee-controlled TS 5.5.17, "Battery Monitoring and Maintenance Program," will not challenge the ability of the DC electrical power subsystem to perform its design function. The maintenance and monitoring required by current TS, which are based on industry standards, will continue to be performed. In addition, the DC electrical power subsystem is within the scope of 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," which will ensure the control of maintenance activities associated with the DC electrical power subsystem.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different accident from any accident previously evaluated?

Response: No.

The proposed change does not involve any physical alteration of the units. No new equipment is being introduced, and installed equipment is not being operated in a new or different manner. There are no setpoints at which protective or mitigating actions are initiated that are affected by the proposed changes. The operability of the DC electrical power subsystems in accordance with the proposed TS is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the plant. The proposed change will not alter the manner in which equipment operation is initiated, nor will the functional demands on credited equipment be changed. No alteration in the operating procedures, which ensure the unit remains within analyzed limits, is proposed, and no change is being made to procedures relied upon to respond to an off-normal event. As such, no new failure modes are being introduced. The proposed change does not alter assumptions made in the safety analyses.

Therefore, the proposed change does not create the possibility of a new or different accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

The proposed change will not adversely affect operation of plant equipment and will not result in a change to the setpoints at which protective actions are initiated. Sufficient DC capacity to support operation of mitigation equipment is ensured. The changes associated with the new battery maintenance and monitoring program will ensure that the station batteries are maintained in a highly reliable manner. The equipment fed by the DC electrical system will continue to provide adequate power to safety-related loads in accordance with analysis assumptions.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above evaluation, PG&E concludes that the proposed amendments present no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements

10 CFR 50, Appendix A, General Design Criteria (GDC) 17, "Electric power systems"

NRC Regulatory Guide 1.6, "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems," March 10, 1971

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

NRC Regulatory Guide 1.129, "Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Nuclear Power Plants," dated [December 1974]

IEEE 308-[1971], "Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," dated [August 1972]

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

Analysis

The DCPP design of the Class 1E 125 V DC electrical power systems is in accordance with the requirements of GDC 17, NRC Regulatory Guide 1.6, and IEEE 308. Redundant power supplies and equipment satisfy GDC 17 for a single failure.

The overall system design including functional requirements, redundancy, capacity, and availability is in conformance with IEEE 308 criteria for Class 1E systems with the exception of battery performance discharge test intervals that are in accordance with IEEE 450-1995. The battery charger supply capacity is in accordance with Regulatory Guide 1.32.

Periodic inspection and testing of the DC systems are performed to monitor the condition of the equipment to ensure reliable operation. Visual inspections, liquid level, specific gravity, and cell voltage checks, and performance discharge tests are performed at regular intervals on each battery. Maintenance and testing procedures and criteria for replacement are in accordance with IEEE 450-1995, and Regulatory Guide 1.129. Visual checks and performance tests are also scheduled for the battery chargers.

The proposed changes to the DC electrical power systems specifications remain consistent with the applicable regulatory requirements by continuing to require full charger operability that is based on the margin afforded in the design capacity of the battery charger and to verify that the batteries are maintained within the established limitations to ensure that the batteries have sufficient capacity to perform the required duty cycle.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 ENVIRONMENTAL CONSIDERATION

PG&E has evaluated the proposed amendments and determined the proposed amendments do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendments meet the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendments.

7.0 REFERENCES

7.1 REFERENCES

1. Industry/Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler TSTF-360, Revision 1, "DC Electrical Rewrite," dated November 3, 2000 (including Attachment 1, "Battery Primer For Nuclear Power Plants, 01/07/2000," Attachment 2, "Kyle Floyd White Paper, A proposed Method for Selecting the Return to Service Current Limit for Safety-Related Batteries," and Attachment 3, "TSTF Response to NRC Comments on TSTF 360 Rev 0 dated 8/11/00").
2. Title 10 to the Code of Federal Regulations, Part 50 (10 CFR 50), Appendix A, General Design Criteria (GDC) 17, "Electric power systems."
3. NUREG-1431, Revision 2, "Standard Technical Specifications, Westinghouse Plants," dated June 2001.
4. Regulatory Guide 1.6, "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems," dated March 10, 1971.
5. Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants," Revision 2, dated February 1977.
6. Regulatory Guide 1.129, "Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Nuclear Power Plants," dated December 1974.
7. IEEE Standard 308-1971, "Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations", dated August 1972.
8. IEEE Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," dated 1995.
9. NRC letter "Facility Operating License Amendment 6 to DPR-80 & Amendment 4 to DPR-82/LAR 85-007," dated April 18, 1986.

10. PG&E letter DCL-85-278, "License Amendment Request 85-07, Revision 1; Combined Technical Specification Changes, Specifications 3.8.2.1 and 3.8.2.2," dated August 27, 1985.
11. PG&E letter DCL-85-214, "Supplemental Information to License Amendment Request 85-07," dated June 14, 1985.
12. NRC letter "Conversion to Improved Technical Specification for Diablo Canyon Power Plant, Units 1 and 2 - Amendment No. 135 to Facility Operating License Nos. DPR-80 and DPR-82 (TAC Nos. M98984 and M98985)," dated May 28, 1999.
13. Nuclear Energy Institute letter to the NRC, "Forward Response to Battery TSTF Proposal," dated September 18, 2000.
14. NRC letter "Proposed Modifications to TSTF-360, Requirements for DC Sources," dated August 11, 2000.
15. Industry/Technical Specification Task Force Standard Technical Specification Change Traveler TSTF-363, "Revise Topical Report references in ITS 5.6.5, COLR," approved April 13, 2000.
16. Exelon Generation Company, LLC, letter "Request for License Amendment for Technical Specifications - DC Electrical Power Systems," dated March, 8 2002.
17. NRC letter "Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 - Issuance of Amendments (TAC NOS. MB4450, MB4451, MB4448, AND MB4449)," dated September 19, 2002.
18. AmerGen Energy Company, LLC, letter "Clinton Power Station, Unit 1 – Request for Amendment to Technical Specifications Associated With DC Electrical Power," dated August 21, 2001.
19. NRC letter "Clinton Power Station, Unit 1 – Issuance of Amendment," dated February 15, 2002.
20. Title 10 to the Code of Federal Regulations, Part 65, Section 65 (10 CFR 50.65), "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

7.2 PRECEDENT

The changes proposed in this LAR are consistent with similar changes previously requested by AmerGen Energy Company, LLC, for Clinton Power Station Unit 1, in the letter "Clinton Power Station, Unit 1 – Request for Amendment to Technical Specifications Associated With DC Electrical Power," dated August 21, 2001, and approved by the NRC in Amendment 142 to Facility Operating License No. NPF-62 for Clinton Power Station Unit 1, "Clinton Power Station, Unit 1 - Issuance of Amendment (TAC No. MB3071)," dated February 15, 2002.

Also, the changes proposed in this LAR are consistent with similar TSTF-360, Revision 1, changes previously requested by Exelon Generation Company, LLC, for Byron Station Units 1 and 2 and Braidwood

Station Units 1 and 2 in the letter "Request for License Amendment for Technical Specifications - DC Electrical Power Systems," dated March 8, 2002, and approved by the NRC in Amendment No. 129 to Facility Operating License No. NPF-37 and Amendment No. 129 to Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2, respectively, and Amendment No. 124 to Facility Operating License No. NPF-72 and Amendment No. 124 to Facility Operating License No. NPF-77 for the Braidwood Station, Unit Nos. 1 and 2, respectively, "Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 - Issuance of Amendments (TAC NOS. MB4450, MB4451, MB4448, AND MB4449)," dated September 19, 2002.

This LAR requests to eliminate the "year" reference to the applicable IEEE 450 in the new TS [5.5.17] battery monitoring and maintenance program and maintain the year reference in the TS Bases. This exception to the TSTF-360, Revision 1, Westinghouse Owners Group TS markup inserts was approved for Byron Station Units 1 and 2 and Braidwood Station Units 1 and 2 in the NRC letter dated September 19, 2002.

PROPOSED TECHNICAL SPECIFICATIONS (MARKED-UP)

Remove Page	Insert Page
3.8-18	3.8-18
3.8-19	3.8-19
3.8-20	3.8-20
3.8-21	3.8-21
3.8-22	3.8-22
3.8-23	3.8-23
3.8-24	3.8-23a
3.8-25	3.8-24
	3.8-25
5.0-24	5.0-24
	5.0-24a

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources - Operating

LCO 3.8.4 Three Class 1E DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One battery charger inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage. AND A.2 Verify battery float current ≤ 2 amps. AND A.3 Restore battery charger to OPERABLE status.	2 hours 12 hours 14 days
B. One battery inoperable.	B.1 Restore battery to OPERABLE status.	2 hours
CA. One DC electrical power subsystem inoperable for reasons other than Condition A or B.	CA.1 Restore DC electrical power subsystem to OPERABLE status.	2 hours
DB. More than one full capacity charger receiving power simultaneously from a single 480 V vital bus. OR ~~Any DC bus not receiving power from its associated AC electrical power distribution subsystem.~~	DB.1 Restore the DC electrical power subsystem to a configuration wherein each charger is powered from its associated 480 volt vital bus.	14 days
EC. Required Action and Associated Completion Time not met.	EC.1 Be in MODE 3. AND EC.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ~~≥ 130 V on float charge~~ greater than or equal to the minimum established float voltage.	7 days
~~SR 3.8.4.2~~	~~Verify no visible corrosion at battery terminals and connectors.~~ ~~OR~~ ~~Verify battery connection resistance is ≤ 150 x 10^{-6} ohm for inter-cell connections, ≤ 150 x 10^{-6} ohm for inter-rack connections, and ≤ 150 x 10^{-6} ohm terminal connections.~~	~~92 days~~
~~SR 3.8.4.3~~	~~Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that could degrade battery performance.~~	~~24 months~~
~~SR 3.8.4.4~~	~~Remove visible terminal corrosion, verify battery cell to cell and terminal connections are clean and tight, and are coated with anti-corrosion material.~~	~~24 months~~
~~SR 3.8.4.5~~	~~Verify battery connection resistance is ≤ 150 x 10^{-6} ohm for inter-cell connections, ≤ 150 x 10^{-6} ohm for inter-rack connections, and ≤ 150 x 10^{-6} ohm for terminal connections.~~	~~24 months~~
SR 3.8.4.~~2~~6	Verify each battery charger supplies ≥ 400 amps at ~~≥ 130 V~~ greater than or equal to the minimum established float voltage for ≥ 4 hours. OR Verify each battery charger can recharge the battery to the fully charged state within 12 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	24 months
SR 3.8.4.~~3~~7	----------NOTES---------- 1. The modified performance discharge test in SR 3.8.6.~~6.4.8~~ may be performed in lieu of ~~the service test in~~ SR 3.8.4.~~3.7.~~ 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. ----------	

Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<< MOVE TO TS SECTION 3.8.6>>>	
~~SR 3.8.4.8~~ ~~NOTE~~ ~~This Surveillance shall not be performed in MODE 1, 2, 3, or 4.~~ ~~Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.~~	~~60 months~~ ~~AND~~ ~~24 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating.~~ ~~AND~~ ~~24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating.~~

There are no changes to this page. Included for information only.

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources-Shutdown

LCO 3.8.5 The Class 1E DC electrical power subsystem shall be OPERABLE to support the DC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution Systems-Shutdown."

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more required DC electrical power subsystems inoperable.	A.1	Declare affected required features(s) inoperable.	Immediately
	OR		
	A.2.1	Suspend CORE ALTERATIONS.	Immediately
		AND	
	A.2.2	Suspend movement of irradiated fuel assemblies.	Immediately
		AND	
	A.2.3	Initiate action to suspend operations involving positive reactivity additions.	Immediately
		AND	
	A.2.4	Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.5.1	----------NOTE---------- The following SRs are not required to be performed: SR 3.8.4.2~~6~~, and SR 3.8.4.3~~7, and SR 3.8.4.8~~. ---------- For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 ~~SR 3.8.4.4~~ ~~SR 3.8.4.7~~ SR 3.8.4.2 ~~SR 3.8.4.5~~ ~~SR 3.8.4.8~~ SR 3.8.4.3 ~~SR 3.8.4.6~~	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery ~~Cell~~ Parameters

LCO 3.8.6 Battery ~~cell~~ parameters for the three Class 1E batteries shall be within ~~the~~ limits ~~of Table 3.8.6-1~~.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

ACTIONS

NOTE

Separate Condition entry is allowed for each battery.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One battery with one or more battery cells with float voltage < 2.07 V.	A.1	Perform SR 3.8.4.1.	2 hours
	AND		
	A.2	Perform SR 3.8.6.1.	2 hours
	AND		
	A.3	Restore affected cell(s) float voltage to ≥ 2.07 V.	24 hours
B. One battery with float current > 2 amps.	B.1	Perform SR 3.8.4.1.	2 hours
	AND		
	B.2	Restore battery float current to ≤ 2 amps.	12 hours

---------- NOTE ---------- Required Action C.2 shall be completed if electrolyte level was below the top of the plates. ----------	---------- NOTE ---------- Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates. ----------	
C. One battery with one or more cells with electrolyte level less than minimum established design limits.	C.1 Restore affected cell(s) electrolyte level to above the top of the plates. AND C.2 Verify no evidence of leakage. AND C.3 Restore affected cell(s) electrolyte level to greater than or equal to minimum established design limits.	8 hours 12 hours 31 days
D. One battery with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell electrolyte temperature to greater than or equal to minimum established design limits.	12 hours
E. Two or more batteries with battery parameters not within limits.	E.1 Restore battery parameters for one battery to within limits.	2 hours

~~A. One or more batteries with one or more battery cell parameters not within Category A or B limits.~~	~~A.1~~	~~Verify pilot cell electrolyte level and float voltage meet Table 3.8.6-1 Category C limits~~	~~1 hour~~
	~~AND~~		
	~~A.2~~	~~Verify battery cell parameters meet Table 3.8.6-1 Category C limits.~~	~~24 hours~~ ~~AND~~ ~~Once per 7 days thereafter~~
	~~AND~~		
	~~A.3~~	~~Restore battery cell parameters to Category A and B limits of Table 3.8.6-1.~~	~~31 days~~

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
FB. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR One ~~or more~~ batteryies with one or more battery cells float voltage < 2.07 V and float current > 2 amps ~~average electrolyte temperature of the representative cells < 60°F~~. ~~OR~~ ~~One or more batteries with one or more battery cell parameters not within Category C values.~~	FB.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	----------NOTE---------- Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1 ---------- Verify each battery float current is ≤ 2 amps.	7 days
SR 3.8.6.2	Verify each battery pilot cell voltage is ≥ 2.07 V.	31 days
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ 2.07 V.	92 days

<< THIS SR MOVED FROM TS SECTION 3.8.4 >>		
SR 3.8.6.~~6~~4.~~8~~	----------NOTE---------- This Surveillance shall not be performed in MODE 1, 2, 3, or 4. ----------	
	Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months AND 24 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating. AND 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating.
~~SR 3.8.6.1~~	~~Verify battery cell parameters meet Table 3.8.6-1 Category A limits.~~	~~7 days~~
~~SR 3.8.6.2~~	~~Verify battery cell parameters meet Table 3.8.6-1 Category B limits.~~	~~92 days~~ ~~AND~~ ~~Once within 7 days after a battery discharge < 118 V~~ ~~AND~~ ~~Once within 7 days after a battery overcharge > 145 V~~
~~SR 3.8.6.3~~	~~Verify average electrolyte temperature of representative cells is ≥ 60°F.~~	~~92 days~~

Table 3.8.6-1 (page 1 of 1)

Battery Cell Parameters Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[a]	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[a]	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity[b][c]	≥ 1.195	≥ 1.190 AND Average of all connected cells ≥ 1.200	Not more than 0.020 below average of all connected cells AND Average of all connected cells ≥ 1.190

(a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum during equalizing charges provided it is not overflowing.

(b) Corrected for electrolyte temperature and level. Level correction is not required, however, when battery charging current is < 2 amps when on float charge.

(c) A battery charging current of < 2 amps when on float charge is acceptable for meeting specific gravity limits following a battery recharge, for a maximum of 7 days. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to expiration of the 7 day allowance.

5.5 Programs and Manuals

5.5.15 Safety Function Determination Program (SFDP) (continued)

b. A required system redundant to the system(s) in turn supported by the inoperable supported system is also inoperable; or

c. A required system redundant to the support system(s) for the supported systems (a) and (b) above is also inoperable.

The SFDP identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

5.5.16 Containment Leakage Rate Testing Program

a. A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide 1.163, "Performance-Based Containment Leak-Test Program, dated September 1995." The ten-year interval between performance of the integrated leakage rate (Type A) test, beginning May 4, 1994, for Unit 1 and April 30, 1993, for Unit 2, has been extended to 15 years.

b. The peak calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 47 psig.

c. The maximum allowable containment leakage rate, L_a, at P_a, shall be 0.10% of containment air weight per day.

d. Leakage rate acceptance criteria are:

1. Containment overall leakage rate acceptance criterion is $\leq 1.0\ L_a$. During the first unit startup following testing in accordance with this program, the leakage rate acceptance criteria are $< 0.60\ L_a$ for the Type B and Type C tests and $\leq 0.75\ L_a$ for Type A tests;

2. Air lock testing acceptance criteria are:

a) Overall air lock leakage rate is $\leq 0.05\ L_a$ when tested at $\geq P_a$.

b) For each door, leakage rate is $\leq 0.01\ L_a$ when pressurized to ≥ 10 psig.

e. The provisions of SR 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program.

f. The provisions of SR 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.17 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," or of the battery manufacturer, of the following:

5.5 Programs and Manuals (continued)

a. Actions to restore battery cells with float voltage < 2.13 V, and

b. Actions to equalize and test battery cells that had been discovered with electrolyte level below the top of the plates.

PROPOSED TECHNICAL SPECIFICATIONS PAGES (RETYPED)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources - Operating

LCO 3.8.4 Three Class 1E DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One battery charger inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage. AND A.2 Verify battery float current ≤ 2 amps. AND A.3 Restore battery charger to OPERABLE status.	2 hours 12 hours 14 days
B. One battery inoperable.	B.1 Restore battery to OPERABLE status.	2 hours
C. One DC electrical power subsystem inoperable for reasons other than Condition A or B.	C.1 Restore DC electrical power subsystem to OPERABLE status.	2 hours
D. More than one full capacity charger receiving power simultaneously from a single 480 V vital bus.	D.1 Restore the DC electrical power subsystem to a configuration wherein each charger is powered from its associated 480 volt vital bus.	14 days
E. Required Action and Associated Completion Time not met.	E.1 Be in MODE 3. AND E.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.2	Verify each battery charger supplies ≥ 400 amps at greater than or equal to the minimum established float voltage for ≥ 4 hours. OR Verify each battery charger can recharge the battery to the fully charged state within 12 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	24 months
SR 3.8.4.3	----------NOTES---------- 1. The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3. 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. ---------- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	24 months

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There are no changes to this page. Included for information only.

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources-Shutdown

LCO 3.8.5 The Class 1E DC electrical power subsystem shall be OPERABLE to support the DC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution Systems-Shutdown."

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more required DC electrical power subsystems inoperable.	A.1	Declare affected required feature(s) inoperable.	Immediately
	OR		
	A.2.1	Suspend CORE ALTERATIONS.	Immediately
		AND	
	A.2.2	Suspend movement of irradiated fuel assemblies.	Immediately
		AND	
	A.2.3	Initiate action to suspend operations involving positive reactivity additions.	Immediately
		AND	
	A.2.4	Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.5.1	----------NOTE---------- The following SRs are not required to be performed: SR 3.8.4.2 and SR 3.8.4.3. ----------	
	For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.2 SR 3.8.4.3.	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Parameters

LCO 3.8.6 Battery parameters for the three Class 1E batteries shall be within limits.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

ACTIONS

NOTE

Separate Condition entry is allowed for each battery.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One battery with one or more battery cells with float voltage < 2.07 V.	A.1	Perform SR 3.8.4.1.	2 hours
	AND		
	A.2	Perform SR 3.8.6.1.	2 hours
	AND		
	A.3	Restore affected cell(s) float voltage to ≥ 2.07 V.	24 hours
B. One battery with float current > 2 amps.	B.1	Perform SR 3.8.4.1.	2 hours
	AND		
	B.2	Restore battery float current to ≤ 2 amps.	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
----------NOTE---------- Required Action C.2 shall be completed if electrolyte level was below the top of the plates. ----------	----------NOTE---------- Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates. ----------	
C. One battery with one or more cells with electrolyte level less than minimum established design limits.	C.1 Restore affected cell(s) electrolyte level to above the top of the plates. AND C.2 Verify no evidence of leakage. AND C.3 Restore affected cell(s) electrolyte level to greater than or equal to minimum established design limits.	8 hours 12 hours 31 days
D. One battery with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell electrolyte temperature to greater than or equal to minimum established design limits.	12 hours
E. Two or more batteries with battery parameters not within limits.	E.1 Restore battery parameters for one battery to within limits.	2 hours
F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR One battery with one or more battery cells float voltage < 2.07 V and float current > 2 amps.	F.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.6.1	----------NOTE---------- Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. ---------- Verify each battery float current is ≤ 2 amps.	7 days
SR 3.8.6.2	Verify each battery pilot cell voltage is ≥ 2.07 V.	31 days
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ 2.07 V.	92 days
SR 3.8.6.6	----------NOTE---------- This Surveillance shall not be performed in MODE 1, 2, 3, or 4. ---------- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months AND 24 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating. AND 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating.

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5.5 Programs and Manuals

5.5.15 Safety Function Determination Program (SFDP) (continued)

b. A required system redundant to the system(s) in turn supported by the inoperable supported system is also inoperable; or

c. A required system redundant to the support system(s) for the supported systems (a) and (b) above is also inoperable.

The SFDP identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

5.5.16 Containment Leakage Rate Testing Program

a. A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide 1.163, "Performance-Based Containment Leak-Test Program, dated September 1995." The ten-year interval between performance of the integrated leakage rate (Type A) test, beginning May 4, 1994, for Unit 1 and April 30, 1993, for Unit 2, has been extended to 15 years.

b. The peak calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 47 psig.

c. The maximum allowable containment leakage rate, L_a, at P_a, shall be 0.10% of containment air weight per day.

d. Leakage rate acceptance criteria are:

1. Containment overall leakage rate acceptance criterion is $\leq 1.0\ L_a$. During the first unit startup following testing in accordance with this program, the leakage rate acceptance criteria are $< 0.60\ L_a$ for the Type B and Type C tests and $\leq 0.75\ L_a$ for Type A tests;

2. Air lock testing acceptance criteria are:

a) Overall air lock leakage rate is $\leq 0.05\ L_a$ when tested at $\geq P_a$.

b) For each door, leakage rate is $\leq 0.01\ L_a$ when pressurized to ≥ 10 psig.

e. The provisions of SR 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program.

f. The provisions of SR 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

(continued)

5.5 Programs and Manuals (continued)

5.5.17 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," or of the battery manufacturer, of the following:

a. Actions to restore battery cells with float voltage < 2.13 V, and

b. Actions to equalize and test battery cells that have been discovered with electrolyte level below the top of the plates.

TECHNICAL SPECIFICATIONS BASES (MARKED-UP)

(For information only)

Bases 3.8.4 Pages B 3.8-44 to B 3.8-51
Bases 3.8.5 Pages B 3.8-52 to B 3.8-54
Bases 3.8.6 Pages B 3.8-55 to B 3.8-60

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources-Operating

BASES

BACKGROUND

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

The 125 VDC electrical power system consists of three independent safety related Class 1E DC electrical power subsystems. Each subsystem consists of one 60-cell 125 VDC battery (Batteries 11(21), 12 (22), and 13 (23)), the dedicated battery charger and backup charger for each battery, and all the associated switchgear, control equipment, and interconnecting cabling. Although the three 125 VDC batteries consist of a 60-cell configuration, analysis is in place to fully support a 59-cell configuration (Ref. 11). Bases information in B 3.8.4, B 3.8.5, and B 3.8.6 are written for a 60-cell battery and can be adjusted on a volts per cell basis for a 59-cell battery.

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

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

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

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

(continued)

BASES

BACKGROUND (continued)

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

Each battery has adequate storage capacity to ~~carry the required load continuously for at least 2 hours as~~ meet the duty cycle(s) discussed in the FSAR, Chapter 8 (Ref. 4). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

The batteries for the three DC electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. ~~The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 128 V per battery. The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5).~~ The minimum design voltage limit is 112.1 V for a 59-cell battery.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 125 V for a 60 cell battery (i.e., cell voltage of 2.06 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.06 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage range of 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The float voltage range of 2.20 to 2.25 Vpc corresponds to a total float voltage output range of 132.0 through 135.0 V for a 60 cell battery.

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 battery charger also has sufficient excess capacity to restore the battery from the design minimum charge to its fully charged state within 12 hours while supplying normal steady state loads discussed in the FSAR, Chapter 8 (Ref. 4).

The battery charger is normally in the float-charge mode. Float-charge is the condition in which the charger is supplying the connected loads and the battery cells are receiving adequate current to optimally charge the battery. This assures the internal losses of a battery are overcome and the battery is maintained in a fully charged state.

When desired, the charger can be placed in the equalize mode. The equalize mode is at a higher voltage than the float mode and charging current is correspondingly higher. The battery charger is operated in the equalize mode after a battery discharge or for routine maintenance. Following a battery discharge, the battery recharge characteristic accepts current at the current limit of the battery charger (if the discharge was significant, e.g., following a battery service test) until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 5~~6~~), and in the FSAR, Chapter 15 (Ref. 6~~7~~), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation.

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

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

b. A worst case single failure.

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

(continued)

BASES (continued)

LCO

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

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

APPLICABILITY

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

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

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

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

ACTIONS

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

Condition A represents one DC electrical power subsystem with one dedicated battery charger inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action A.1 requires that the terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the dedicated charger to OPERABLE status or providing an alternate means of restoring the associated battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action A.2) from any discharge that might have occurred due to the charger inoperability.

ACTIONS

A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limiting mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current limit mode that is necessary during the recovery period following a battery discharge event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.2).

Required Action A.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged. If at the expiration of the 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable in accordance with LCO 3.8.6 Required Action B.2.

Required Action A.3 limits the restoration time for the inoperable dedicated battery charger to 14 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., backup charger or non-Class 1E battery charger). The 14 day completion time reflects a reasonable time to effect restoration of the dedicated battery charger to operable status.

B.1

Condition B represents one DC electrical power subsystem with one battery inoperable. With one battery inoperable, the DC bus is being supplied by the associated OPERABLE battery charger. Any event that results in a loss of the associated 480 VAC vital bus supporting the normal battery charger will also result in loss of or degraded DC to the

ACTIONS

associated DC electrical power subsystem. Recovery of the 480 VAC vital bus, especially if it is due to a loss of offsite power, will be hampered by the fact that many of the components necessary for the recovery (e.g., diesel generator control and field flash, AC load shed and diesel generator output circuit breakers, etc.) likely rely upon the battery. In addition, the energization transients of any DC loads that are beyond the capability of the battery charger and normally require the assistance of the battery will not be able to be brought online. The 2 hour limit allows sufficient time to effect restoration of an inoperable battery given that the majority of the conditions that lead to battery inoperability (e.g., loss of battery charger, battery cell voltage less than 2.07 V, etc.) are identified in Specifications 3.8.4, 3.8.5, and 3.8.6 together with additional specific completion times.

CA.1

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

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

(continued)

BASES

ACTIONS

CA.1 (continued)

1.93 (Ref. 7~~8~~) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

DB.1

The design of the 125 VDC electrical power distribution system is such that a battery can have associated with it a dedicated full capacity charger powered from its associated 480 VAC vital bus or ~~an~~ backup ~~alternate~~ full capacity charger powered from another 480 VAC vital bus. Use of the backup full capacity charger results in more than one full capacity charger receiving power simultaneously from a single 480 V vital bus and causes the requirements of independence and redundancy between subsystems to no longer be maintained. Thus ~~However,~~ operation ~~in the latter condition or,~~ with two chargers powered by the same vital bus is limited to 14 days.

EC.1 and EC.2

If the inoperable DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7~~8~~).

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

The minimum established float voltage provided by the battery manufacturer is 2.17 Vpc or 130.2 V at the battery terminals for a 60-cell battery. This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the battery chargers, which support ~~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, while supplying the continuous steady state loads of the associated DC electrical power subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. ~~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. 89).

~~SR 3.8.4.2~~

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

~~SR 3.8.4.2 (continued)~~

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

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

~~SR 3.8.4.3~~

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

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

~~SR 3.8.4.4 and SR 3.8.4.5~~

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

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

SR 3.8.4.~~2~~6

This SR ~~requires that each battery charger be capable of supplying 400 amps at ≥ 130 V for ≥ 4 hours. These requirements are based on~~ verifies the design capacity of the battery chargers ~~(Ref. 4)~~. According to Regulatory Guide 1.32 (Ref. ~~9~~10), the battery charger supply is recommended ~~required~~ to be

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.26 (continued)

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

This SR provides two options. One option requires that each battery charger be capable of supplying 400 amps at the minimum established float voltage for greater than 4 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest combined demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is $\leq$ 2 amps.

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

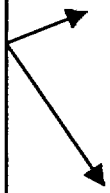
SR 3.8.4.37

A battery service test is a special test of battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements as specified in FSAR Chapter 8, (Ref. 4).

The Surveillance Frequency of 24 months is consistent with the intent of Regulatory Guide 1.32 (Ref. 910) and Regulatory Guide 1.129 (Ref. 1011), which state that the battery service test should be performed during refueling operations or at some other outage.

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

Exchange paragraph order and move both paragraphs to Bases for SR 3.8.6.6 (renumbered from SR 3.8.4.8)



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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.~~3~~7 (continued)

percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test. The modified performance discharge test and service test should be performed in accordance with IEEE-450 (Ref. ~~8~~9).

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

<< Move entire revised Bases for SR 3.8.4.8 to Bases for SR 3.8.6.6 >>

SR 3.8.6.~~6~~4.~~8~~

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

~~A battery modified performance discharge test is described in the Bases for SR 3.8.4.7.~~ Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.6.~~6~~4.~~8~~; however, only the modified performance discharge test may be used to satisfy ~~SR 3.8.4.8 while satisfying~~ the battery service test requirements of SR 3.8.4.~~3~~7 ~~at the same time~~.

Insert two paragraphs from Bases for SR 3.8.4.3

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. ~~3~~9) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 24 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. ~~3~~9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is < 90% of the manufacturer's rating. The Surveillance Frequency basis is consistent with IEEE-450 (Ref. ~~3~~9), except if accelerated testing is required, it will be performed at an 24-month frequency to coincide with a refueling outage.

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

BASES (continued)

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE Std. 308-1971.
4. FSAR, Chapter 8.
~~5. IEEE Std. 485-1978.~~
5~~6~~. FSAR, Chapter 6.
6~~7~~. FSAR, Chapter 15.
7~~8~~. Regulatory Guide 1.93, December 1974.
8~~9~~. IEEE Std. 450-1995.
9~~10~~. Regulatory Guide 1.32, February 1977.
10~~11~~. Regulatory Guide 1.129, December 1974.
11. Electrical Design Calculations 235A-DC thru 235F-DC.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources-Shutdown

BASES

BACKGROUND	A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources-Operati[illegible] **No changes required**
APPLICABLE SAFETY ANALYSES	The initial conditions o[illegible]s Accident and transient analyses in the FSAR, Chapter [illegible] Chapter 15 (Ref. 2), assume that Engineered Safety Fe[illegible] are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY. The OPERABILITY of the minimum DC electrical power sources during MODES 5 and 6 and during movement of irradiated fuel assemblies ensures that: a. The unit can be maintained in the shutdown or refueling condition for extended periods; b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as a fuel handling accident. The DC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).
LCO	The DC electrical power subsystems, each subsystem consisting of one battery, one battery charger per battery, and the corresponding control equipment and interconnecting class 1E cabling within the subsystem, are required to be OPERABLE to support required trains of the distribution systems required OPERABLE by LCO 3.8.10, "Distribution Systems-Shutdown." An OPERABLE subsystem consists of a DC bus connected to a battery with an OPERABLE battery charger which is fed from an OPERABLE AC vital bus (Ref B.3.8.10).

(continued)

BASES

LCO (continued)

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

No changes required

APPLICABILITY

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

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

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

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

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

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

ACTIONS

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

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

(continued)

BASES

ACTIONS

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

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

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.38. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

REFERENCES

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

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery ~~Cell~~ Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage~~, and specific gravity~~ for the DC electrical power subsystem ~~source~~ batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources - Operating," and LCO 3.8.5, "DC Sources - Shutdown." In addition to the limitations of this Specification, the Battery Monitoring and Maintenance Program also implements a program specified in Specification 5.5.17 for monitoring various battery parameters that is based on the recommendations of IEEE Standard 450, "IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications" (Ref. 3).

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 125 V for a 60 cell battery (i.e., cell voltage of 2.06 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.06 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturing instructions. Optimal long term performance however, is obtained by maintaining a float voltage range of 2.20 to 2.25 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The float voltage range of 2.20 to 2.25 Vpc corresponds to a total float voltage output range of 132.0 through 135.0 V for a 60 cell battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining the required DC electrical power subsystem(s) OPERABLE during accident conditions, in the event of:

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

b. A worst case single failure.

Battery ~~cell~~ parameters satisfy the Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO	Battery ~~cell~~ parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Battery parameter ~~Electrolyte~~ limits are conservatively established, allowing continued DC electrical system function even with ~~Category A and B~~ limits not met. Additional preventive maintenance, testing, and monitoring performed in accordance with the Battery Monitoring and Maintenance Program is conducted as specified in Specification 5.5.17.
APPLICABILITY	The battery ~~cell~~ parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery OPERABILITY is only required when the DC power source is required to be OPERABLE. Refer to the Applicability discussion in Bases for LCO 3.8.4 and LCO 3.8.5.

(continued)

BASES (continued)

ACTIONS

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

With one or more cells in one battery < 2.07 V, the battery cell is degraded. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage (SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (SR 3.8.6.1). This assures that there is still sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells < 2.07 V, and continued operation is permitted for a limited period up to 24 hours.

Since the Required Actions only specify "perform," a failure of SR 3.8.4.1 or SR 3.8.6.1 acceptance criteria does not result in this Required Action not met. However, if one of the SRs is failed the appropriate Conditions(s), depending on the cause of the failure, is entered. If SR 3.8.6.1 is failed when in Condition A, then there is not assurance that there is still sufficient battery capacity to perform the intended function. In this case the battery must be declared inoperable and Condition F must be entered.

B.1 and B.2

A battery with float current > 2 amps indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage. If the terminal voltage is found to be less than the minimum established float voltage there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. Condition A addressed charger inoperability. If the charger is operating in the current limit mode after 2 hours that is an indication that the battery has been substantially discharged and likely cannot perform its required design functions. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 V, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 V there is good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action B.2) from any discharge that might have occurred due to temporary loss of the battery charger. A discharged battery with float voltage (the charger setpoint) across its terminals indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If the condition is due to one or more cells in a low voltage condition but still greater than 2.07 V and float voltage is found to be satisfactory, this is not indication of a substantially discharged battery and 12 hours is a reasonable time prior to declaring the battery inoperable.

Since Required Action B.1 only specifies "perform," a failure of SR 3.8.4.1 acceptance criteria does not result in the Required Action not met. However, if SR 3.8.4.1 is failed, the appropriate Condition(s), depending on the cause of the failure, is entered.

C.1, C.2, and C.3

With one battery with one or more cells electrolyte level above the top of the plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of electrolyte level not met. Within 31 days the minimum established design limits for electrolyte level must be re-established.

With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 address this potential (as well as provisions in Specification 5.5.17, Battery Monitoring and Maintenance Program). They are modified by a note that indicates they are only applicable if electrolyte level is below the top of the plates. Within 8 hours level is required to be restored to above the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Specification 5.5.17.b item to initiate action to equalize and test in accordance with manufacturer's recommendation are taken from Annex D of IEEE Standard 450 (Ref. 3). They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cells(s) replaced.

D.1

With a battery with pilot cell temperature less than the minimum established design limits, 12 hours is allowed to restore the temperature to within limit. A low electrolyte temperature limits the current and power available. Since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended function and the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not met.

E.1

With two or more batteries in redundant DC electrical power subsystems with battery parameters not within limits there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform there required function, given that redundant batteries are involved. With redundant batteries involved this potential could result in total loss of function on multiple systems that rely upon the batteries. The longer completion times specified for battery parameters on non-redundant batteries not within limits are therefore not appropriate, and the parameters must be restored to within limits on at least one DC electrical power subsystem within 2 hours.

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

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

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

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

~~F~~B.1

With one ~~or more~~ battery ~~batteries~~ with any ~~one or more~~ battery ~~cell~~ parameter~~s~~ outside the ~~Category C limit for any connected cell~~ allowances of the Required Actions for Condition A, B, C, D, or E, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery ~~electrical power subsystem~~ must be declared inoperable. Additionally, discovering a battery with one or more battery cells float voltage less than 2.07 V and float current greater than 2 amps indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately. ~~other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required~~

BASES

ACTIONS

~~B.1 (continued)~~

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

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

Verifying battery float current while on float charge is used to determine the state of charge of the battery. 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 charged state. The float current requirements are based on the float current indicative of a charged battery. Use of float current to determine the state of charge of the battery is consistent with IEEE-450 (Ref. 3). The 7 day frequency is consistent with IEEE-450 (Ref. 3).

This SR is modified by a Note that states the float current requirement is not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. When this float voltage is not maintained the Required Actions of LCO 3.8.4 Action A are being taken, which provide the necessary and appropriate verifications of the battery condition. Furthermore, the float current limit of 2 amps is established based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

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

SR 3.8.6.2 and 3.8.6.5

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established float voltage provided by the battery manufacturer, which corresponds to 130.2 V for 60 cells at the battery terminals, or 2.17 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltages in the range of less than 2.13 Vpc, but greater than 2.07 Vpc, are addressed in Specification 5.5.17. SRs 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V. The Frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE-450 (Ref. 3).

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

SR 3.8.6.3

The electrolyte level minimum established design limit is the manufacturer minimum level indication mark on the battery case. The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintains adequate electron transfer capability. The Frequency is consistent with IEEE-450 (Ref. 3).

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

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

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e. 60°F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The Frequency is consistent with IEEE-450 (Ref. 3).

SR 3.8.6.6

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.

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.6.6; however, only the modified performance discharge test may be used to satisfy the battery service test requirements of SR 3.8.4.3.

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. The modified performance discharge test and service test should be performed in accordance with IEEE-450 (Ref. 3).

It may consist of just two rates; for instance 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 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 must 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.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 3) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 24 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 3), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is < 90% of the manufacturer's rating. The Surveillance Frequency basis is consistent with IEEE-450 (Ref. 3), except if accelerated testing is required, it will be performed at a 24-month frequency to coincide with a refueling outage.

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~Table 3.8.6-1~~

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

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

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

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

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

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

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

~~Table 3.8.6-1 (continued)~~

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

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

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

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

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

~~Table 3.8.6-1 (continued)~~

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

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. IEEE Std. 450-1995.
4. FSAR, Chapter 8
5. IEEE Std. 485-1983~~78~~.

Enclosure 5
PG&E Letter DCL-03-084

TECHNICAL SPECIFICATIONS BASES PAGES (RETYPED)
(For information only)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources-Operating

BASES

BACKGROUND

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

The 125 VDC electrical power system consists of three independent safety related Class 1E DC electrical power subsystems. Each subsystem consists of one 60-cell 125 VDC battery (Batteries 11(21), 12 (22), and 13 (23)), the dedicated battery charger and backup charger for each battery, and all the associated switchgear, control equipment, and interconnecting cabling. Although the three 125 VDC batteries consist of a 60-cell configuration, analysis is in place to fully support a 59-cell configuration (Ref. 11). Bases information in B 3.8.4, B 3.8.5, and B 3.8.6 are written for a 60-cell battery and can be adjusted on a volts per cell basis for a 59-cell battery.

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

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

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

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

(continued)

BASES

BACKGROUND (continued)

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

Each battery has adequate storage capacity to meet the duty cycle(s) discussed in the FSAR, Chapter 8 (Ref. 4). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

The batteries for the three DC electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 112.1 V for a 59-cell battery.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 125 V for a 60 cell battery (i.e., cell voltage of 2.06 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage $\geq$ 2.06 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage range of 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The float voltage range of 2.20 to 2.25 Vpc corresponds to a total float voltage output range of 132.0 through 135.0 V for a 60 cell battery.

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 battery charger also has sufficient excess capacity to restore the battery from the design minimum charge to its fully charged state within 12 hours while supplying normal steady state loads discussed in the FSAR, Chapter 8 (Ref. 4).

The battery charger is normally in the float-charge mode. Float-charge is the condition in which the charger is supplying the connected loads and the battery cells are receiving adequate current to optimally charge the battery. This assures the internal losses of a battery are overcome and the battery is maintained in a fully charged state.

(continued)

BASES

BACKGROUND (continued)

When desired, the charger can be placed in the equalize mode. The equalize mode is at a higher voltage than the float mode and charging current is correspondingly higher. The battery charger is operated in the equalize mode after a battery discharge or for routine maintenance. Following a battery discharge, the battery recharge characteristic accepts current at the current limit of the battery charger (if the discharge was significant, e.g., following a battery service test) until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

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

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

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

b. A worst case single failure.

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

(continued)

BASES (continued)

LCO

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

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

APPLICABILITY

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

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

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

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

ACTIONS

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

Condition A represents one DC electrical power subsystem with one dedicated battery charger inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action A.1 requires that the terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the dedicated charger to OPERABLE status or providing an alternate means of restoring the associated battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action A.2) from any discharge that might have occurred due to the charger inoperability.

(continued)

BASES

ACTIONS (continued)

A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limiting mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current limit mode that is necessary during the recovery period following a battery discharge event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.2).

Required Action A.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged. If at the expiration of the 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable in accordance with LCO 3.8.6 Required Action B.2.

Required Action A.3 limits the restoration time for the inoperable dedicated battery charger to 14 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., backup charger or non-Class 1E battery charger). The 14 day completion time reflects a reasonable time to effect restoration of the dedicated battery charger to operable status.

(continued)

BASES

ACTIONS (continued)

B.1

Condition B represents one DC electrical power subsystem with one battery inoperable. With one battery inoperable, the DC bus is being supplied by the associated OPERABLE battery charger. Any event that results in a loss of the associated 480 VAC vital bus supporting the normal battery charger will also result in loss of or degraded DC to the associated DC electrical power subsystem. Recovery of the 480 VAC vital bus, especially if it is due to a loss of offsite power, will be hampered by the fact that many of the components necessary for the recovery (e.g., diesel generator control and field flash, AC load shed and diesel generator output circuit breakers, etc.) likely rely upon the battery. In addition, the energization transients of any DC loads that are beyond the capability of the battery charger and normally require the assistance of the battery will not be able to be brought online. The 2 hour limit allows sufficient time to effect restoration of an inoperable battery given that the majority of the conditions that lead to battery inoperability (e.g., loss of battery charger, battery cell voltage less than 2.07 V, etc.) are identified in Specifications 3.8.4, 3.8.5, and 3.8.6 together with additional specific completion times.

C.1

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

If one of the required DC electrical power subsystems is inoperable for reasons other than Condition A or B (e.g., 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 the minimum necessary DC electrical power subsystems to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 7) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

(continued)

BASES

ACTIONS (continued)

D.1

The design of the 125 VDC electrical power distribution system is such that a battery can have associated with it a dedicated full capacity charger powered from its associated 480 VAC vital bus or a backup full capacity charger powered from another 480 VAC vital bus. Use of the backup full capacity charger results in more than one full capacity charger receiving power simultaneously from a single 480 V vital bus and causes the requirements of independence and redundancy between subsystems to no longer be maintained. Thus, operation with two chargers powered by the same vital bus is limited to 14 days.

E.1 and E.2

If the inoperable DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

The minimum established float voltage provided by the battery manufacturer is 2.17 Vpc or 130.2 V at the battery terminals for a 60-cell battery. This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the battery chargers, which support 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, while supplying the continuous steady state loads of the associated DC electrical power subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 8).

SR 3.8.4.2

This SR verifies the design capacity of the battery chargers. According to Regulatory Guide 1.32 (Ref. 9), the battery charger supply is recommended 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.

This SR provides two options. One option requires that each battery charger be capable of supplying 400 amps at the minimum established float voltage for greater than 4 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest combined demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is ≤ 2 amps.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

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

SR 3.8.4.3

A battery service test is a special test of battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements as specified in FSAR Chapter 8, (Ref. 4).

The Surveillance Frequency of 24 months is consistent with the intent of Regulatory Guide 1.32 (Ref. 9) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage.

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

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

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE Std. 308-1971.
4. FSAR, Chapter 8.
5. FSAR, Chapter 6.
6. FSAR, Chapter 15.
7. Regulatory Guide 1.93, December 1974.
8. IEEE Std. 450-1995.
9. Regulatory Guide 1.32, February 1977.
10. Regulatory Guide 1.129, December 1974.
11. Electrical Design Calculations 235A-DC thru 235F-DC.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources-Shutdown

BASES

BACKGROUND

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

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

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

The OPERABILITY of the minimum DC electrical power sources during MODES 5 and 6 and during movement of irradiated fuel assemblies ensures that:

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as a fuel handling accident.

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

LCO

The DC electrical power subsystems, each subsystem consisting of one battery, one battery charger per battery, and the corresponding control equipment and interconnecting class 1E cabling within the subsystem, are required to be OPERABLE to support required trains of the distribution systems required OPERABLE by LCO 3.8.10, "Distribution Systems-Shutdown." An OPERABLE subsystem consists of a DC bus connected to a battery with an OPERABLE battery charger which is fed from an OPERABLE AC vital bus (Ref B.3.8.10).

(continued)

BASES

LCO (continued)

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

APPLICABILITY

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

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

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

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

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

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

ACTIONS

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

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

(continued)

BASES

ACTIONS

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

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

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.3. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

REFERENCES

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

B 3.8 ELECTRICAL POWER SYSTEMS
B 3.8.6 Battery Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage for the DC electrical power subsystem 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." In addition to the limitations of this Specification, the Battery Monitoring and Maintenance Program also implements a program specified in Specification 5.5.17 for monitoring various battery parameters that is based on the recommendations of IEEE Standard 450, "IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications" (Ref. 3).

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 125 V for a 60 cell battery (i.e., cell voltage of 2.06 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage $\geq$ 2.06 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturing instructions. Optimal long term performance however, is obtained by maintaining a float voltage range of 2.20 to 2.25 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The float voltage range of 2.20 to 2.25 Vpc corresponds to a total float voltage output range of 132.0 through 135.0 V for a 60 cell battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining the required DC electrical power subsystem(s) OPERABLE during accident conditions, in the event of:

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

b. A worst case single failure.

Battery parameters satisfy the Criterion 3 of 10 CFR 50.36(c)(2)(ii).

(continued)

BASES (continued)

LCO	Battery 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. Battery parameter limits are conservatively established, allowing continued DC electrical system function even with limits not met. Additional preventive maintenance, testing, and monitoring performed in accordance with the Battery Monitoring and Maintenance Program is conducted as specified in Specification 5.5.17.
APPLICABILITY	The battery parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery OPERABILITY is only required when the DC power source is required to be OPERABLE. Refer to the Applicability discussion in Bases for LCO 3.8.4 and LCO 3.8.5.

(continued)

BASES (continued)

ACTIONS

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

With one or more cells in one battery < 2.07 V, the battery cell is degraded. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage (SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (SR 3.8.6.1). This assures that there is still sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells < 2.07 V, and continued operation is permitted for a limited period up to 24 hours.

Since the Required Actions only specify "perform," a failure of SR 3.8.4.1 or SR 3.8.6.1 acceptance criteria does not result in this Required Action not met. However, if one of the SRs is failed the appropriate Conditions(s), depending on the cause of the failure, is entered. If SR 3.8.6.1 is failed when in Condition A, then there is not assurance that there is still sufficient battery capacity to perform the intended function. In this case the battery must be declared inoperable and Condition F must be entered.

B.1 and B.2

A battery with float current > 2 amps indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage. If the terminal voltage is found to be less than the minimum established float voltage there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. Condition A addressed charger inoperability. If the charger is operating in the current limit mode after 2 hours that is an indication that the battery has been substantially discharged and likely cannot perform its required design functions. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

(continued)

BASES

ACTIONS (continued)

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 V, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 V there is good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action B.2) from any discharge that might have occurred due to temporary loss of the battery charger. A discharged battery with float voltage (the charger setpoint) across its terminals indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If the condition is due to one or more cells in a low voltage condition but still greater than 2.07 V and float voltage is found to be satisfactory, this is not indication of a substantially discharged battery and 12 hours is a reasonable time prior to declaring the battery inoperable.

Since Required Action B.1 only specifies "perform," a failure of SR 3.8.4.1 acceptance criteria does not result in the Required Action not met. However, if SR 3.8.4.1 is failed, the appropriate Condition(s), depending on the cause of the failure, is entered.

C.1, C.2, and C.3

With one battery with one or more cells electrolyte level above the top of the plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of electrolyte level not met. Within 31 days the minimum established design limits for electrolyte level must be re-established.

With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 address this potential (as well as provisions in Specification 5.5.17, Battery Monitoring and Maintenance Program). They are modified by a note that indicates they are only applicable if electrolyte level is below the top of the plates. Within 8 hours level is required to be restored to above the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Specification 5.5.17.b item to initiate action to equalize and test in accordance with manufacturer's recommendation are taken from Annex D of IEEE Standard 450 (Ref. 3). They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cells(s) replaced.

(continued)

BASES

ACTIONS (continued)

D.1

With a battery with pilot cell temperature less than the minimum established design limits, 12 hours is allowed to restore the temperature to within limit. A low electrolyte temperature limits the current and power available. Since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended function and the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not met.

E.1

With two or more batteries in redundant DC electrical power subsystems with battery parameters not within limits there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform there required function, given that redundant batteries are involved. With redundant batteries involved this potential could result in total loss of function on multiple systems that rely upon the batteries. The longer completion times specified for battery parameters on non-redundant batteries not within limits are therefore not appropriate, and the parameters must be restored to within limits on at least one DC electrical power subsystem within 2 hours.

F.1

With one battery with any battery parameter outside the allowances of the Required Actions for Condition A, B, C, D, or E, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery must be declared inoperable. Additionally, discovering a battery with one or more battery cells float voltage less than 2.07 V and float current greater than 2 amps indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

Verifying battery float current while on float charge is used to determine the state of charge of the battery. 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 charged state. The float current requirements are based on the float current indicative of a charged battery. Use of float current to determine the state of charge of the battery is consistent with IEEE-450 (Ref. 3). The 7 day frequency is consistent with IEEE-450 (Ref. 3).

This SR is modified by a Note that states the float current requirement is not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. When this float voltage is not maintained the Required Actions of LCO 3.8.4 Action A are being taken, which provide the necessary and appropriate verifications of the battery condition. Furthermore, the float current limit of 2 amps is established based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

SR 3.8.6.2 and 3.8.6.5

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established float voltage provided by the battery manufacturer, which corresponds to 130.2 V for 60 cells at the battery terminals, or 2.17 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltages in the range of less than 2.13 Vpc, but greater than 2.07 Vpc, are addressed in Specification 5.5.17. SRs 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V. The Frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE-450 (Ref. 3).

SR 3.8.6.3

The electrolyte level minimum established design limit is the manufacturer minimum level indication mark on the battery case. The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintains adequate electron transfer capability. The Frequency is consistent with IEEE-450 (Ref. 3).

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e. 60°F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The Frequency is consistent with IEEE-450 (Ref. 3).

SR 3.8.6.6

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.

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.6.6; however, only the modified performance discharge test may be used to satisfy the battery service test requirements of SR 3.8.4.3.

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. The modified performance discharge test and service test should be performed in accordance with IEEE-450 (Ref. 3).

It may consist of just two rates; for instance 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 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 must 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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 3) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 24 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 3), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is < 90% of the manufacturer's rating. The Surveillance Frequency basis is consistent with IEEE-450 (Ref. 3), except if accelerated testing is required, it will be performed at a 24-month frequency to coincide with a refueling outage.

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

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. IEEE Std. 450-1995.
4. FSAR, Chapter 8
5. IEEE Std. 485-1983.

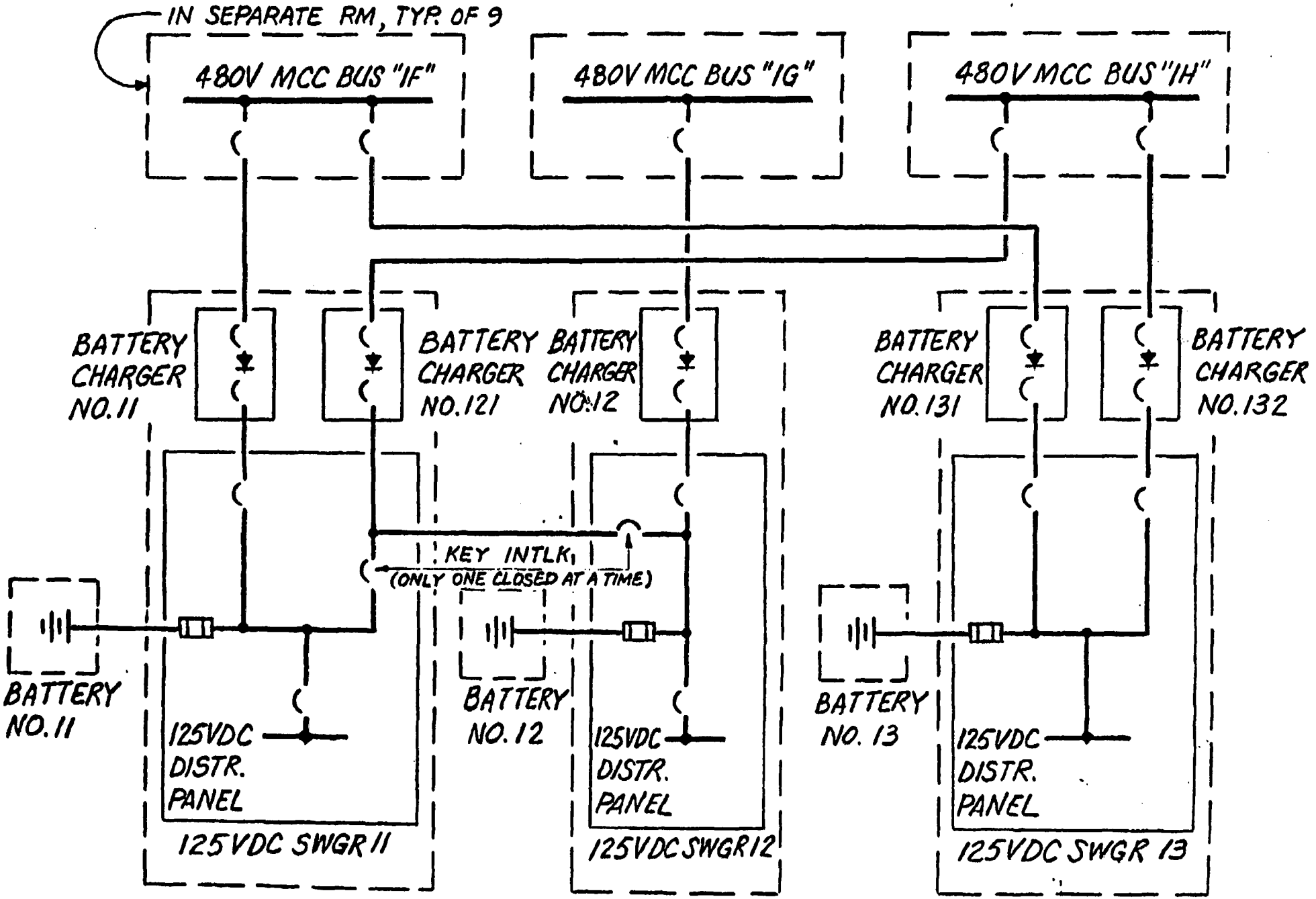
SUMMARY OF DIFFERENCES FROM TSTF-360, REVISION 1

LIST OF STARS PLANT LAR DIFFERENCES FROM TSTF-360, REVISION 1			APPLICABILITY	
DIFF. NO.	LOCATION	DESCRIPTION	COMANCHE PEAK	DIABLO CANYON
3.8.4-01	LCO 3.8.4 Condition A	The word "required" is added to the bracketed condition description wording provided for plants with two batteries in each DC electric power subsystem (train). This difference is needed for clarification because at CPSES each DC electrical power subsystem (train) consists of two batteries with each battery provided with two full sized and fully qualified battery chargers. Adding the term "required" refers to the battery charger presently in service for each battery in each DC subsystem as specified in the TS Bases Table B 3.8.4-1. This change is specific to the CPSES plant configuration and is consistent with the current CPSES plant-licensing basis.	Yes	No
3.8.4-02	LCO 3.8.4 Required Actions A.1, A.2, A.3, and B.1	The words "affected" and "required" are added to the Required Action statements to clarify that the action is associated with battery(ies) directly affected by the inoperable required battery charger(s). This difference is plant-specific and is consistent with the current CPSES plant-licensing basis.	Yes	No
3.8.4-03	LCO 3.8.4 Required Action A.2 Completion Time	The Completion Time for LCO 3.8.4 Required Action A.2 is revised from "Once per 12 hours" to "12 hours" to verify battery float current less than or equal 2 amps. This change is only applicable to DCPP.	No	Yes
3.8.4-04	LCO 3.8.4 Required Action A.3 Completion Time	The Completion Time for LCO 3.8.4 Required Action A.3 is revised from "7 days" to "14 days" based on the current plant-specific design and licensing basis for DCPP. This difference from TSTF-360, Revision 1, is applicable only to DCPP.	No	Yes
3.8.4-05	LCO 3.8.4 Condition D	LCO 3.8.4 Condition D for more than one full capacity charger receiving power simultaneously from a single 480 V vital bus, including its associated Required Action and Completion Time, is retained by DCPP based on its current plant-specific design and licensing basis. This difference from TSTF-360, Revision 1, is applicable only to DCPP.	No	Yes

LIST OF STARS PLANT LAR DIFFERENCES FROM TSTF-360, REVISION 1			APPLICABILITY	
DIFF. NO.	LOCATION	DESCRIPTION	COMANCHE PEAK	DIABLO CANYON
3.8.4-06	SR 3.8.4.2 First Test Option	The first performance option of this surveillance test is also revised to replace the TSTF- 360, Revision 1, bracketed value of "≥[400] amps" for the battery charger test current with the current CPSES plant- specific value of "≥300 amps" presently required by SR 3.8.4.6. This difference is only applicable to CPSES and is consistent with the current CPSES plant design and license bases.	Yes	No
3.8.4-07	SR 3.8.4.2 First Test Option	SR 3.8.4.2 is revised to replace the bracketed value for the battery charger test duration of "≥ [8] hours" with the plant-specific value of "≥ 4 hours." This change is specific to DCPP.	No	Yes
3.8.4-08	SR 3.8.4.3 Note 2	Note 2 is different from the corresponding Note provided in TSTF-360, Revision 1, because the current SR 3.8.4.7 surveillance test requirement at CPSES is not changed, but only renumbered to SR 3.8.4.3. Thus, Note 2 is also retained unchanged. This difference is consistent with the current CPSES licensing basis and is applicable only to CPSES.	Yes	No
3.8.4-09	SR 3.8.4.2 and SR 3.8.4.3	This difference from TSTF-360, Revision 1, is reflective of the current 24 month surveillance test frequency applicable to DCPP.	No	Yes
3.8.5-01	LCO 3.8.5 (entire specification)	This difference from TSTF-360, Revision 1, is based on and consistent with the Reviewer's Note for standard TS LCO 3.8.5 as provided in NUREG-1431, Revision 2. CPSES would retain its current LCO 3.8.5 requirements and APPLICABILITY that require only one DC electrical power subsystem train to be operable during shutdown conditions. Hence, the TSTF-360, Revision 1, changes to LCO 3.8.5 (Action A and the bracketed optional wording in Condition B) are not proposed, with the exception that the SR 3.8.5.1 references to the Section 3.8.4 surveillance test requirements be revised to reflect the proposed changes to the Section 3.8.4 Surveillance Requirements, consistent with the changes proposed in TSTF-360, Revision 1. This difference is based on the current CPSES licensing basis and is also applicable to DCPP.	Yes	Yes
3.8.6-01	LCO 3.8.6 Condition A, B, and C	The LCO 3.8.6 Condition A, B, and C is revised from "one battery on one train" to "one battery" to reflect the plant-specific design of three Class 1E batteries and one battery per DC electrical power subsystem. This is a DCPP only change.	No	Yes

LIST OF STARS PLANT LAR DIFFERENCES FROM TSTF-360, REVISION 1			APPLICABILITY	
DIFF. NO.	LOCATION	DESCRIPTION	COMANCHE PEAK	DIABLO CANYON
3.8.6-02	LCO 3.8.6 Required Actions B.2	The word "affected" is added to the Required Action B.2 statement to clarify that the action is associated with the battery(ies) with float current > 2 amps. This difference is consistent with similar changes proposed for the Required Actions of LCO 3.8.4. This difference is plant-specific and is consistent with the current CPSES plant-licensing basis.	Yes	No
3.8.6-03	LCO 3.8.6 Required Actions C.1 and C.3	The phrase "affected cell(s)" is added for clarification in regard to restoration of cell electrolyte level. This difference is consistent with the current CPSES plant licensing basis and is applicable to both CPSES and DCPP.	Yes	Yes
3.8.6-04	LCO 3.8.6 Condition E	The LCO 3.8.6 Condition E is revised from "one or more batteries in redundant trains" to "two or more batteries" to reflect the plant-specific design of three Class 1E batteries and one battery per DC electrical power subsystem. This is a DCPP only change.	No	Yes
3.8.6-05	SR 3.8.6.6 Note	The Note accompanying SR 3.8.6.6 is different from the corresponding Note provided in TSTF-360, Revision 1, because the current SR 3.8.4.8 surveillance test requirement at CPSES is not changed, but only renumbered to SR 3.8.6.6. Thus, the current Note is also retained unchanged. This difference is consistent with the current CPSES licensing basis and is applicable only to CPSES.	Yes	No
5.5-01	5.5.19 (5.5.17 for DCPP) Battery Monitoring and Maintenance Program	Different from TSTF-360, Revision 1, the TS Administrative Control Program 5.5.19 for CPSES (and 5.5.17 for DCPP) "Battery Maintenance and Monitoring Program," reference to the IEEE-450 version year 1995 is moved to the Bases. The supporting justification for this difference is provided in Enclosure 1 as part of Proposed Change (5 e). This change is applicable to both CPSES and DCPP.	Yes	Yes
5.5- 02	5.5.19 (5.5.17 for DCPP) Battery Monitoring and Maintenance Program	Different from TSTF- 360, Revision 1, the TS Administrative Control Program 5.5.19 for CPSES (and 5.5.17 for DCPP) "Battery Maintenance and Monitoring Program," paragraph b., the phrase "below the minimum established design limit" is replaced by "below the top of the plates." The minimum established design limit is a level above the top of the plates. This change is needed to be consistent with IEEE- 450-1995, Annex D. This change is applicable to both CPSES and DCPP.	Yes	Yes

SINGLE LINE DIAGRAM OF DCPP 125 V DC SYSTEM


IN SEPARATE RM, TYP. OF 9
480V MCC BUS "1F"
480V MCC BUS "1G"
480V MCC BUS "1H"
BATTERY CHARGER NO. 11
BATTERY CHARGER NO. 121
BATTERY CHARGER NO. 12
BATTERY CHARGER NO. 131
BATTERY CHARGER NO. 132
KEY INTLK
(ONLY ONE CLOSED AT A TIME)
BATTERY NO. 11
125VDC DISTR. PANEL
125VDC SWGR 11
BATTERY NO. 12
125VDC DISTR. PANEL
125VDC SWGR 12
BATTERY NO. 13
125VDC DISTR. PANEL
125VDC SWGR 13