SOUTHERN CALIFORNIA
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Brian Katz
Vice President

March 30, 2007

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington D.C. 20555

Subject: **Docket Nos. 50-361 and 50-362**
Proposed Change Number (PCN)-548, Revision 2
Battery and DC Sources Upgrades and Cross-Tie
San Onofre Nuclear Generating Station, Units 2 and 3

Reference: February 28, 2006 letter from B. Katz (SCE) to Document Control Desk (NRC), Subject: Proposed Change Number (PCN)-548, Revision 1, San Onofre Nuclear Generating Station Units 2 and 3

Dear Sir or Madam:

Pursuant to 10CFR50.90, Southern California Edison (SCE) hereby requests the following amendment to operating licenses NPF-10 and NPF-15 for San Onofre Units 2 and 3, respectively: revise Technical Specifications (TSs) 3.8.1, "AC Sources – Operating," 3.8.4, "DC Sources – Operating," 3.8.5, "DC Sources – Shutdown," 3.8.6, "Battery Cell Parameters," 3.8.7, "Inverters – Operating," and 3.8.9, "Distribution Systems – Operating." This change will also add a new Battery Monitoring and Maintenance Program, section 5.5.2.16. This revised amendment request completely supersedes our submittal of February 28, 2006, and incorporates some further explanations of engineering judgement as the result of the meeting between the industry's Technical Specification Task Force (TSTF)-360 Working Group (TSTF-360wg) and NRC personnel on July 12, 2006. SCE personnel participated in the TSTF-360wg and have applied the lessons learned from that work in this proposed Amendment Request. The changes from Revision 1 of this Amendment Request are identified by side change bars in Enclosure 2.

The proposed TS changes will provide operational flexibility supported by DC electrical subsystem design upgrades that are in progress. These upgrades will provide increased capacity batteries, additional battery chargers, and the means to cross-connect DC subsystems while meeting all design battery loading requirements. With these modifications in place, it will be feasible to perform routine surveillances as well as battery replacements online.

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As discussed in the Reference, this license amendment request to permit an extended Completion Time when batteries are cross-tied is a pilot application of Regulatory Guide 1.200 For Trial Use, "Assessment Results for Risk-Informed Activities," and the associated draft Standard Review Plan, Chapter 19.1, "Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities." As also discussed in the Reference, the NRC has indicated this review of pilot applications is eligible for a waiver of review fees.

The proposed change includes upgrade of the battery maintenance practices to conform to i) industry standard IEEE 450-2002, in lieu of the current commitment to the 1980 revision, and/or ii) improved specifications as per Technical Specification Task Force (TSTF)-360, Revision 1, "DC Electrical Rewrite." Where prudent, engineering evaluation and concurrence from the battery manufacturer have been used to justify the proposed changes (i.e., it is recognized that IEEE 450-2002 is not yet approved by the NRC for use and application).

Also, the proposed change will revise terminology of trains, channels, systems, and subsystems to make the licenses for the San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 consistent with industry convention.

The SONGS DC electrical system is an extremely robust design with four full-capacity battery subsystems providing power to the four independent instrument and DC-power subsystems. With this proposed change to the Technical Specifications, the routine operation of four battery subsystems will be maintained with an allowance to temporarily operate with three batteries supporting the four subsystems to enable routine testing as well as scheduled or emergent maintenance.

SCE has evaluated these requests under the standards set forth in 10CFR50.92(c) and determined that a finding of "no significant hazards consideration" is justified.

SCE requests the approval of the proposed amendments within one year. Once approved, the amendments shall be implemented within 90 days. Please note the battery upgrade project will not necessarily be completed prior to implementation of the amendment. The proposed change includes a note to restrict use of the subsystem cross-tie feature until after appropriate project completion and battery testing.

If you have any questions or require additional information, please contact Ms. Linda T. Conklin at 949-368-9443.

Sincerely,

Brian Katz

Enclosures:

1. Notarized Affidavits
2. Licensee's Evaluation
   Attachments
   - A. Existing Technical Specifications pages, Unit 2
   - B. Existing Technical Specifications pages, Unit 3
   - C. Proposed Technical Specifications pages, Redline and Strikeout, Unit 2
   - D. Proposed Technical Specifications pages, Redline and Strikeout, Unit 3
   - E. Proposed Technical Specifications pages, Unit 2
   - F. Proposed Technical Specifications pages, Unit 3
   - G1. Proposed Bases pages, Unit 2 (for information only and representative for Unit 3)
   - G2. Proposed Licensee Controlled Specifications pages, Unit 2 (for Information only and representative for Unit 3)
   - H. List of Regulatory Commitments
   - I. Probabilistic Risk Assessment (PRA) Evaluation
   - J. Review Aid

cc: B. S. Mallett, Regional Administrator, NRC Region IV
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 & 3
N. Kalyanam, NRC Project Manager, San Onofre Units 2 and 3
S. Y. Hsu, Department of Health Services, Radiologic Health Branch
D. R. Hoffman, Excel Services Corporation (TSTF-360wg Coordinator)

ENCLOSURE 1

NOTARIZED AFFIDAVITS

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Application of SOUTHERN CALIFORNIA EDISON COMPANY, ET AL. for a Class 103 License to Acquire, Possess, and Use a Utilization Facility as Part of Unit No. 2 of the San Onofre Nuclear Generating Station	))))))	Docket No. 50-361 Amendment Application No. 229, Revision 2

SOUTHERN CALIFORNIA EDISON COMPANY, et al. pursuant to 10CFR50.90, hereby submit Amendment Application No. 229, Revision 2. This amendment application consists of Proposed Change No. 548, Revision 2 to Facility Operating License No. NPF-10. Proposed Change No. 548, Revision 2 is a request to revise Technical Specifications (TSs) 3.8.1, "AC Sources – Operating," 3.8.4, "DC Sources – Operating," 3.8.5, "DC Sources – Shutdown," 3.8.6, "Battery Cell Parameters," 3.8.7, "Inverters – Operating," and 3.8.9, "Distribution Systems – Operating." This change will also add a new Battery Monitoring and Maintenance Program, section 5.5.2.16. This change will extend the Completion Time for an inoperable subsystem battery by allowing manual cross-connect of distribution subsystems, include improvements included in Revision 1 to Technical Specification Task Force (TSTF) – 360, and make editorial modifications more consistent with industry use.

State of California
County of San Diego

Brian Katz
Brian Katz, Vice President

Subscribed and sworn to (~~or affirmed~~) before me this 30th day of

March, 2007,

personally known to me ~~or proved to me on the basis of satisfactory evidence~~ to be the person who appeared before me.

Signature Dawn A. Farrell
Notary Public

DAWN A. FARRELL
Commission # 1623105
Notary Public - California
San Diego County
My Comm. Expires Nov 20, 2009

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Application of SOUTHERN CALIFORNIA EDISON COMPANY, ET AL. for a Class 103 License to Acquire, Possess, and Use a Utilization Facility as Part of Unit No. 3 of the San Onofre Nuclear Generating Station	)))))	Docket No. 50-362 Amendment Application No. 213, Revision 2

SOUTHERN CALIFORNIA EDISON COMPANY, et al. pursuant to 10CFR50.90, hereby submit Amendment Application No. 213, Revision 2. This amendment application consists of Proposed Change No. 548, Revision 2 to Facility Operating License No. NPF-15. Proposed Change No. 548, Revision 2 is a request to revise Technical Specifications (TSs) 3.8.1, "AC Sources – Operating," 3.8.4, "DC Sources – Operating," 3.8.5, "DC Sources – Shutdown," 3.8.6, "Battery Cell Parameters," 3.8.7, "Inverters – Operating," and 3.8.9, "Distribution Systems – Operating." This change will also add a new Battery Monitoring and Maintenance Program, section 5.5.2.16. This change will extend the Completion Time for an inoperable subsystem battery by allowing manual cross-connect of distribution subsystems, include improvements included in Revision 1 to Technical Specification Task Force (TSTF) – 360, and make editorial modifications more consistent with industry use.

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Signature Dawn A. Farrell
Notary Public

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ENCLOSURE 2

LICENSEE'S EVALUATION

PCN 548, Rev. 2

AC Sources, DC Sources, and Battery Parameters

LICENSEE'S EVALUATION

PCN 548, Rev. 2

AC Sources, DC Sources and Battery Parameters

SUBJECT: **Proposed Change No. 548, Rev. 2, is a request to revise Technical Specifications (TSs) 3.8.1, "AC Sources – Operating," 3.8.4, "DC Sources – Operating," 3.8.5, "DC Sources – Shutdown," 3.8.6, "Battery Cell Parameters," 3.8.7, "Inverters – Operating," and 3.8.9, "Distribution Systems – Operating." This change will also add a new Battery Monitoring and Maintenance Program, section 5.5.2.16. This change will extend the Completion Time for an inoperable subsystem battery by allowing manual cross-connect of distribution subsystems, include improvements included in Revision 1 to Technical Specification Task Force (TSTF) – 360, and make editorial modifications more consistent with industry use.**

1.0 INTRODUCTION

The proposed change is intended to provide operational flexibility supported by Direct Current (DC) electrical subsystem design upgrades that are in progress. These upgrades will provide increased capacity batteries, additional battery chargers, and the means to cross-connect DC subsystems. With these modifications in place, it will be feasible to perform routine surveillances as well as battery replacements online.

The proposed change includes upgrade of the battery maintenance practices to conform to industry standard IEEE 450-2002. The proposed change reduces and in some cases increases surveillances to conform to the requirements of IEEE 450-2002. The proposed change also includes improvements to the various electrical specifications reflected in Technical Specification Task Force (TSTF) – 360, Revision 1, "DC Electrical Rewrite" [Ref. 7.1]. Where prudent, engineering evaluation and concurrence from the battery manufacturer have been used to justify the proposed changes; i.e., it is recognized that IEEE 450-2002 is not yet approved by the NRC for use and application. The proposed change will also revise terminology of trains, channels, systems and subsystems to make the San Onofre Nuclear Generating Station (SONGS) licenses consistent with industry convention.

To allow operational flexibility associated with these design upgrades, the proposed change is to amend the Operating Licenses and revise Technical Specification (TS) 3.8.1, "AC Sources – Operating," and TS 3.8.4, "DC Sources – Operating" to extend the Completion Time (CT) for an inoperable subsystem battery by allowing manual cross-connect of DC distribution subsystems A and C, or B and D, during Modes 1-4. The proposed changes will also modify Surveillance Requirements (SR) 3.8.4.7, "Battery Service Test" and 3.8.4.8, "Battery Performance Discharge Test" to allow a Modified Performance Discharge Test and to allow tests to be performed while the unit is online, TS 3.8.5, "DC Sources – Shutdown," and it will modify TS 3.8.6, "Battery Cell Parameters," to allow operational flexibility associated with approved allowances recommended in NUREG-1432, Revision 3, which originated from TSTF-360 and reflect testing requirements to IEEE 450.

The SONGS DC electrical system is an extremely robust design with four full-capacity battery subsystems providing power to the four independent instrument and DC-power subsystems. With this proposed change to the TS, the routine operation with four batteries will be maintained with an allowance to temporarily operate with three batteries supporting the four subsystems to enable routine testing as well as scheduled or emergent maintenance with the Unit in Modes 1-4.

2.0 PROPOSED CHANGE

General description of changes:

Southern California Edison (SCE) is requesting a change to the SONGS 2 and 3 TS 3.8.4, "DC Sources – Operating." This change will allow a CT for one inoperable DC electrical power subsystem battery for a period of 30 days during Modes 1-4, exclusive of the battery charger which has its own Action, by adding an additional required action to allow manual cross-connect of DC distribution subsystems A and C, or B and D. TS 3.8.4 Condition A currently requires that one inoperable battery or associated control equipment or cabling be restored to operable status within 2 hours or be in Mode 3 within 6 hours and Mode 5 within 36 hours. The proposed change would allow a 30-day CT by adding a required action to allow manual cross-connect of the inoperable distribution subsystem with an operable subsystem of the same safety train. The proposed change would allow a 30-day CT and allow the manual cross-connect of the same train DC distribution subsystems to support operability of the associated DC loads based on a Probabilistic Risk Assessment (PRA) of the cross-connected configuration. The proposed changes would allow a 30-day CT provided the following conditions are met:

1. The inoperable subsystem can be cross-connected within 2 hours.
2. Required battery charger(s) and DC buses are operable.
3. Batteries are sized and tested to accommodate the combined connected load.

The proposed changes will also include changes to existing SR 3.8.4.7 (renumbered as SR 3.8.4.3), "Battery Service Test" and SR 3.8.4.8 (relocated as SR 3.8.6.6), "Battery Performance Discharge Test" per TSTF-360, Rev. 1. These SRs will be revised to allow the option of a modified performance discharge test as recommended by IEEE 450, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications." Surveillance Requirement 3.8.4.3 (renumbered), which currently allows a battery performance discharge test to be performed in lieu of a battery service test once per 48 months, is revised to allow unrestricted substitution; however, only a "modified" performance discharge test is allowed to satisfy this substitution. Since the modified performance discharge test completely encompasses the load profile of the battery service test, it adequately confirms the intent of the service test – to verify the battery capacity to supply the design basis load profile.

Please note that a change is made from Revision 1 of this Amendment Request (dated February 28, 2006), restoring the surveillance test intervals of SRs 3.8.4.1 and 3.8.6.1 to their current interval of 7 days following engineering review and the recommendation of the battery manufacturer, EnerSys Inc.

Also, Attachment I, Probabilistic Risk Assessment (PRA) Evaluation, has been changed to incorporate Request for Additional Information responses where necessary. These changes from Revision 1 of this Amendment Request are identified by side change bars in Attachment I.

Specific description of changes:

The proposed change includes the following specific changes to the existing Technical Specifications.

LCO 3.8.1

1. SR 3.8.1.1 The words in the NOTES "Buses 3A04 and 3D1" and "Buses 3A06 and 3D2" are simplified to "Bus 3A04" and "Bus 3A06," respectively (example for the Unit 2 TS). This is a San Onofre specific clarification of which buses are required. Specification of the preferred DC subsystem is not required.

LCO 3.8.4

1. The LCO statement is revised from the "Train A, Train B, Train C, and Train D" electrical power subsystems to "Train A and Train B." The SONGS-specific design terminology is more accurately reflected by presenting Train A and B, each with two subsystems, rather than as Train A, B, C, and D.

2. A new Condition A (comparable to existing Condition C, which is deleted) is added:

> "One or two required battery charger(s) on one train inoperable."

This makes the Condition more concordant with the Standard Technical Specifications (STS) and revises actions to be taken when the battery charger is not OPERABLE. The revised condition deletes "or associated control equipment or cabling" as these are included in the definition of OPERABILITY. The Required Actions and Completion Times are modified consistent with TSTF-360, Rev. 1 to validate battery OPERABILITY while in this Condition. Required Action A.2 is to "Verify battery float current ≤ 2 amps." The threshold of ≤ 2 amps has been verified with the manufacturer, EnerSys Inc., as an appropriate threshold for determining OPERABILITY. A digital multimeter of high accuracy in an average function mode will be used to measure the steady state float charging current. The multimeter is capable of measuring the low magnitude of DC current (less than 2 amps) and filtering the induced AC noise from the connected inverter. A millivolt shunt located close to the battery terminal provides the battery float charging current signal. It is expected that the float current at a given float voltage will increase with age as the plates open and have a greater effective surface area. Required Action A.3 is added as a 'backstop' to permit this Condition for not more than 7 days. Note: San Onofre 2 and 3 converted to

Revision 0 of NUREG 1432, Standard Technical Specifications (STS), Combustion Engineering Plants, dated September 1992, which did not include Required Action A.3. This change is consistent with later STSs (e.g., Revision 3.0, Published June, 2004), which have this 7-day Required Action.

3. A new Condition B (comparable to existing Condition D, which is deleted) is inserted to declare the associated battery inoperable should the battery parameters being monitored in the Required Actions for Condition A not be satisfactory.

4. Existing Condition A is modified, as new Condition C, to specifically cover conditions not included in new Condition A. With the DC electrical power subsystem inoperable (exclusive of the battery charger), a two hour Completion Time to restore the subsystem to OPERABLE status is still provided with a new optional Required Action to cross-connect to the subsystem in the same Train. Once the cross-connection is made, this Required Action is satisfied and new Condition D is entered.

New optional Required Action C.2 has a note that cross-connection:

> "Requires a battery with a rated capacity of greater than or equal to 1800 amp-hours."

This note is necessary since all eight 1800 AH rated batteries (four batteries on each unit) are not expected to be installed and tested prior to implementation of this amendment. Accordingly, this note would preclude use of this optional Required Action until the necessary battery subsystem upgrades and testing are complete.

5. New Condition D is inserted to provide an upper limit for the duration of the time when DC subsystems are cross-connected. In routine operation there are two electrical Trains consisting of four batteries of the four DC subsystems powering the four independent instrumentation, control, and power subsystems. For up to 30 days this design conservatism would be reduced to two electrical Trains consisting of three batteries of the four DC battery subsystems fully capable of powering the four instrumentation, control, and power subsystems. A Probabilistic Risk Assessment analysis of this temporary configuration is provided in Attachment I. The 30-day Completion Time is analyzed to permit both preventive and corrective maintenance online as well as online change out of batteries (and required commissioning / OPERABILITY tests).

New Condition D is modified by the same note included in new optional Required Action C.2 to ensure this feature is not used until the appropriately sized battery is in place:

"Requires a battery with a rated capacity of greater than or equal to 1800 amp-hours."

6. Existing Condition B is relabeled Condition E and modified to include the failure to satisfy the new Conditions (added above) as entry conditions to mandate plant shutdown.

7. SR 3.8.4.1 is modified per TSTF-360, Rev. 1, to provide surveillance of "greater than or equal to the minimum established float voltage" from the current requirement of "≥129V on float charge." Also, the frequency is restored to the current interval of 7 days following engineering review and the recommendation of the battery manufacturer, EnerSys Inc. The draft Licensee Controlled Specifications (LCS), Attachment G.2, contain the minimum established float voltage.

8. Existing requirements of SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 are removed from the TS per the recommendations of TSTF-360, Rev. 1. These include measures regarded as routine preventive maintenance, such as inspecting for signs of corrosion, physical damage, and electrical resistance measuring. The draft LCS contains these relocated requirements. The 92-day frequency for existing SR 3.8.4.2 will be changed to 31 days, consistent with IEEE 450.

9. Existing SR 3.8.4.6 is renumbered to SR 3.8.4.2 and
   a. The NOTE "Credit may be taken for unplanned events that satisfy this SR." is deleted as pragmatically unhelpful,
   b. In accordance with the recommendations of TSTF-360, Rev.1, the required duration for this surveillance is reduced from 12 to 8 hours. This change is appropriate since the proposed SR requires SONGS to verify each battery charger supplies ≥ rated amps at ≥ the minimum established float voltage for 8 hours. The current TS SR (3.8.4.6) requires this surveillance performance test be conducted at the charger's rated output at the float voltage for 12 hours. When at rated output, steady state maximum temperature of all components within a charger will be reached much sooner than the 12-hour interval. Continuous operation for two hours after reaching the maximum steady state temperature will demonstrate a charger's rated capability. A conservative estimate is that a battery charger would reach a maximum steady state temperature under rated output at a float voltage near its rated voltage in 6 hours or less. Therefore, testing for 8 hours is sufficient for the charger temperature to stabilize and be maintained for approximately 2 hours.
   c. The operability limits are relocated to the LCS and the SR revised as follows:
      - The minimum specified current is changed from "300 amps" to "rated amps"

- The minimum specified voltage is changed from "129 V" to "the minimum established float voltage"

d. Also, specified in TSTF-360, Rev. 1 for this SR is "Verify each battery charger can recharge the battery to the fully charged state 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 is not adopted for SONGS as it is not required for anticipated SONGS testing.

10. Existing SR 3.8.4.7 is renumbered to SR 3.8.4.3, and
    a. NOTES 2 and 3 are removed:
        - NOTE 2, "This Surveillance shall not be performed in Mode 1,2,3, or 4." is a restriction that can be removed with the ability to cross-connect DC subsystems in a given Train. While cross-connected, one battery can provide electrical power for both subsystems while the other battery is tested online.
        - NOTE 3, "Credit may be taken for unplanned events that satisfy this SR." is deleted as noted previously (see #9) as unhelpful.
    b. The following change is made per the recommendations of IEEE 450:
        - NOTE 1 is changed to specify "The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3" (the reference SR numbers are changed consistent with this amendment request).
        - The proposed SR 3.8.4.3 30-month service test frequency is in accordance with IEEE 450, which requires a service test at the discretion of the user at periodic times between the 60-month performance tests.

The extension of the surveillance test interval is considered permissible for the following reasons:

i. With the incorporation of the Class 1E battery cross-tie capability, battery performance testing can be performed on-line.

ii. Historically, battery maintenance on nuclear power plants has been performed during refueling outages not to exceed 24-month intervals. SONGS experience has indicated that there have been no battery failures using the 24-month test frequency for battery service tests. Therefore, the service test interval, when extended to 30 months, is not expected to affect SONGS' capability to detect battery health and capacity.

iii. Battery life expectancy can be optimized by using a less frequent test such as a 30-month modified performance test (service and performance test combined). SONGS proposes not to use separate service and performance tests for the new 1800 amp-hour (AH) batteries. In lieu of service and/or performance tests, SONGS intends to perform a "Modified Performance Discharge Test" at 30-month intervals to achieve the best trending results by using the same test method throughout the battery life.

iv. A routine test frequency of 30 months will better dove-tail with the scheduling of the more rigorous 60-month interval battery performance of modified performance discharge tests.

For these reasons, SCE regards the extension of the test interval as justified and desirable for long-term battery reliability.

- NOTE 2 contains the existing TS 3.8.4.7 Note 1 which states "The battery performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3 once per 48 months." This includes the revised reference SR numbers and a reasonable replacement frequency for using SR 3.8.6.6 without the modified performance discharge test option.

11. Existing SR 3.8.4.8 is relocated to be the new SR 3.8.6.6 as a more appropriate location.

LCO 3.8.5

1. The word "The" is added to the beginning of the LCO. This is an editorial change.

2. Conditions and Required Actions are modified consistent with the changes to LCO 3.8.4. The entry Condition for Required Action C is revised from "One..." to "One or more..." per TSTF-360, Rev. 1. Also, proposed Required Action C.2.3 is "Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration." This is consistent with the current licensing basis.

3. SR 3.8.5.1 is modified to reflect changes previously described in 3.8.4, DC Sources – Operating:
   a. The DC sources are OPERABLE when the following SRs are satisfied: 3.8.4.1, 3.8.4.2, and 3.8.4.3.
   b. This SR is modified by a NOTE that the following SRs are not required to be performed: 3.8.4.2 and 3.8.4.3.

LCO 3.8.6

1. General comment: LCO 3.8.6 undergoes significant editorial changes.

2. The LCO is relabeled from "Battery Cell Parameters" to "Battery Parameters." Similar to the nomenclature change in LCO 3.8.4, the LCO 3.8.6 is changed from:

> "Battery cell parameters for the Train A, Train B, Train C, and Train D batteries shall be within the Category A and B limits of Table 3.8.6-1."

> To read:

"Battery parameters for the Train A and Train B batteries shall be within limits."

This modification is more consistent with the STS and denotes that there are two electrical Trains, A and B. As noted elsewhere, subsystems A and C batteries support Train A, and subsystems B and D batteries support Train B.

Note that discussion referring to Table 3.8.6-1 is removed. This table, in subsequent discussion, is deleted in its entirety (while its requirements are included in new SRs in the TSs and LCSs and deficiencies in satisfying these SRs are accommodated in the Conditions).

3. Existing Condition A is deleted. This Condition was entered upon failing to meet the Category A and B values of existing Table 3.8.6-1. In accordance with the recommendations of TSTF-360, Rev. 1, this table and specific action levels are superseded by new Conditions.

4. New Condition A is inserted. In this Condition, cell float voltage of 2.07 VDC has not been met (this is the equivalent of the Category C limit in Table 3.8.6-1). This requires performance of SR 3.8.4.1 (battery terminal voltage) and SR 3.8.6.1 (float current verification) within 2 hours in addition to restoration of the affected cell float voltage within 24 hours. Required Action A.3 is to "Restore affected cell voltage ≥ 2.07 V." The threshold of ≥ 2.07 V has been verified with the manufacturer, EnerSys Inc., as an appropriate threshold for determining OPERABILITY.

5. New Condition B is inserted. In this Condition, float current exceeds 2 amps. The Required Actions specify performance of SR 3.8.4.1 (battery terminal voltage) within 2 hours and restoration of float current to ≤2 amps within 12 hours.

6. New Condition C is added if battery electrolyte level is not maintained (this is the equivalent to Category A, B and C for electrolyte level in Table 3.8.6-1). The overall recovery of electrolyte level within 31 days is consistent with the Completion Time for existing Condition A. However, NOTES are added to Required Actions to denote remedial measures should the electrolyte level fall below the top of the battery plates:

"1. Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates."

"2. Required Action C.2 shall be completed if electrolyte level was below the top of the plates."

These NOTES are consistent with TSTF-360, Rev. 1 and are in addition to current TS practices.

New Required Action C.1 directs restoration of the electrolyte level to above the top of the plates within 8 hours. New Required Action C.2 directs completing an investigation of potential battery cell jar leakage and verifying no evidence of leakage within 12 hours. New Required Action C.3, as noted above, is comparable to existing Action A.3, in that it restores electrolyte level to limits within 31 days. Also, new LCS 3.8.106 will verify electrolyte level is above the top of the plates in accordance with Administrative Controls section 5.5.2.16.b which is modified from the TSTF-360, Rev. 1 to clarify that action is needed when the electrolyte level is below the top of the plates.

The manufacturer, EnerSys Inc., has concurred with the electrolyte level limits specified in these Required Actions ("above the top of the plates" in 8 hours and "greater than or equal to minimum established design limits" in 31 days) as appropriate measures to minimize possible damage and restore OPERABILITY for the affected battery.

7. New Condition D provides a Required Action and Completion Time should the battery pilot cell temperatures be found low. This surveillance is currently in existing Condition B (for the remaining parameters in Condition B, see item 9 below). SONGS operating experience has demonstrated a negligible difference in operating temperature (i.e., well within the 5-degree F bounds guidelines for temperature stability per IEEE 450-1980) between the different battery cells. Therefore, the use of a pilot cell is considered appropriate for demonstrating the temperature of the entire battery.

8. New Condition E provides a Required Action and Completion Time should redundant Trains of batteries not be within limits. This is consistent with TSTF-360, Rev. 1: "Restore battery parameters for batteries in one train to within limits" with a Completion Time of 2 hours.

9. Existing Condition B is relabeled as Condition F, and
   a. Required Actions and associated Completion Times A through E not met are added as a reason for entering this Condition, and
   b. Technical parameter limits in the Condition are re-specified per the recommendations of TSTF-360, Rev. 1:
      - "One or more batteries" is reworded as "One or two batteries on one train" for clarity since there are two required batteries on a given train, and
      - "with average electrolyte temperature of the representative cells <60°F" is replaced with "with one or more battery cells with float voltage <2.07V and float current >2 amps." The temperature Condition is relocated to the proposed LCS.
      - "<u>OR</u> One or more batteries with one or more battery cell parameters not within Category C values." is deleted consistent with deleting Table 3.8.6-1.

10. SR 3.8.6.1

a. In accordance with the recommendations of IEEE 450, this surveillance:
   - rather than meet Table 3.8.6-1 category A limits, is re-specified to verify ≤2 amps float current.
   - for clarity, "each" is added to the Surveillance (as revised, this now reads "Verify each battery float current...").
   - the specified frequency for this surveillance is maintained at 7 days.

b. This surveillance is modified by a NOTE that this does not need to be met if the float voltage of SR 3.8.4.1 is not being met. That is, one is already in a Condition in LCO 3.8.4, so further performance of this SR is not required.

11. Existing SR 3.8.6.2 is deleted. It is replaced with SRs 3.8.6.2 and 3.8.6.3. These are discussed in items 12 and 13 below.

12. New SR 3.8.6.2 verifies pilot cell voltage ≥2.07 V every 31 days. This is in accordance with TSTF-360, Rev.1.

13. New SR 3.8.6.3 verifies each connected cell electrolyte level every 31 days. This is the equivalent of the current Category B limit of Table 3.8.6-1, which is surveilled every 92 days. This surveillance frequency is per TSTF-360, Rev. 1.

14. Existing SR 3.8.6.3 is modified and renumbered to SR 3.8.6.4. This SR replaces verification of electrolyte temperature of representative cells to >60°F with verification of each pilot cell temperature to "greater than or equal to minimum established design limits." Also, the specified frequency for this surveillance is increased from once per 92 days to once per 31 days. These changes are made per the recommendations of TSTF-360, Rev. 1. The draft LCS contains the minimum design limits.

15. New SR 3.8.6.5 verifies each connected cell voltage every 92 days. This is consistent with TSTF-360, Rev. 1 and IEEE 450.

16. New SR 3.8.6.6 is the relocated existing SR 3.8.4.8. This surveillance is modified to allow a modified performance discharge test per TSTF-360, Rev. 1.

17. Table 3.8.6-1 is deleted in its entirety. The limits are incorporated in other SRs in the TSs and LCSs consistent with TSTF-360, Rev.1.

LCO 3.8.7

1. For clarity, the LCO is restated from: "The required Train A, Train B, Train C, and Train D inverters shall be OPERABLE." to read: "The required Channel A, B, C, and D, AC inverters shall be OPERABLE." This is an editorial change.

LCO 3.8.9

1. Similar to editorial changes clarifying the two electrical Trains configuration, the LCO is restated from:

> "Train A and Train B AC; Trains A, B, C, and D DC; and Trains A, B, C, and D AC vital bus electrical power distribution subsystems shall be OPERABLE."

to read:

> "Train A and Train B AC, Subsystems A, B, C, and D DC, and Channels A, B, C, and D AC vital bus electrical power distribution systems shall be OPERABLE."

This is an editorial change.

§ 5.5.2.16

1. A new Program is added: "Battery Monitoring and Maintenance Program" as new section 5.5.2.16 to the Procedures, Programs, and Manuals Section of the Technical Specifications. The Program description meets the intent of TSTF-360, Rev. 1. The battery manufacturer, EnerSys Inc., has concurred with the specified minimum electrolyte level and float voltage as the appropriate thresholds to ensure battery OPERABILITY.

The Bases, Attachment G.1, will similarly be modified to reflect the above changes.

3.0 BACKGROUND

TS 3.8.4 requires the Train A and Train B DC electrical power subsystems to be operable. The 125VDC electrical power system consists of four independent and redundant Class 1E DC electrical power subsystems. Subsystems A and C support the Train A Class 1E Engineered Safety Features (ESF) equipment and subsystems B and D support the Train B Class 1E ESF equipment. Each subsystem consists of one 125VDC battery, a battery charger for the battery, inverter, and miscellaneous connected loads. During normal operation, the 125VDC load is powered from battery chargers that also maintain the batteries in a fully charged condition. In case of loss of AC power to a battery charger, the DC load is automatically powered from the associated battery.

The current DC system configuration has two independent and redundant trains; each train consists of two subsystems each with a battery and battery charger power source. Subsystems A and C support Train A and subsystems B and D support Train B. Subsystem C also provides control power for the Turbine Driven Auxiliary Feedwater Pump P140. Provisions in the existing design allow for temporarily cross-connecting DC subsystems of the same safety train during Modes 5 and 6 to facilitate maintenance on batteries and to maintain operability of the operating unit's 4.16kV Class 1E ESF buses. The Mode 5 and 6 cross-connect design includes permanently installed molded case isolation switches provided for each DC bus that can be connected via temporarily installed cable to a spare breaker on the DC bus. This spare breaker position is also utilized when necessary to connect a spare non-Class 1E battery charger via temporary cable to the bus in the event the normal charger is inoperable.

The DC system is currently being upgraded by SCE to replace each of the existing batteries with larger 1800 AH rated batteries, add two 400 Amp rated swing battery chargers and 600 Amp, 250 Volt rated disconnect switches, and upgrade several circuit breakers in DC switchboards and distribution panels (refer to attached Sketches 1 and 2 in Attachment J of Train A and Train B systems, respectively). One swing battery charger will be shared between DC subsystems A and C, and a second swing charger will be shared between DC subsystems B and D. The second swing charger can be aligned to the non-safety-related bus D5. Each swing battery charger will have mechanically interlocked, dedicated DC circuit breakers to allow it to feed only one subsystem at a time. An additional 600 Amp circuit breaker is interposed between the swing battery charger and the associated battery bank for separation and isolation. SCE has installed a new Class 1E 1800 AH rated spare battery bank (B00X) so that replacements of the existing batteries (e.g., at end of battery service life) can also be performed online. When B00X is no longer needed, it will be removed from the plant.

Condition A of TS 3.8.4 currently requires that one inoperable battery or associated control equipment or cabling be restored to operable status within 2 hours or be in Mode 3 within 6 hours and Mode 5 within 36 hours. Condition A represents a subsystem with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. The basis for the 2-hour completion time is consistent with Regulatory Guide (RG) 1.93 ("Availability of Electric Power Sources") which has its emphasis on assessing unit status and stabilizing the unit to minimize the potential for complete loss of DC power to the affected train.

Current SR 3.8.4.6, battery charger operability limits, will be modified and relocated to the Licensee Controlled Specifications.

SR 3.8.4.7 currently requires a service test to be performed on a battery every 24 months to verify capability to meet the load profile (battery duty cycle) of the most limiting Design Basis Accident (DBA). The discharge rate and test length correspond to the design duty cycle requirements. There is a note to this SR that allows substitution of the battery performance discharge test (SR 3.8.4.8) in lieu of the service test every 48 months to allow not having to perform both a service test and a performance discharge test in the same cycle.

SR 3.8.4.8 currently requires a battery performance discharge test be performed at a constant current to determine the battery capacity and detect/determine overall battery degradation due to age and usage. The acceptance criteria for this Surveillance are consistent with IEEE 450 and IEEE 485-1997. These standards recommend that the battery be replaced if its capacity is below 80% of the manufacturer rating. The frequency for this surveillance is every 60 months, or more frequently if the battery shows signs of degradation or has reached 85% of its expected life.

4.0 EVALUATION

The following discussion provides the engineering evaluation of the proposed changes (a detailed listing of specific changes follows):

This proposed change to TS 3.8.4 will extend the CT for an inoperable DC subsystem battery, exclusive of the battery charger which has its own LCO, by adding an additional action to allow manual cross-connect of distribution subsystems A and C, or B and D for a period of 30 days during Modes 1-4. These changes will be implemented provided the following conditions are met:

1. The inoperable subsystem can be cross-connected within 2 hours.
2. Required battery charger(s) and DC buses are operable.
3. Batteries are sized and tested to accommodate the combined connected loads.

The proposed changes to SR 3.8.4.7 and 3.8.4.8 are to eliminate individual service tests and performance discharge tests and replace them with a modified performance discharge test. This modified performance discharge test would combine aspects of the service test and performance discharge test into one test profile. The existing service test assures the battery will meet the duty profile between tests and allows trending of battery terminal voltages for each period of the duty cycle profile. The performance discharge test trends the battery capacity from the factory acceptance tests to end of life. Battery capacity and individual cell voltages are compared to acceptance criteria for determining end of life conditions. The modified performance discharge test would combine the peak (bounding) service profile test conditions from various duty cycles with the required performance discharge rate. This test methodology is endorsed by IEEE 450 and is identified in the Combustion Engineering (CE) Standard Technical Specifications (STS). This test would provide better trending data for the battery terminal voltages, individual cell voltages, and capacity.

Table 1 of Attachment J, "Review Aid," summarizes the upgrade to the 2002 Revision of IEEE 450.

In order to implement the improvements provided by TSTF-360, Rev. 1, the following identifies changes that are made to LCOs 3.8.4, 3.8.5, and 3.8.6 (n.b.: these improvements, (1) through (8), are cited below from TSTF-360, Rev. 1):

(1) Provide a specific Action & increased Completion Time for an inoperable battery charger (extended from 8 to 12 hours in LCO 3.8.4 Required Action A.2).
(2) Relocate preventative maintenance SRs to licensee controlled programs (i.e., new Licensee Controlled Specifications (LCSs) 3.8.104 and 3.8.106).
(3) Provide alternate testing criteria for battery charger testing.
(4) Replace battery specific gravity monitoring with float current monitoring (at SONGS, SR 3.8.6.1).
(5) Relocate (to a licensee controlled program (at SONGS, new LCS 3.8.106) based on IEEE 450 and/or the ISTS Bases) and create a program (Battery Monitoring and Maintenance Program, new section 5.5.2.16) to reference actions for cell voltage and electrolyte level:
    (a) Category A & B value limits for cell voltage and electrolyte level, along with the associated compensatory actions;
    (b) Category C specific value limit for electrolyte level;
    (c) The specific value limit for electrolyte temperature; and
    (d) Specific value for the minimum battery charging float voltage (at SONGS, new LCS 3.8.104);
    (e) Cell voltage, restoration, and testing of cells.
(6) Provide specific Actions and increased Completion Times for out-of-limits conditions for cell voltage, electrolyte level, and electrolyte temperature (implemented in LCO 3.8.6).
(7) Enhanced Bases are provided for each above change.
(8) Eliminate the "once per 60 month" restriction on replacing the battery service test with the battery modified performance discharge test (implemented in SR 3.8.6.6).

The following is the rationale provided with TSTF-360, Rev. 1, as applicable to SONGS 2 and 3 to justify the improvements specified in that document. These changes are indexed to conform to implementation to TSTF-360, Rev. 1 (from the “Description” section of TSTF-360, Rev. 1, cited above):

(1) Current NUREG STS (reference: NUREG-1432, Rev. 3, published June 2004) limit restoration time for an inoperable battery charger to the same time as for an inoperable battery or a completely deenergized DC distribution subsystem. The primary role of the battery charger is in support of maintaining 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 10-15 seconds - the time required for the Emergency Diesel Generator (EDG) to tie on). In analyzed post-accident scenarios, there is no safety related criteria for recharging a fully discharged battery in any specific time period.

The current 2-hour restoration time is based on Regulatory Guide 1.93, and has been applied equally to a minimal reduction in battery charger design capacity (which even may still support any and all post-accident assumed functions) as well as to a complete disconnected/deenergized DC subsystem. This change is attempting to apply a more reasonable restoration time, while: a) focusing efforts on retaining battery capabilities; b) continuing to require full charger OPERABILITY that is based on the margin afforded in the design capacity of the battery charger -- consistent with the current basis for charger OPERABILITY; and c) the 2-hour restoration time for a deenergized DC distribution subsystem (found in NUREG 1432, STS for Combustion Engineering Plants, LCO 3.8.9).

Refer also to the proposed Bases for LCO 3.8.4 Action A for additional discussion. The proposed Action A for LCO 3.8.4 (and similarly for LCO 3.8.5) provides a 2-hour Completion Time followed by a 12-hour repetitive verification of battery capability. These times are contingent on a focused and tiered approach assuring adequate battery capability is maintained. This first priority for the operator is to minimize the battery discharge, which is required to be terminated within 2 hours (Required Action A.1). Presuming that the battery discharge (if occurring) can be terminated and that the DC bus remains energized (as required by a separate LCO), there is a reasonable basis for extending the restoration time for an inoperable charger beyond the 2-hour limit. The second tiered action proposes 12-hours to establish that the battery has sufficient capacity to perform its assumed duty cycle as measured by float current $\leq$ 2 amps (which may involve some recharging of lost capacity that occurred during the initial 2 hours). Given the choice of a plant shutdown in this condition (as currently required) versus a 12-hour determination (at the end of which it is reasonable to assume the battery can be shown to have its assumed capacity), this appears to be an acceptable relaxation.

Since the focus of this allowance is that battery capacity be preserved and assured, the means of accomplishing this is left to plant capabilities. In many cases there would be spare battery chargers that could be employed within the initial 2-hours; in other cases it may be the degraded, normally in-service charger that can continue to float the battery.

(2) Per 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 SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 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 type activity. For example, the Bases for SR 3.8.4.4 identify removal of visible corrosion and tightening of terminal connections as a preventive maintenance SR (both of which are generally quicker than verifying

battery connection resistance). SR 3.8.4.3 (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. 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 bracketed values of resistance specified in the NUREG are manufacturer recommended values; that is, 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 has a direct impact on operability; however, it is adequately determined as acceptable through completion of the battery service and discharge tests. As such, these activities are also inappropriate for Operability SRs and are generally better controlled under the maintenance programs for batteries.

Accordingly, these surveillances will be relocated to the Licensee Controlled Specifications (LCS). This will enable these activities, although recommended by IEEE 450 but not strictly required to specify Operability, to be maintained.

(3) The NUREG STS (reference: NUREG-1432, Rev. 3, published June 2004) SR 3.8.4.2 requires specific parameters for battery charger performance testing. This test is intended to confirm the charger design capacity.

(4) This change proposes to replace battery specific gravity monitoring with float current monitoring (SR 3.8.6.1).

(5) (a) NUREG STS (reference: NUREG-1432, Rev. 3, published June 2004) LCO 3.8.6 on battery cell voltage and electrolyte level parameters contains various levels (Categories) of limitations. 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 levels for long term battery quality and extended battery life. As such, they 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." It is proposed that these values, and the actions associated with restoration, be relocated to licensee-controlled programs that are under the control of 10 CFR 50.59. These programs are to be based on the recommendations of IEEE-450, 1995. The parameter values will continue to be controlled at their current level, and actions will be implemented in accordance with the plant corrective action program. Furthermore, the battery and its preventive maintenance and monitoring are under the regulatory requirements of the Maintenance Rule. This relocation will continue to assure the battery is maintained at current levels of performance, and allows the Technical Specifications (and the licensed operators) to focus on parameter value degradations that approach (but continue to provide some margin to) levels that may impact battery operability.

(b)(c) The specific limiting values for the battery electrolyte temperature and level are also relocated to licensee controlled programs that are under the control of 10 CFR 50.59. The TSs will require the electrolyte temperature and level to be greater than or equal to the "minimum established design limits." Depending on the available excess capacity of the associated battery, the minimum temperature necessary to support operability of the battery can vary. Relocation to licensee-controlled programs can allow flexibility to monitor and control this limit at values directly related to the battery ability to perform its assumed function.

(d) The specific limiting value for the minimum operating battery charging float voltage is relocated to the LCS, which are under the change control of 10 CFR 50.59. The TSs will require the battery charger to supply battery terminal voltage "greater than or equal to the minimum established float voltage." The battery manufacturer establishes this voltage to provide the optimum charge on the battery. This voltage will maintain the battery plates in a condition that supports maintaining grid life.

As such, the "minimum established float voltage" can be adequately controlled outside of the Technical Specifications.

(e) The Actions related to: (1) cell voltage < 2.13 V, (2) restoration, and (3) testing of cells that had electrolyte level below the top of the plates are specified by a new Section 5.0 Program.

(6) The remaining parameter limits are proposed to have more specific actions associated with each parameter that recognizes its unique impact on the battery and its continued operability. The proposed change provides specific Actions and increased Completion Times for out-of-limits

conditions for cell voltage, electrolyte level, and electrolyte temperature. These allowed times recognize the margins available, the minimal impact on the battery capacity and capability to perform its intended function, and the likelihood of effecting restoration in a timely fashion and avoiding an unnecessary plant shutdown. The Bases for each Required Action provides specific justification for each proposed action.

(7) Currently, the existing TS allowed outage time for DC System related inoperabilities is 2 hours for a battery and one hour for a single charger of one train. Proposed above are relaxations in allowed restoration times for inoperable battery chargers, as well as for specific limited off normal conditions for selected battery parameters. The proposed change to Specification 3.8.4 continues to retain the previous 2-hour Completion Time for the inoperability of a battery (even assuming the charger is operable), however, the format is presented such that a separate Action is applicable for the inoperability of the battery alone. The Bases for Action B of 3.8.4 acknowledges a potential for an individual utility to approach the Staff with specific justification to extend the battery restoration time beyond this 2-hour limit. As such the format is provided to accommodate this potential. In the event the allowed restoration time for an inoperable battery is retained at 2 hours, Condition B and C could be combined into a single Condition.

The potential for extending the battery allowed restoration time might be based on several factors. The Bases acknowledges that during the time the battery is inoperable additional single failures are not required to be assumed. Therefore, even in the event of a loss of offsite power (alone or in conjunction with a Design Basis Accident (DBA)), the associated battery charger will be expected to restore power to the DC subsystem after the associated diesel generator is connected. As such, an extension to the 2-hour period could be found acceptable on a plant specific basis.

(8) The "once per 60 month" restriction on replacing the battery service test with the battery modified performance discharge test is eliminated. Since the modified performance discharge test completely encompasses the load profile of the battery service test, it adequately confirms the intent of the service test to verify the battery capacity to supply the design basis load profile.

The following provides a justification of the proposed changes for evaluation:

LCO 3.8.1 The change to this LCO is regarded as acceptable since it is a clarification permitted following equipment upgrade.

1. SR 3.8.1.1 The words in the NOTES “Buses 3A04 and 3D1” and “Buses 3A06 and 3D2” are simplified to “Bus 3A04” and “Bus 3A06,” respectively

(example for the Unit 2 TS). This is a San Onofre specific clarification of which buses are required. Specification of the preferred DC subsystem is not required.

LCO 3.8.4 The changes to this LCO are regarded as acceptable since they include changes per TSTF-360, Rev. 1, IEEE 450, are permitted following equipment upgrade, or are editorial improvements.

1. The LCO statement is revised from the "Train A, Train B, Train C, and Train D" electrical power subsystems to "Train A and Train B." The SONGS-specific design terminology is more accurately reflected by presenting Train A and B, each with two subsystems, rather than as Train A, B, C, and D.

2. A new Condition A (comparable to existing Condition C, which is deleted) is added:

> "One or two required battery charger(s) on one train inoperable."

This makes the Condition more concordant with the STS and revises actions to be taken when the battery charger is not OPERABLE. The revised condition deletes "or associated control equipment or cabling" as these are included in the definition of OPERABILITY. The Required Actions and Completion Times are modified consistent with TSTF-360, Rev. 1 to validate battery OPERABILITY while in this Condition. Required Action A.2 is to "Verify battery float current ≤ 2 amps." The threshold of ≤ 2 amps has been verified with the manufacturer, EnerSys Inc., as an appropriate threshold for determining OPERABILITY. A digital multimeter of high accuracy in an average function mode will be used to measure the steady state float charging current. The multimeter is capable of measuring the low magnitude of DC current (less than 2 amps) and filtering the induced AC noise from the connected inverter. A millivolt shunt located close to the battery terminal provides the battery float charging current signal. It is expected that the float current at a given float voltage will increase with age as the plates open and have a greater effective surface area. Required Action A.3 is added as a 'backstop' to permit this Condition for not more than 7 days. Note: San Onofre 2 and 3 converted to Revision 0 of NUREG 1432, Standard Technical Specifications (STS), Combustion Engineering Plants, dated September 1992, which did not include Required Action A.3. This change is consistent with later STSs (e.g., Revision 3.0, Published June, 2004) which have this 7-day Required Action.

3. A new Condition B (comparable to existing Condition D, which is deleted) is inserted to declare the associated battery inoperable should the battery parameters being monitored in the Required Actions for Condition A not be satisfactory. This direction is given, comparable to the existing Condition D, although this requirement is not included in TSTF-360, Rev. 1.

4. Existing Condition A is modified, as new Condition C, to specifically cover conditions not included in new Condition A. With the DC electrical power subsystem inoperable (exclusive of the battery charger), a two hour Completion Time to restore the subsystem to OPERABLE status is still provided with a new optional Required Action to cross-connect to the subsystem in the same Train. Once the cross-connection is made, this Required Action is satisfied and new Condition D is entered.

New optional Required Action C.2 has a note that cross-connection:

> "Requires a battery with a rated capacity of greater than or equal to 1800 amp-hours."

This note is necessary since all eight 1800 AH rated batteries (four batteries on each unit) are not expected to be installed and tested prior to implementation of this amendment. Accordingly, this note would preclude use of this optional Required Action until the necessary battery subsystem upgrades and testing are complete.

The addition of Required Action C.2 ("Cross connect with same train DC subsystem") is part of the revised design included in this review; this is not included in TSTF-360, Rev. 1.

5. New Condition D is inserted to provide an upper limit for the duration of the time when DC subsystems are cross-connected. In routine operation there are two electrical Trains consisting of four batteries of the four DC subsystems powering the four independent instrumentation, controls, and power subsystems. For up to 30 days this design conservatism would be reduced to two electrical Trains consisting of three batteries of the four DC battery subsystems fully capable of powering the four instrumentation, control, and power subsystems. A Probabilistic Risk Assessment (PRA) analysis of this temporary configuration is provided in Attachment I. The 30-day Completion Time is analyzed to permit both preventive and corrective maintenance online as well as online change out of batteries (and required commissioning / OPERABILITY tests). Similar to item 4 above, Condition D is new to this design with the cross-tie capability; this Condition is not included in TSTF-360, Rev. 1.

New Condition D is modified by the same note included in new optional Required Action C.2 to ensure this feature is not used until the appropriately sized battery is in place:

> "Requires a battery with a rated capacity of greater than or equal to 1800 amp-hours."

6. Existing Condition B is relabeled Condition E and modified to include the failure to satisfy the new Conditions (added above) as entry conditions to mandate plant shutdown.

7. SR 3.8.4.1 is modified per TSTF-360, Rev. 1, to provide surveillance of "greater than or equal to the minimum established float voltage" from the current requirement of "≥129V on float charge." Also, the frequency is restored to the current interval of 7 days following engineering review and the recommendation of the battery manufacturer, EnerSys Inc. The draft LCS contains the minimum established float voltage.

8. Existing requirements of SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 are removed from the TS per the recommendations of TSTF-360, Rev. 1. These include measures regarded as routine preventive maintenance, such as inspecting for signs of corrosion, physical damage, and electrical resistance measuring. The draft LCS containing these relocated requirements is included in Attachment G.2. The 92-day frequency for existing SR 3.8.4.2 will be changed to 31 days, consistent with IEEE 450.

9. Existing SR 3.8.4.6 is renumbered to SR 3.8.4.2 and
   a. The NOTE, "Credit may be taken for unplanned events that satisfy this SR." is deleted as pragmatically unhelpful,
   b. In accordance with the recommendations of TSTF-360, Rev. 1 the required duration for this surveillance is reduced from 12 to 8 hours. This change is appropriate since the proposed SR requires SONGS to verify each battery charger supplies ≥ rated amps at ≥ the minimum established float voltage for 8 hours. The current TS SR (3.8.4.6) requires this surveillance performance test be conducted at the charger's rated output at the float voltage for 12 hours. When at rated output, steady state maximum temperature of all components within a charger will be reached much sooner than the 12-hour interval. Continuous operation for two hours after reaching the maximum steady state temperature will demonstrate a charger's rated capability. A conservative estimate is that a battery charger would reach a maximum steady state temperature under rated output at a float voltage near its rated voltage in 6 hours or less. Therefore, testing for 8 hours is sufficient for the charger temperature to stabilize and be maintained for approximately 2 hours.
   c. The operability limits are relocated to the LCS and the SR revised as follows:
      - The minimum specified current is changed from "300 amps" to "rated amps"
      - The minimum specified voltage is changed from "129 V" to "the minimum established float voltage"
   d. Also, specified in TSTF-360, Rev. 1 for this SR is "Verify each battery charger can recharge the battery to the fully charged state 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 is not adopted for SONGS as it is not required for anticipated SONGS testing.

10. Existing SR 3.8.4.7 is renumbered to SR 3.8.4.3, and
    a. NOTES 2 and 3 are removed:
        - NOTE 2, "This Surveillance shall not be performed in Mode 1,2,3, or 4." is a restriction that can be removed with the ability to cross-connect DC subsystems in a given Train. While cross-connected, one battery can provide electrical power for both subsystems while the other battery is tested online.
        - NOTE 3, "Credit may be taken for unplanned events that satisfy this SR." is deleted as noted previously (see #9) as unhelpful.

    b. The following change is made per the recommendations of IEEE 450:
        - NOTE 1 is changed to specify "The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3" (the reference SR numbers are changed consistent with this amendment request).
        - The proposed SR 3.8.4.3 30-month service test frequency is in accordance with IEEE 450, which requires a service test at the discretion of the user at periodic times between the 60-month performance tests.

The extension of the surveillance test interval is considered permissible for the following reasons:

i. With the incorporation of the Class 1E battery cross-tie capability, battery performance testing can be performed on-line.
ii. Historically, battery maintenance on nuclear power plants has been performed during refueling outages not to exceed 24-month intervals. SONGS experience has indicated that there have been no battery failures using the 24-month test frequency for battery service tests. Therefore, the service test interval, when extended to 30 months, is not expected to affect SONGS' capability to detect battery health and capacity.
iii. Battery life expectancy can be optimized by using a less frequent test such as a 30-month modified performance test (service and performance test combined). SONGS proposes not to use separate service and performance tests for the new 1800 AH batteries. In lieu of service and/or performance tests, SONGS intends to perform a "Modified Performance Discharge Test" at 30-month intervals to achieve the best trending results by using the same test method throughout the battery life.
iv. A routine test frequency of 30 months will better dove-tail with the scheduling of the more rigorous 60-month interval battery performance of modified performance discharge tests.

For these reasons, SCE regards the extension of the test interval as justified and desirable for long-term battery reliability.

- NOTE 2 contains the existing TS 3.8.4.7 Note 1 which states "The battery performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3 once per 48 months." This includes the revised reference SR numbers and a reasonable replacement frequency for using SR 3.8.6.6 without the modified performance discharge test option.

11. Existing SR 3.8.4.8 is relocated to be the new SR 3.8.6.6 as a more appropriate location (the changes to new SR 3.8.6.6 are discussed below).

LCO 3.8.5 The change to this LCO is regarded as acceptable since it incorporates the changes made to LCO 3.8.4 above.

1. The word "The" is added to the beginning of the LCO. This is an editorial change.

2. Conditions and Required Actions are modified consistent with the changes to LCO 3.8.4. The entry Condition for Required Action C is revised from "One..." to "One or more..." per TSTF-360, Rev. 1. Also, proposed Required Action C.2.3 is "Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration." This is consistent with the current licensing basis.

3. SR 3.8.5.1 is modified to reflect changes previously described in 3.8.4, DC Sources – Operating:
   a. The DC sources are OPERABLE when the following SRs are satisfied: 3.8.4.1, 3.8.4.2, and 3.8.4.3.
   b. This SR is modified by a NOTE that the following SRs are not required to be performed: 3.8.4.2 and 3.8.4.3.

LCO 3.8.6 The changes to this LCO are regarded as acceptable since they include changes per TSTF-360, Rev. 1 and IEEE 450, are permitted following equipment upgrade, or are editorial improvements.

1. General comment: LCO 3.8.6 undergoes significant editorial changes.

2. The LCO is relabeled from "Battery Cell Parameters" to "Battery Parameters." Similar to nomenclature change in LCO 3.8.4, the LCO 3.8.6 is changed from:

> "Battery cell parameters for the Train A, Train B, Train C, and Train D batteries shall be within the Category A and B limits of Table 3.8.6-1."
>
> To read:
>
> "Battery parameters for the Train A and Train B batteries shall be within limits."

This modification is more consistent with the STS and denotes that there are two electrical Trains, A and B. As noted elsewhere, subsystems A and C batteries support Train A, and subsystems B and D batteries support Train B.

Note that discussion referring to Table 3.8.6-1 is removed. This table, in subsequent discussion, is deleted in its entirety (while its requirements are included in new SRs in the TSs and LCSs and deficiencies in satisfying these SRs are accommodated in the Conditions).

3. Existing Condition A is deleted. This Condition was entered upon failing to meet the Category A and B values of existing Table 3.8.6-1. In accordance with the recommendations of TSTF-360, Rev. 1, this table and specific action levels are superseded by new Conditions.

4. New Condition A is inserted. In this Condition, cell float voltage of 2.07 VDC has not been met (this is the equivalent of the Category C limit in Table 3.8.6-1). This requires performance of SR 3.8.4.1 (battery terminal voltage) and SR 3.8.6.1 (float current verification) within 2 hours in addition to restoration of the affected cell float voltage within 24 hours. Required Action A.3 is to "Restore affected cell voltage ≥ 2.07 V." The threshold of ≥ 2.07 V has been verified with the manufacturer, EnerSys Inc., as an appropriate threshold for determining OPERABILITY.

5. New Condition B is inserted. In this Condition, float current exceeds 2 amps. The Required Actions specify performance of SR 3.8.4.1 (battery terminal voltage) within 2 hours and restoration of float current to ≤2 amps within 12 hours.

6. New Condition C is added if battery electrolyte level is not maintained (this is the equivalent to Category A, B, and C for electrolyte level in Table 3.8.6-1). The overall recovery of electrolyte level within 31 days is consistent with the Completion Time for existing Condition A. However, NOTES are added to the Required Actions to denote remedial measures should the electrolyte level fall below the top of the battery plates:

> "1. Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates."
>
> "2. Required Action C.2 shall be completed if electrolyte level was below the top of the plates."

These NOTES are consistent with TSTF-360, Rev. 1 and are in addition to current TS practices.

New Required Action C.1 directs restoration of the electrolyte level to above the top of the plates within 8 hours. New Required Action C.2 directs completing an investigation of potential battery cell jar leakage and verifying no evidence of leakage within 12 hours. New Required Action C.3, as noted above, is comparable to existing Action A.3, in that it restores electrolyte level to limits within 31 days. Also, new LCS 3.8.106 will verify electrolyte level is above the top of the plates in accordance with Administrative Controls section 5.5.2.16.b which is modified from the TSTF-360, Rev. 1 to clarify that action is needed when the electrolyte level is below the top of the plates.

The manufacturer, EnerSys Inc., has concurred with the electrolyte level limits specified in these Required Actions ("above the top of the plates" in 8 hours and "greater than or equal to minimum established design limits" in 31 days) as appropriate measures to minimize possible damage and restore OPERABILITY for the affected battery.

7. New Condition D provides a Required Action and Completion Time should the battery pilot cell temperatures be found low. This surveillance is currently in existing Condition B (for the remaining parameters in Condition B, see item 9 below). SONGS operating experience has demonstrated a negligible difference in operating temperature (i.e., well within the 5-degree F bounds guidelines for temperature stability per IEEE 450-1980) between the different battery cells. Therefore, the use of a pilot cell is considered appropriate for demonstrating the temperature of the entire battery.

8. New Condition E provides a Required Action and Completion Time should redundant Trains of batteries not be within limits. This is consistent with TSTF-360, Rev. 1: "Restore battery parameters for batteries in one train to within limits" with a Completion Time of 2 hours.

9. Existing Condition B is relabeled as Condition F, and
   a. Required Actions and associated Completion Times A through E not met are added as a reason for entering this Condition, and
   b. Technical parameter limits in the Condition are re-specified per the recommendations of TSTF-360, Rev. 1:
      - "One or more batteries" is reworded as "One or two batteries on one train" for clarity since there are two required batteries on a given train, and
      - "with average electrolyte temperature of the representative cells <60°F" is replaced with "with one or more battery cells with float voltage <2.07 V and float current >2 amps." The temperature Condition is relocated to the proposed LCS.
      - "<u>OR</u> One or more batteries with one or more battery cell parameters not within Category C values." is deleted consistent with deleting Table 3.8.6-1 as discussed in item 17 below.

10. SR 3.8.6.1
    a. Consistent with the recommendations of IEEE 450, this surveillance:
        - rather than meet Table 3.8.6-1 category A limits, is re-specified to verify ≤2 amps float current.
        - for clarity, "each" is added to the Surveillance (as revised, this now reads "Verify each battery float current...").
        - the specified frequency for this surveillance is maintained at 7 days.
    b. This surveillance is modified by a NOTE that this does not need to be met if the float voltage of SR 3.8.4.1 is not being met. That is, one is already in a Condition in LCO 3.8.4, so further performance of this SR is not required.

11. Existing SR 3.8.6.2 is deleted. It is replaced with SRs 3.8.6.2 and 3.8.6.3. These are discussed in items 12 and 13 below.

12. New SR 3.8.6.2 verifies pilot cell voltage ≥2.07 V every 31 days. This is in accordance with TSTF-360, Rev. 1.

13. New SR 3.8.6.3 verifies each connected cell electrolyte level every 31 days. This is the equivalent of the current Category B limit of Table 3.8.6-1, which is surveilled every 92 days. This surveillance frequency is per TSTF-360, Rev.1.

14. Existing SR 3.8.6.3 is modified and renumbered to SR 3.8.6.4. This SR replaces verification of electrolyte temperature of representative cells to >60°F with verification of each pilot cell temperature to "greater than or equal to minimum established design limits." Also, the specified frequency for this surveillance is increased from once per 92 days to once per 31 days. These changes are made per the recommendations of TSTF-360, Rev. 1. The draft LCS contains the minimum design limits.

15. New SR 3.8.6.5 verifies each connected cell voltage every 92 days. This is consistent with TSTF-360, Rev. 1 and IEEE 450.

16. New SR 3.8.6.6 is the relocated existing SR 3.8.4.8. This surveillance is modified to allow a modified performance discharge test per TSTF-360, Rev. 1.

17. Table 3.8.6-1 is deleted in its entirety. The limits are incorporated in other SRs in the TSs and LCSs consistent with TSTF-360, Rev. 1.

LCO 3.8.7 The change to this LCO is regarded as acceptable since it consists of editorial improvements only.

1. For clarity, the LCO is restated from: "The required Train A, Train B, Train C, and Train D inverters shall be OPERABLE." to read: "The required Channel A, B, C, and D, AC inverters shall be OPERABLE." This is an editorial change.

LCO 3.8.9 The change to this LCO is regarded as acceptable since it consists of editorial improvements only.

1. Similar to editorial changes clarifying the two electrical Trains configuration, the LCO is restated from:

> "Train A and Train B AC; Trains A, B, C, and D DC; and Trains A, B, C, and D AC vital bus electrical power distribution subsystems shall be OPERABLE."
>
> to read:
>
> "Train A and Train B AC, Subsystems A, B, C, and D DC, and Channels A, B, C, and D AC vital bus electrical power distribution systems shall be OPERABLE."

This is an editorial change.

§ 5.5.2.16 The change to this Administrative Controls section is regarded as acceptable since it consists of incorporation of the TSTF-360 / NUREG-1432 commitment for a Battery Monitoring and Maintenance Program.

1. A new Program is added: "Battery Monitoring and Maintenance Program" as new section 5.5.2.16 to the Procedures, Programs, and Manuals Section of the Technical Specifications. The Program description meets the intent of TSTF-360, Rev. 1. The battery manufacturer, EnerSys Inc., has concurred with the specified minimum electrolyte level and float voltage as the appropriate thresholds to ensure battery OPERABILITY.

ELECTRICAL DESIGN CHANGES

To be able to fully utilize the flexibility provided by the proposed TS, design changes are currently being made to the electrical system to provide the ability to manually cross-connect DC subsystems during operating Modes 1-4 and continue to meet General Design Criteria (GDC) 17, GDC 18, Regulatory Guide (RG) 1.6, and IEEE 308. These design changes include one new swing battery charger to be shared by subsystems A and C and another by subsystems B, D, or non-1E bus D5. Electrical isolation and independence between subsystems required by RG 1.75 is maintained by the isolation capability of the battery charger itself and the kirk key interlocked output circuit breakers. The existing batteries for each train are being replaced with batteries with 1800 amp-hour ratings. (Refer to Sketches 1 and 2 of the post-modification system in Attachment J, Review Aid). Currently, the subsystems A and B batteries are rated 1260 amp-hours nominal 8-hour, and the subsystems C and D batteries are rated 1800 (previously 1500) amp-hours nominal 8-hour.

Each additional swing charger will be powered from the train aligned common Emergency Safety Feature (ESF) Motor Control Center that can be powered from either Unit 2 or Unit 3 ESF buses (refer to Sketches 1 and 2 in Attachment J of Train A and Train B systems). The output of one swing charger will have provisions, via separate output breakers, for alignment to either subsystem A or C. The output of the other swing battery charger could be aligned to the subsystem B, D, or non-1E bus D5 battery DC system via the supply breakers for each bus. There will be mechanical interlocks to prevent closure of multiple output breakers to ensure that a swing charger will be connected to one DC bus at a time. This ensures that subsystems are not cross connected through a swing charger. Additional isolation circuit breakers are provided in each feed from the swing battery charger to the associated batteries. During cross-connected configuration battery chargers may be paralleled to share the load. Each charger has a current limit feature and consequently will not challenge interrupting duties of the protective devices during parallel operations.

Permanent cables will be upgraded between the molded case isolation switches used for the cross-connect configuration. Distribution system panels and breakers will be increased in size and capacity as necessary to handle the increased load requirements and short circuit current.

During Mode 1-4 cross-connect configurations, as needed by maintenance activities or for corrective activities, administrative controls will be in place to ensure that the required battery chargers are operable. The new swing charger will provide added flexibility to either supply a discharged battery or to supply the cross-connected distribution systems or to replace a normal battery charger should the normal battery charger become unavailable. The two batteries will not continuously operate in parallel supplying the cross-connected distribution system.

Each of the subsystems A, B, C, and D distribution buses are located in separate rooms to meet Appendix R and RG 1.75 requirements for system separation and redundancy. Each distribution room contains the associated distribution switchboard, associated battery charger, inverter, distribution panel, and molded case isolation switches and circuit breakers for the cross-connect configuration. The new swing charger for each Train will be located in the subsystem A distribution room and subsystem B distribution room, respectively.

PROBABILISTIC RISK ASSESSMENT (PRA) ASSESSMENT

The SONGS 2/3 Living PRA was used to assess the risk impact of entering TS 3.8.4 for an extended period of 30 days for the configuration where two same train DC subsystems are cross-connected with one battery supporting both buses. The analysis was performed consistent with the guidelines of Regulatory Guides 1.174, "An Approach For Using Probabilistic Risk Assessment In Risk-Informed Decisions On Plant-Specific Changes To The Licensing Basis," [Ref. 7.9] and 1.177, "An

Approach For Plant-Specific, Risk-Informed Decision making: Technical Specifications" [Ref. 7.10].

Methodology:

The SONGS 2/3 Living PRA Models and the Safety Monitor were used to assess the core damage and large early release frequencies (CDF and LERF) for two cases: 1) base case – nominal maintenance for all components, and 2) a battery removed from service with the associated bus cross-connected to another bus from the same train. The results from these calculations are combined with additional data to yield results that are measured against PRA acceptance guidelines from Regulatory Guides 1.174 and 1.177. A full PRA discussion is provided in Attachment I.

PRA Quality:

The SONGS PRA has been subjected to extensive peer and regulatory review. The PRA Model, assumptions, database changes, improvements, and computer code are controlled and documented by administrative procedure. The Model and database reflect the as-built design with enhancements that reflect design changes to the 1E DC system and the most recent historical data. Therefore, the SONGS 2/3 Living PRA is of a quality consistent with that required to perform accurate, thorough, and comprehensive evaluations for this application.

Conclusions:

The increases in core damage and large early release frequencies with two same train DC buses cross connected for 30 days are less than 1E-7/year and 1E-8/year, respectively. The changes in risk are small because a fully qualified alternate power source is aligned when a battery is removed for maintenance. The calculated incremental conditional core damage probability (ICCDP) and incremental conditional large early release probability (ICLERP) are less than the acceptance guidelines from NRC Regulatory Guide 1.177 of 5E-7 and 5E-8, respectively.

The expected frequency of TS 3.8.4 usage and duration are combined with the core damage frequency while in the TS to assess the expected annual risk impact of the TS change. The expected annual risk impact is measured against NRC Regulatory Guide 1.174. The expected annual increase in risk is << 1E-7/year for CDF and <<1E-8/year for LERF, which are less than the RG 1.174 acceptance guidelines.

Therefore, the flexibility of the enhanced DC system to allow cross-connection to the other subsystem on the same train supports a TS 3.8.4 allowed outage time extension to 30 days as measured against the risk acceptance guidelines of References 7.9 and 7.10.

PRA Summary:

The PRA results compare favorably against Regulatory Guides 1.174 and 1.177 in large part because a qualified alternate source of power is aligned prior to removing a battery. When aligned to the alternate power source, each DC bus remains energized with a highly reliable source. If a battery is removed from service without the alternate power source aligned, the associated sub-channel reliability is reduced. This is outside the scope of the PRA for this PCN since shutdown is required if the alternate power source is not aligned in 2 hours. The action to initiate shutdown in 2 hours is the same as the current TS where the allowed outage time is 2 hours when a battery is removed from service.

5.0 REGULATORY SAFETY ANALYSIS

The proposed change to Technical Specification (TS) 3.8.4, "DC Sources – Operating," would extend the Completion Time (CT) for an inoperable Direct Current (DC) subsystem, exclusive of the battery charger which has its own Limiting Condition for Operation (LCO), by adding required actions to allow manual cross-connect of distribution subsystems A and C or B and D for a period of 30 days during Modes 1-4. These changes will be allowed provided the following conditions are met:

1. The inoperable subsystem can be cross-connected within 2 hours.
2. Required battery chargers are operable.
3. Batteries are sized and tested to accommodate the combined connected loads.

The regulatory basis for TS 3.8.4 is to assure, as required by 10CFR50, Appendix A, General Design Criterion (GDC) 17, the DC electrical power system will provide sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. This ensures the DC system is capable of supporting systems critical to precluding or mitigating the release of fission product radioactivity.

The purpose of the LCO is to minimize the impact of loss of a DC safety train on the required Engineered Safety Feature (ESF) equipment needed to ensure that:

1. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of Anticipated Operational Occurrences (AOOs) or abnormal transients; and

2. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated Design Basis Accident (DBA).

Complying with the LCO assures that the assumptions reflected in the analysis for DBAs as documented in San Onofre Nuclear Generating Station (SONGS) 2 and 3 Updated Final Safety Analysis Report (UFSAR) Chapter 15, Accident Analysis are met.

The proposed change will extend the CT for inoperable DC subsystems to allow for effective assessment of corrective actions during Modes 1-4 by cross-connecting DC subsystems A and C or subsystems B and D. Use of the cross-connect option of the DC subsystems will be allowed provided all required battery chargers are operable and required batteries have met the service, performance, or modified performance test profiles.

The capability of the DC subsystems to be effectively cross-connected in a safe and timely manner is contingent upon the completion of the design changes discussed above. Effective switching with the appropriate administrative and mechanical restrictions/interlocks designed into the existing system configurations will assure system perturbations are held to a minimum.

The proposed changes to existing Surveillance Requirements (SRs) 3.8.4.7 and 3.8.4.8 are to eliminate the service profile test and performance tests in their entirety after new batteries are installed. The modified performance discharge test would combine aspects of the service test and performance test into one test profile. The modified performance discharge test would assure the batteries would be capable of meeting the design bases duty cycles.

The revised calculations, Probabilistic Risk Assessment (PRA), proposed surveillance testing, and safety analysis indicate the basis for the Technical Specification requirements will be met during the extended period in which a DC subsystem is found inoperable and during the period DC distribution buses subsystems A and C or B and D are cross-connected.

EVALUATION

Battery and Charger Sizing

The results of the sizing calculation to support this amendment request indicate the larger capacity 1800 amp-hour rated battery will meet the design bases load requirements when supplying cross-connected DC subsystems.

The new 400A swing chargers and existing 300A chargers are adequate to support the design bases load requirements for various operating scenarios. In all cross-connect scenarios the required charger(s) can supply the buses' steady state loads and recharge the battery from a design minimum state within 24 hours.

Protection (Breakers, Fuses, Switches)

The results of circuit protection and coordination analysis to support the design change indicate that the larger capacity battery will require improvements/upgrades in the protective devices and distribution panels provided in the DC subsystems. Upgrades in breakers to accommodate increased short circuit currents and setpoint changes for improved coordination will be implemented prior to installation of larger capacity batteries and prior to implementation of the DC distribution system cross-connect capability. With the upgrade implemented, DC cables and distribution equipment will provide adequate protection to support the proposed changes.

During cross connecting of subsystem buses A and C or B and D, two batteries will be paralleled for a short duration. An electrical fault during that duration could exceed the interrupting duties of the protective devices. This is an accepted practice during transfer of power sources and is considered to be an acceptable minimal risk. Failure of the cross-tied DC buses and/or associated battery(ies) is bounded by the failure of a 4kV bus (an entire train) which is evaluated in UFSAR Table 8.3-8, "FMEA U2 Class 1E AC and DC power systems."

Separation requirements (Regulatory Guide (RG) 1.75, "Physical Independence of Electric Systems")

The new design complies with the separation requirements of IEEE 384 and RG 1.75 as follows:

1. The replacement batteries will be installed at the same location as the existing batteries located in dedicated battery rooms, thus maintaining the original separation and isolation requirements.
2. Swing battery chargers will be installed in separate distribution rooms. Swing battery chargers have dedicated output circuit breakers located in separate compartments. The output circuit breakers are mechanically interlocked to restrict swing battery charger alignment to only one subsystem at a time. A redundant circuit breaker, external to the swing battery charger, is installed for isolation of each battery from the swing battery charger.
3. The swing charger itself is a qualified isolation device.

5.1 No Significant Hazards Consideration

The Commission has provided standards for determining whether a significant hazards consideration exists as stated in 10CFR50.92(c). A proposed amendment to an operating license for a facility involves no significant hazards consideration if operation of the facility in accordance with a proposed amendment would not: (1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) Involve a significant reduction in a margin of safety. A discussion of these standards as they relate to this amendment request follows:

i. Will operation of the facility in accordance with this proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The proposed changes to Technical Specifications (TS) 3.8.4 and 3.8.6 would allow extension of the Completion Time (CT) for inoperable Direct Current (DC) distribution subsystems to manually cross-connect DC distribution buses of the same safety train of the operating unit for a period of 30 days. Currently the CT only allows for 2 hours to ascertain the source of the problem before a controlled shutdown is initiated. Loss of a DC subsystem is not an initiator of an event. However, complete loss of a Train A (subsystems A and C) or Train B (subsystems B and D) DC system would initiate a plant transient/plant trip.

   Operation of a DC Train in cross-connected configuration does not affect the quality of DC control and motive power to any system. Therefore, allowing the cross-connect of DC distribution systems does not significantly increase the probability of an accident previously evaluated in Chapter 15 of the Updated Final Safety Analysis Report (UFSAR).

   The above conclusion is supported by Probabilistic Risk Assessment (PRA) evaluation which encompasses all accidents, including UFSAR Chapter 15.

   The Frequency for Surveillance Requirements in TS 3.8.4.3 is changed from 24 months to 30 months. San Onofre Nuclear Generating Station (SONGS) experience has indicated that there have been no battery failures using the 24-month test frequency for battery service tests, and extending the interval to 30 months is not expected to affect SONGS' capability to detect battery health and capacity. Also, the routine test frequency of 30 months will better dove-tail with the scheduling of the more rigorous 60-month interval battery performance of modified performance discharge tests.

   Enhancements from TSTF-360, Rev. 1 and IEEE 450 have been incorporated into Limiting Conditions for Operation (LCOs) 3.8.4, 3.8.5, and 3.8.6. These changes do not impact the probability or consequences of an accident previously evaluated.

   Further changes are made of an editorial nature or provide clarification only. For example, discussions regarding electrical 'Trains' and 'Subsystems' will be in more conventional terminology. LCOs affected by editorial changes include 3.8.1, 3.8.4, 3.8.5, 3.8.6, 3.8.7, and 3.8.9.

The changes being proposed in the TS do not affect assumptions contained in other safety analyses or the physical design of the plant, nor do they affect other Technical Specifications that preserve safety analysis assumptions.

Therefore, operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously analyzed.

ii. Will operation of the facility in accordance with this proposed change create the possibility of new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed change modifies surveillances and LCOs for batteries and chargers to meet the requirements of IEEE 450-2002 whose intent is to maintain the same equipment capability as previously assumed in our commitment to IEEE 450-1980.

The proposed change will allow the cross-tie of DC subsystems and allow extension of the CT for an inoperable subsystem to 30 days. Failure of the cross-tied DC buses and/or associated battery(ies) is bounded by existing evaluations for the failure of an entire electrical train.

Swing battery chargers are added to increase the overall DC system reliability. Administrative and mechanical controls will be in place to ensure the design and operation of the DC systems continue to meet the UFSAR design basis.

LCOs 3.8.1, 3.8.4, 3.8.5, 3.8.6, 3.8.7, and 3.8.9 revisions are editorial clarifications and do not affect plant design.

Therefore, operation of the facility in accordance with this proposed change will not create the possibility of new or different kind of accident from any accident previously evaluated.

iii. Will operation of the facility in accordance with this proposed change involve a significant reduction in a margin of safety?

Response: No.

Changes in accordance with IEEE 450 and TSTF-360, Rev. 1 maintain the same level of equipment performance stated in the UFSAR and the current Technical Specifications.

Swing battery chargers are added to increase the overall DC system reliability. Administrative and mechanical controls will be in place to ensure the design and operation of the DC systems continue to meet the UFSAR design basis.

The addition of the DC cross-tie capability proposed for LCO 3.8.4 has been evaluated, as described previously, using PRA and determined to be of acceptable risk as long as the duration while cross-tied is limited to 30 days. An LCO has been included as part of this proposed change to ensure that plant operation, with DC buses cross-tied, will not exceed 30 days.

All remaining changes are editorial.

Therefore, operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety.

Summary

Based on the above discussion, Southern California Edison (SCE) has concluded that: (1) that the proposed amendment request does not constitute a significant hazards consideration as defined by 10 CFR 50.92 and (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed change.

5.2 Applicable Regulatory Requirements/Criteria

NUREG-0800, "Standard Review Plan," Section 8.3.2, "DC Power Systems (Onsite)," describes the acceptance criteria and determines if the DC onsite power system satisfies the requirements of General Design Criteria (GDC) 2, 4, 5, 17, 18, and 50 and will perform its intended functions during all plant operating, accident, and station blackout conditions. A discussion of continued compliance with the requirements is discussed in the following paragraphs.

U.S. NRC Regulatory Guide 1.75, "Physical Independence of Electric Systems," describes a method acceptable to the NRC staff of complying with IEEE 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," and Criteria 3, 17, and 21 of Appendix A to 10 CFR 50, with respect to the physical independence of the circuits and electric equipment comprising or associated with the Class 1E power system, the protection system, systems actuated or controlled by the protection system, and auxiliary or supporting systems that must be operable for the protection system. The new system configurations allowed by the proposed TS changes will continue to meet the physical independence requirements of these systems.

U.S. NRC Regulatory Guide 1.93 "Availability of Electric Power Sources" describes operating procedures and restrictions acceptable to the Regulatory staff which should be implemented if the available electric power sources are less than the LCO. The new system configurations allowed by the proposed changes will continue to meet the availability requirements of the system.

10 CFR 50, Appendix A, General Design Criteria:

Compliance with GDC 2 requires that nuclear power plant structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as earthquake, tornado, hurricane, flood, tsunami, or seiche without loss of capability to perform their intended safety functions. Therefore, the DC power system and its components must normally be located in Seismic Category I structures
that provide protection from the effects of tornadoes, tornado missiles, and floods. The new system configurations allowed by the proposed TS changes will continue to meet the requirements of GDC 2.

Compliance with GDC 4 requires that structures, systems, and components important to safety (a) be designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operations, maintenance, testing, and postulated accidents and (b) be appropriately protected against dynamic effects that result from equipment failures, including missiles. The new system configurations allowed by the proposed TS changes will continue to meet the requirements of GDC 4.

Compliance with GDC 5 requires that structures, systems, and components important to safety shall not be shared among nuclear power units, unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units. The new system configuration allowed by the proposed TS changes will continue to meet the requirements of GDC 5. The new swing chargers will have the capability of being powered from either of the two operating SONGS units through train separated motor control centers (MCCs) common to both units. These MCCs can receive power from the associated safety trains of both units. Use of the above options to power common MCCs will continue to adhere to existing procedures with appropriate updates to ensure reliability of the DC systems.

Compliance with GDC 17 requires that onsite and offsite electrical power be provided to facilitate the functioning of structures, systems, and components important to safety. Each electric power system, assuming the other system is not functioning, must provide sufficient capacity and capability to ensure that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and that the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents. In addition, these onsite power supplies and onsite electrical distribution systems have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. The proposed changes to the TS do not alter the basic alignment and operation of the existing Class 1E 4kV, 480V, and 120VAC systems nor the 125VDC systems.

Compliance with GDC 18 requires that electric power systems important to safety be designed to permit appropriate periodic inspection and testing of key areas and features to assess their continuity and the condition of their components. The proposed changes to the TS continue to allow the flexibility and testability of the systems both during power and shutdown operations in order to meet the requirements of GDC 18.

Compliance with GDC 50 requires that the reactor containment structure, including access openings, penetrations, and containment heat removal systems, be designed so that the containment structure and its internal compartments can accommodate, without
exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any Loss of Coolant Accident (LOCA). The proposed changes to the TS continue to ensure systems and components required to support safety systems during a LOCA will be available.

Compliance with 10 CFR 50.63 requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout of specified duration. As required by 10 CFR 50.63, electrical systems must be of sufficient capacity and capability to ensure that the core is cooled and that appropriate containment integrity is maintained in the event of a station blackout. The capacity of the DC sources required for station blackout must therefore be verified to be adequate with respect to the worst-case station blackout load profile and specified duration. DC system and battery sizing analysis to support the proposed TS changes ensure the batteries are designed and tested to meet station blackout load profile requirements under all postulated operating conditions.

EVALUATION CONCLUSIONS

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

Southern California Edison (SCE) has determined that the proposed amendment involves no changes in the amount or type of effluent that may be released offsite, and results in no increase in individual or cumulative occupational radiation exposure. As described above, the proposed TS amendment involves no significant hazards consideration and, as such, meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9).

7.0 REFERENCES

7.1 Industry / TSTF Standard Technical Specification Change Traveler TSTF-360, Rev. 1, "DC Electrical Rewrite"
7.2 SONGS 2 and 3, Updated Final Safety Analysis Report
7.3 SONGS 2 and 3, Technical Specifications
7.4 NUREG-0800, U.S. NRC Standard Review Plan Section 8.3.2
7.5 Regulatory Guide 1.93, Availability of Electric Power Sources
7.6 IEEE 308, Standard Criteria for Class 1E Power Systems For Nuclear Power Generating Stations
7.7 IEEE 450, Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications
7.8 Standard Technical Specifications, Combustion Engineering Plants, Rev. 0 (NUREG 1432)
7.9 Regulatory Guide 1.174, An Approach for using Probabilistic Risk Assessment in Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis
7.10 Regulatory Guide 1.177, An Approach for Plant-Specific, Risk-Informed Decision making: Technical Specifications
7.11 Pilot Application of ASME PRA Standard Peer Review Process for the San Onofre Nuclear Generating Station Units 2 and 3 PRA, WCAP-16165 Rev. 0, CEOG Task 1037, November 2003
7.12 Regulatory Guide 1.75, Physical Independence of Electric Systems

ATTACHMENT A

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Existing Technical Specifications pages, Unit 2

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
F. Required Action and Associated Completion Time of Condition A, B, C, D, or E not met.	F.1	Be in MODE 3.	6 hours
	AND		
	F.2	Be in MODE 5.	36 hours
G. Three or more required AC sources inoperable.	G.1	Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	-------------------NOTES------------------- 1. Buses 3A04 and 3D1 are required when unit crosstie breaker 3A0416 is used to provide a source of AC power. 2. Buses 3A06 and 3D2 are required when unit crosstie breaker 3A0603 is used to provide a source of AC power. ---	
	Verify correct breaker alignment and power availability for each required offsite circuit.	7 days

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources – Operating

LCO 3.8.4 The Train A, Train B, Train C, and Train D DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One battery or associated control equipment or cabling inoperable.	A.1	Restore DC electrical power subsystem to OPERABLE status.	2 hours
B. Required Action and Associated Completion Time not met.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 5.	36 hours
C. One required battery charger or associated control equipment or cabling inoperable.	C.1	Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	1 hour AND Once per 8 hours thereafter

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition C not met.	D.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ≥ 129 V on float charge.	7 days
SR 3.8.4.2	Verify no visible corrosion at terminals and connectors. <u>OR</u> Verify connection resistance is ≤ $150x10^{-6}$ ohm for inter-cell connections, ≤ $150x10^{-6}$ ohm for inter-rack connections, ≤ $150x10^{-6}$ ohm for inter-tier connections, and ≤ $150x10^{-6}$ ohm for terminal connections.	92 days
SR 3.8.4.3	Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.4	Remove visible terminal corrosion, verify 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 connection resistance is $\leq 150 \times 10^{-6}$ ohm for inter-cell connections, $\leq 150 \times 10^{-6}$ ohm for inter-rack connections, $\leq 150 \times 10^{-6}$ ohm for inter-tier connections, and $\leq 150 \times 10^{-6}$ ohm for terminal connections.	24 months
SR 3.8.4.6	---NOTE--- Credit may be taken for unplanned events that satisfy this SR. --- Verify each battery charger supplies $\geq$ 300 amps at $\geq$ 129 V for $\geq$ 12 hours.	24 months
SR 3.8.4.7	---NOTES--- 1. SR 3.8.4.8 may be performed in lieu of SR 3.8.4.7 once per 48 months. 2. This Surveillance shall not be performed in MODE 1,2,3, or 4. 3. Credit may be taken for unplanned events that satisfy this SR. --- 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
SR 3.8.4.8	-------------------NOTES------------------- 1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 2. Credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test.	60 months AND -----NOTE------ Only applicable when battery shows degradation or has reached 85% of the expected life --------------- 12 months

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources – Shutdown

LCO 3.8.5 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 battery or associated control equipment or cabling inoperable.	A.1 Declare affected required feature(s) inoperable.	Immediately
	<u>OR</u>	
	A.2.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	A.2.2 Suspend movement of irradiated fuel assemblies.	Immediately
	<u>AND</u>	
	A.2.3 Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.	Immediately
	<u>AND</u>	
		(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately
B. One required battery charger or associted control equipment or cabling inoperable.	B.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	1 hour <u>AND</u> Once per 8 hours thereafter
C. Required Action and associated Completion Time of Condition B not met.	C.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	-------------------NOTE------------------- The following SRs are not required to be performed: SR 3.8.4.6, SR 3.8.4.7, 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 Train A, Train B, Train C, and Train D batteries shall be within the Category A and B 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 or more batteries with one or more battery cell parameters not within limits.	A.1	Verify pilot cells electrolyte level and float voltage meet Table 3.8.6-1 Category C values.	1 hour
	<u>AND</u>		
	A.2	Verify battery cell parameters meet Table 3.8.6-1 Category C values.	24 hours
	<u>AND</u>		
	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
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> One or more batteries with average electrolyte temperature of the representative cells < 60°F. <u>OR</u> One or more batteries with one or more battery cell parameters not within Category C values.	B.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
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 battery discharge < 110 V AND Once within 7 days after battery overcharge > 150 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 Surveillance Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE VALUE 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]	≥ 1.200	≥ 1.195 AND Average of all connected cells ≥ 1.205	Not more than 0.020 below the average of all connected cells AND Average of all connected cells ≥ 1.195

(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 is < 2 amps when on float charge.

(c) Specific gravity measurement may be substituted with the stabilized battery charging or float current for determining the state of charge of the designated pilot cell. This is acceptable only during a maximum of 7 days following a battery charge.

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters – Operating

LCO 3.8.7 The required Train A, Train B, Train C, and Train D inverters shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------------	
A. One required inverter inoperable.	A.1 Power AC vital bus from its Class 1E constant voltage source transformer.	2 hours
	AND	
	A.2 Restore inverter to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.7.1	Verify correct inverter voltage and alignment to required AC vital buses.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems – Operating

LCO 3.8.9 Train A and Train B AC; Trains A, B, C, and D DC; and Trains A, B, C, and D AC vital bus electrical power distribution subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1	Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours AND 16 hours from discovery of failure to meet LCO
B. One or more AC vital bus inoperable.	B.1	Restore AC vital bus subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO
C. One or more DC electrical power distribution subsystem inoperable.	C.1	Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3. AND D.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.9.1	Verify correct breaker alignments and voltage to required AC, DC, and AC vital bus electrical power distribution subsystems.	7 days

5.5 Procedures, Programs, and Manuals (continued)

5.5.2.15 Containment Leakage Rate Testing Program (Continued)

The provisions of Surveillance Requirement 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program. However, test frequencies specified in this Program may be extended consistent with the guidance provided in NEI 94-01, "Industry Guideline For Implementing Performance-Based Option Of 10CFR 50, Appendix J," as endorsed by Regulatory Guide 1.163. Specifically, NEI 94-01 has these provisions for test frequencies extension:

1. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for recommended Type A testing may be extended by up to 15 months. This option should be used only in cases where refueling schedules have been changed to accommodate other factors.

2. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for the recommended surveillance frequency for Type B and Type C testing may be extended by up to 25 percent of the test interval, not to exceed 15 months.

The provisions of Surveillance Requirement 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

(continued)

ATTACHMENT B

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Existing Technical Specifications pages, Unit 3

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and Associated Completion Time of Condition A, B, C, D, or E not met.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours
G. Three or more required AC sources inoperable.	G.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	-------------------NOTES------------------- 1. Buses 2A04 and 2D1 are required when unit crosstie breaker 2A0417 is used to provide a source of AC power. 2. Buses 2A06 and 2D2 are required when unit crosstie breaker 2A0619 is used to provide a source of AC power. --- Verify correct breaker alignment and power availability for each required offsite circuit.	7 days

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources – Operating

LCO 3.8.4 The Train A, Train B, Train C, and Train D DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One battery or associated control equipment or cabling inoperable.	A.1	Restore DC electrical power subsystem to OPERABLE status.	2 hours
B. Required Action and Associated Completion Time not met.	B.1 AND B.2	Be in MODE 3. Be in MODE 5.	6 hours 36 hours
C. One required battery charger or associated control equipment or cabling inoperable.	C.1	Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	1 hour AND Once per 8 hours thereafter

(continued)

SURVEILLANCE REQUIREMENTS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition C not met.	D.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ≥ 129 V on float charge.	7 days
SR 3.8.4.2	Verify no visible corrosion at terminals and connectors. <u>OR</u> Verify connection resistance is ≤ 150×10^{-6} ohm for inter-cell connections, ≤ 150×10^{-6} ohm for inter-rack connections, ≤ 150×10^{-6} ohm for inter-tier connections, and ≤ 150×10^{-6} ohm for terminal connections.	92 days
SR 3.8.4.3	Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.4	Remove visible terminal corrosion, verify 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 connection resistance is $\leq 150x10^{-6}$ ohm for inter-cell connections, $\leq 150x10^{-6}$ ohm for inter-rack connections, $\leq 150x10^{-6}$ ohm for inter-tier connections, and $\leq 150x10^{-6}$ ohm for terminal connections.	24 months
SR 3.8.4.6	--------------------NOTE------------------- Credit may be taken for unplanned events that satisfy this SR. --- Verify each battery charger supplies ≥ 300 amps at ≥ 129 V for ≥ 12 hours.	 24 months
SR 3.8.4.7	-------------------NOTES------------------- 1. SR 3.8.4.8 may be performed in lieu of SR 3.8.4.7 once per 48 months. 2. This Surveillance shall not be performed in MODE 1,2,3, or 4. 3. Credit may be taken for unplanned events that satisfy this SR. --- 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
SR 3.8.4.8	-------------------NOTES------------------- 1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 2. Credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test.	60 months AND -----NOTE------ Only applicable when battery shows degradation or has reached 85% of the expected life --------------- 12 months

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources – Shutdown

LCO 3.8.5 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 battery or associated control equipment or cabling inoperable.	A.1 Declare affected required feature(s) inoperable.	Immediately
	<u>OR</u>	
	A.2.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	A.2.2 Suspend movement of irradiated fuel assemblies.	Immediately
	<u>AND</u>	
	A.2.3 Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.	Immediately
	<u>AND</u>	
		(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately
B. One required battery charger or associted control equipment or cabling inoperable.	B.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	1 hour AND Once per 8 hours thereafter
C. Required Action and associated Completion Time of Condition B not met.	C.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	-------------------NOTE------------------- The following SRs are not required to be performed: SR 3.8.4.6, SR 3.8.4.7, 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 Train A, Train B, Train C, and Train D batteries shall be within the Category A and B 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 or more batteries with one or more battery cell parameters not within limits.	A.1	Verify pilot cells electrolyte level and float voltage meet Table 3.8.6-1 Category C values.	1 hour
	<u>AND</u>		
	A.2	Verify battery cell parameters meet Table 3.8.6-1 Category C values.	24 hours
	<u>AND</u>		
	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
B. Required Action and associated Completion Time of Condition A not met. OR One or more batteries with 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.	B.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
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 battery discharge < 110 V AND Once within 7 days after battery overcharge > 150 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 Surveillance Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE VALUE 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]	≥ 1.200	≥ 1.195 AND Average of all connected cells ≥ 1.205	Not more than 0.020 below the average of all connected cells AND Average of all connected cells ≥ 1.195

(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 is < 2 amps when on float charge.

(c) Specific gravity measurement may be substituted with the stabilized battery charging or float current for determining the state of charge of the designated pilot cell. This is acceptable only during a maximum of 7 days following a battery charge.

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters – Operating

LCO 3.8.7 The required Train A, Train B, Train C, and Train D inverters shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------------	
A. One required inverter inoperable.	A.1 Power AC vital bus from its Class 1E constant voltage source transformer.	2 hours
	AND	
	A.2 Restore inverter to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.7.1	Verify correct inverter voltage and alignment to required AC vital buses.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems – Operating

LCO 3.8.9 Train A and Train B AC; Trains A, B, C, and D DC; and Trains A, B, C, and D AC vital bus electrical power distribution subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1 Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours AND 16 hours from discovery of failure to meet LCO
B. One or more AC vital bus inoperable.	B.1 Restore AC vital bus subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO
C. One or more DC electrical power distribution subsystem inoperable.	C.1 Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3. AND D.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.9.1	Verify correct breaker alignments and voltage to required AC, DC, and AC vital bus electrical power distribution subsystems.	7 days

5.5 Procedures, Programs, and Manuals (continued)

5.5.2.15 Containment Leakage Rate Testing Program (Continued)

The provisions of Surveillance Requirement 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program. However, test frequencies specified in this Program may be extended consistent with the guidance provided in NEI 94-01, "Industry Guideline For Implementing Performance-Based Option Of 10CFR 50, Appendix J," as endorsed by Regulatory Guide 1.163. Specifically, NEI 94-01 has these provisions for test frequencies extension:

1. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for recommended Type A testing may be extended by up to 15 months. This option should be used only in cases where refueling schedules have been changed to accommodate other factors.

2. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for the recommended surveillance frequency for Type B and Type C testing may be extended by up to 25 percent of the test interval, not to exceed 15 months.

The provisions of Surveillance Requirement 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

(continued)

ATTACHMENT C

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Proposed Technical Specifications pages, Redline and Strikeout, Unit 2

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and Associated Completion Time of Condition A, B, C, D, or E not met.	F.1 Be in MODE 3. <u>AND</u> F.2 Be in MODE 5.	6 hours 36 hours
G. Three or more required AC sources inoperable.	G.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	-------------------NOTES------------------- 1. Bus~~es~~ 3A04~~and 3D1~~ <u>is</u> ~~are~~ required when unit crosstie breaker 3A0416 is used to provide a source of AC power. 2. Bus~~es~~ 3A06~~and 3D2~~ <u>is</u> ~~are~~ required when unit crosstie breaker 3A0603 is used to provide a source of AC power. --- Verify correct breaker alignment and power availability for each required offsite circuit.	7 days

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources—Operating

LCO 3.8.4 The Train A and~~,~~ Train B~~, Train C, and Train D~~ DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required battery charger(s) on one train inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore required battery charger(s) to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Declare associated battery inoperable.	Immediately

(continued)

ACTIONS (continued)

<table>
<tr><th>CONDITION</th><th>REQUIRED ACTION</th><th>COMPLETION TIME</th></tr>
<tr><td><u>C</u><s>A</s>. One <u>DC electrical power subsystem</u> <s>battery or associated control equipment or cabling</s> inoperable <u>for reasons other than Condition A</u>.</td><td><u>C</u><s>A</s>.1 Restore DC electrical power subsystem to OPERABLE status.

<u>OR</u>

<u>C.2</u> <u>Cross connect with same train DC subsystem.**</u></td><td>2 hours

<u>2 hours</u></td></tr>
<tr><td><u>D.</u> <u>DC Subsystem Buses cross connected.**</u></td><td><u>D.1</u> <u>Restore DC Subsystem Buses to non-cross-connected configuration.</u></td><td><u>30 days</u></td></tr>
<tr><td><u>E</u><s>B</s>. Required Action and Associated Completion Time <u>of Condition C or D</u> not met.</td><td><u>E</u><s>B</s>.1 Be in MODE 3.

<u>AND</u>

<u>E</u><s>B</s>.2 Be in MODE 5.</td><td>6 hours

36 hours</td></tr>
<tr><td><s>C. One required battery charger or associated control equipment or cabling inoperable.</s></td><td><s>C.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits.</s></td><td><s>1 hour</s>

<s>AND</s>

<s>Once per 8 hours thereafter</s></td></tr>
<tr><td><s>D. Required Action and associated Completion Time of Condition C not met.</s></td><td><s>D.1 Declare associated battery inoperable.</s></td><td><s>Immediately</s></td></tr>
</table>

<s>(continued)</s>

<u>** Note:</u> <u>Requires a battery with a rated capacity of greater than or equal to 1800 amp-hours.</u>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is greater than or equal to the minimum established float voltage ~~≥ 129 V on float charge.~~	7 days
~~SR 3.8.4.2~~	~~Verify no visible corrosion at terminals and connectors.~~ ~~OR~~ ~~Verify connection resistance is ≤ 150x10⁻⁶ ohm for inter-cell connections, ≤ 150x10⁻⁶ ohm for inter-rack connections, ≤ 150x10⁻⁶ ohm for inter-tier connections, and ≤ 150x10⁻⁶ ohm for terminal connections.~~	~~92 days~~
~~SR 3.8.4.3~~	~~Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration.~~	~~24 months~~

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.8.4.4~~	~~Remove visible terminal corrosion, verify 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 connection resistance is ≤ 150x10^{-6} ohm for inter-cell connections, ≤ 150x10^{-6} ohm for inter-rack connections, ≤ 150x10^{-6} ohm for inter-tier connections, and ≤ 150x10^{-6} ohm for terminal connections.~~	~~24 months~~
SR 3.8.4.26	~~NOTE~~ ~~Credit may be taken for unplanned events that satisfy this SR.~~ Verify each battery charger supplies ≥ rated ~~300~~ amps at ≥ the minimum established float voltage ~~129 V~~ for ≥ 8~~12~~ hours.	24 months
SR 3.8.4.37	NOTES 1. The modified performance discharge test in SR 3.8.~~4.8~~6.6 may be performed in lieu of SR 3.8.4.~~7~~3 ~~once per 48 months~~. 2. The battery performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3 once per 48 months. ~~2. This Surveillance shall not be performed in MODE 1,2,3, or 4.~~ ~~3. Credit may be taken for unplanned events that satisfy this SR.~~ 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.	30 ~~24~~ months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.8.4.8~~	~~-----NOTES-----~~ ~~1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4.~~ ~~2. Credit may be taken for unplanned events that satisfy this SR.~~ ~~----------~~ ~~Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test.~~	~~60 months~~ ~~AND~~ ~~-----NOTE-----~~ ~~Only applicable when battery shows degradation or has reached 85% of the expected life~~ ~~----------~~ ~~12 months~~

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources — Shutdown

LCO 3.8.5 The 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 two required battery charger(s) inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore required battery charger(s) to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Declare associated battery inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
~~A~~C. One or more required ~~battery or associated control equipment or cabling~~ DC electrical power subsystem(s) inoperable for reasons other than Condition A.	~~A~~C.1	Declare affected required feature(s) inoperable.	Immediately
	OR		
	~~A~~C.2.1	Suspend CORE ALTERATIONS.	Immediately
		AND	
	~~A~~C.2.2	Suspend movement of irradiated fuel assemblies.	Immediately
		AND	
	~~A~~C.2.3	Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.	Immediately
		AND	
	~~A~~C.2.4	Initiate action to restore required DC electrical power subsystem(s) to OPERABLE status.	Immediately

~~(continued)~~

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B. One required battery charger or associated control equipment or cabling inoperable.~~	~~B.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits.~~	~~1 hour~~ ~~AND~~ ~~Once per 8 hours thereafter~~
~~C. Required Action and associated Completion Time of Condition B not met.~~	~~C.1 Declare associated battery inoperable.~~	~~Immediately~~

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	------------------NOTE------------------ The following SRs are not required to be performed: SR 3.8.4.26, and SR 3.8.4.37, 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 3.8.4.37 SR 3.8.4.2 SR 3.8.4.5 SR 3.8.4.8. SR 3.8.4.3 SR 3.8.4.26, and	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 Train A and~~,~~ Train B~~, Train C, and Train D~~ batteries shall be within limits. ~~the Category A and B 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 or more batteries with one or more battery cell parameters not within limits.~~	~~A.1 Verify pilot cells electrolyte level and float voltage meet Table 3.8.6-1 Category C values.~~	~~1 hour~~
	~~AND~~	
	~~A.2 Verify battery cell parameters meet Table 3.8.6-1 Category C values.~~	~~24 hours~~
	~~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
A. One or two batteries on one train 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 voltage ≥ 2.07 V.	24 hours
B. One or two batteries on one train 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
C. One or two batteries on one train with one or more cells with electrolyte level less than minimum established design limits.	------------NOTES------------ 1. Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates. 2. Required Action C.2 shall be completed if electrolyte level was below the top of the plates. ----------------------------	
	C.1 Restore electrolyte level to above the top of the plates.	8 hours
	AND	
	C.2 Verify no evidence of leakage.	12 hours
	AND	
	C.3 Restore electrolyte level to greater than or equal to minimum established design limits.	31 days
D. One or two batteries on one train with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits.	12 hours
E. One or more batteries in redundant trains with battery parameters not within limits.	E.1 Restore battery parameters for batteries in one train to within limits.	2 hours

(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 two more batteries on one train with one or more battery cells with float voltage < 2.07 V and float current > 2 amps. with 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. ----------------------------------	(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
	Verify each battery float current is ≤ 2 amps. ~~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 battery discharge < 110 V~~ ~~AND~~ ~~Once within 7 days after battery overcharge > 150 V~~
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~~3~~	Verify each battery pilot cell ~~average electrolyte~~ temperature is greater than or equal to minimum established design limits. ~~of representative cells is > 60°F.~~	31 ~~92~~ days
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ 2.07 V.	92 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.6	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 12 months when the battery shows degradation or has reached 85% of the expected life with capacity < 100% of the manufacturer's rating AND 24 months when the battery has reached 85% of the expected life with capacity ≥ 100% of the manufacturer's rating

Table 3.8.6-1 (page 1 of 1)
Battery Surveillance Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE VALUE FOR EACH CONNECTED CELL
Electrolyte Level	≥ Minimum level indication mark, and ≤ 3 inch above maximum level indication mark[a]	≥ Minimum level indication mark, and ≤ 3 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]	≥ 1.200	≥ 1.195 AND Average of all connected cells ≥ 1.205	Not more than 0.020 below the average of all connected cells AND Average of all connected cells ≥ 1.195

(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 is ≤ 2 amps when on float charge.

(c) Specific gravity measurement may be substituted with the stabilized battery charging or float current for determining the state of charge of the designated pilot cell. This is acceptable only during a maximum of 7 days following a battery charge.

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters—Operating

LCO 3.8.7 The required <u>Channel A, B, C, and D AC</u> ~~Train A, Train B, Train C, and Train D~~ inverters shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------------	
A. One required inverter inoperable.	A.1 Power AC vital bus from its Class 1E constant voltage source transformer.	2 hours
	<u>AND</u>	
	A.2 Restore inverter to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u>	
	B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.7.1	Verify correct inverter voltage and alignment to required AC vital buses.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems—Operating

LCO 3.8.9 Train A and Train B AC,~~;~~ Subsystems A, B, C, and D DC, and Channels A, B, C, and D AC vital bus ~~Trains A, B, C, and D DC; and Trains A, B, C, and D AC vital bus~~ electrical power distribution ~~sub~~systems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1 Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours AND 16 hours from discovery of failure to meet LCO
B. One or more AC vital bus inoperable.	B.1 Restore AC vital bus subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO
C. One or more DC electrical power distribution subsystem inoperable.	C.1 Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3. AND D.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.9.1	Verify correct breaker alignments and voltage to required AC, DC, and AC vital bus electrical power distribution subsystems.	7 days

5.5 Procedures, Programs, and Manuals (continued)

5.5.2.15 Containment Leakage Rate Testing Program (Continued)

The provisions of Surveillance Requirement 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program. However, test frequencies specified in this Program may be extended consistent with the guidance provided in NEI 94-01, "Industry Guideline For Implementing Performance-Based Option Of 10CFR 50, Appendix J," as endorsed by Regulatory Guide 1.163. Specifically, NEI 94-01 has these provisions for test frequencies extension:

1. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for recommended Type A testing may be extended by up to 15 months. This option should be used only in cases where refueling schedules have been changed to accommodate other factors.

2. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for the recommended surveillance frequency for Type B and Type C testing may be extended by up to 25 percent of the test interval, not to exceed 15 months.

The provisions of Surveillance Requirement 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.2.16 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries For Stationary Applications," of the following:

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

b. Actions to verify that the remaining cells are above 2.07 V when a battery cell or cells have been found less than 2.13 V, and

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

ATTACHMENT D

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Proposed Technical Specifications pages, Redline and Strikeout, Unit 3

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and Associated Completion Time of Condition A, B, C, D, or E not met.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours
G. Three or more required AC sources inoperable.	G.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	------------------NOTES------------------ 1. Bus~~es~~ 2A04 ~~and 2D1 are~~is required when unit crosstie breaker 2A0417 is used to provide a source of AC power. 2. Bus~~es~~ 2A06 ~~and 2D2 are~~is required when unit crosstie breaker 2A0619 is used to provide a source of AC power. --- Verify correct breaker alignment and power availability for each required offsite circuit.	 7 days

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources—Operating

LCO 3.8.4 The Train A and, Train B, Train C, and Train D DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required battery charger(s) on one train 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 required battery charger(s) to OPERABLE status.	2 hours Once per 12 hours 7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Declare associated battery inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C~~A~~. One DC electrical power subsystem ~~battery or associated control equipment or cabling~~ inoperable for reasons other than Condition A.	C~~A~~.1 Restore DC electrical power subsystem to OPERABLE status. OR C.2 Cross connect with same train DC subsystem.**	2 hours 2 hours
D. DC Subsystem Buses cross connected.**	D.1 Restore DC Subsystem Buses to non-cross-connected configuration.	30 days
E~~B~~. Required Action and Associated Completion Time of Condition C or D not met.	E~~B~~.1 Be in MODE 3. AND E~~B~~.2 Be in MODE 5.	6 hours 36 hours
~~C. One required battery charger or associated control equipment or cabling inoperable.~~	~~C.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits.~~	~~1 hour~~ ~~AND~~ ~~Once per 8 hours thereafter~~
~~D. Required Action and associated Completion Time of Condition C not met.~~	~~D.1 Declare associated battery inoperable.~~	~~Immediately~~

** Note: Requires a battery with a rated capacity of greater than or equal to 1800 amp-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 ~~≥ 129 V on float charge.~~	7 days
~~SR 3.8.4.2~~	~~Verify no visible corrosion at terminals and connectors.~~ ~~OR~~ ~~Verify connection resistance is ≤ 150x10^-6 ohm for inter-cell connections, ≤ 150x10^-6 ohm for inter-rack connections, ≤ 150x10^-6 ohm for inter-tier connections, and ≤ 150x10^-6 ohm for terminal connections.~~	~~92 days~~
~~SR 3.8.4.3~~	~~Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration.~~	~~24 months~~

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.8.4.4~~	~~Remove visible terminal corrosion, verify 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 connection resistance is $\leq 150x10^{-6}$ ohm for inter-cell connections, $\leq 150x10^{-6}$ ohm for inter-rack connections, $\leq 150x10^{-6}$ ohm for inter-tier connections, and $\leq 150x10^{-6}$ ohm for terminal connections.~~	~~24 months~~
SR 3.8.4.2~~6~~	~~-------------------NOTE-------------------~~ ~~Credit may be taken for unplanned events that satisfy this SR.~~ --- Verify each battery charger supplies ≥ rated ~~300~~ amps at ≥ the minimum established float voltage ~~129 V~~ for ≥ 8~~12~~ hours.	24 months
SR 3.8.4.3~~7~~	-------------------NOTES------------------- 1. The modified performance discharge test in SR 3.8.~~4.8~~6.6 may be performed in lieu of SR 3.8.4.~~7~~3 ~~once per 48 months~~. 2. The battery performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3 once per 48 months. ~~2. This Surveillance shall not be performed in MODE 1,2,3, or 4.~~ ~~3. Credit may be taken for unplanned events that satisfy this SR.~~ --- 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.	30 ~~24~~ months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.8.4.8~~	~~------------------NOTES------------------~~ ~~1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4.~~ ~~2. Credit may be taken for unplanned events that satisfy this SR.~~ ~~---~~ ~~Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test.~~	~~60 months~~ ~~AND~~ ~~-----NOTE------~~ ~~Only applicable when battery shows degradation or has reached 85% of the expected life~~ ~~--------------~~ ~~12 months~~

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources — Shutdown

LCO 3.8.5 The 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 two required battery charger(s) inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore required battery charger(s) to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Declare associated battery inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
AC. One or more required battery or associated control equipment or cabling DC electrical power subsystem(s) inoperable for reasons other than Condition A.	AC.1	Declare affected required feature(s) inoperable.	Immediately
	OR		
	AC.2.1	Suspend CORE ALTERATIONS.	Immediately
	AND		
	AC.2.2	Suspend movement of irradiated fuel assemblies.	Immediately
	AND		
	AC.2.3	Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.	Immediately
	AND		
	AC.2.4	Initiate action to restore required DC electrical power subsystem(s) to OPERABLE status.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B. One required battery charger or associted control equipment or cabling inoperable.~~	~~B.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits.~~	~~1 hour~~ ~~AND~~ ~~Once per 8 hours thereafter~~
~~C. Required Action and associated Completion Time of Condition B not met.~~	~~C.1 Declare associated battery inoperable.~~	~~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 3.8.4.3~~7~~ ~~SR 3.8.4.2~~ ~~SR 3.8.4.5~~ ~~SR 3.8.4.8.~~ ~~SR 3.8.4.3~~ SR 3.8.4.2~~6~~, and	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 Train A and~~,~~ Train B~~, Train C, and Train D~~ batteries shall be within limits.~~the Category A and B 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 or more batteries with one or more battery cell parameters not within limits.~~	~~A.1 Verify pilot cells electrolyte level and float voltage meet Table 3.8.6-1 Category C values.~~	~~1 hour~~
	~~AND~~	
	~~A.2 Verify battery cell parameters meet Table 3.8.6-1 Category C values.~~	~~24 hours~~
	~~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
A. One or two batteries on one train with one or more battery cells with float voltage <2.07 V.	A.1 Perform SR 3.8.4.1. AND A.2 Perform SR 3.8.6.1 AND A.3 Restore affected cell voltage ≥ 2.07 V.	2 hours 2 hours 24 hours
B. One or two batteries on one train with float current > 2 amps.	B.1 Perform SR 3.8.4.1 AND B.2 Restore battery float current to ≤ 2 amps.	2 hours 12 hours

(continued)

ACTIONS (Continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One or two batteries on one train with one or more cells with electrolyte level less than minimum established design limits.	------------NOTES------------ 1. Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates. 2. Required Action C.2 shall be completed if electrolyte level was below the top of the plates. ----------------------------	
	C.1 Restore electrolyte level to above the top the of plates.	8 hours
	AND	
	C.2 Verify no evidence of leakage.	12 hours
	AND	
	C.3 Restore electrolyte level to greater than or equal to minimum established design limits.	31 days
D. One or two batteries on one train with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits.	12 hours
E. One or more batteries in redundant trains with battery parameters not within limits.	E.1 Restore battery parameters for batteries in one train to within limits.	2 hours

(continued)

ACTIONS (Continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F~~B~~. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR One or two ~~more~~ batteries on one train with one or more battery cells with float voltage < 2.07 V and float current > 2 amps. ~~with 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.~~	F~~B~~.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. --	(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
	Verify each battery float current is ≤ 2 amps. ~~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 battery discharge < 110 V~~ ~~AND~~ ~~Once within 7 days after battery overcharge > 150 V~~
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.~~3~~4	Verify each battery pilot cell~~average electrolyte~~ temperature is greater than or equal to minimum established design limits.~~of representative cells is > 60°~~F.	31~~92~~ days
SR 3.8.6.5	Verify each battery connected cell voltage is ≥2.07 V.	92 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.6	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 12 months when the battery shows degradation or has reached 85% of the expected life with capacity <100% of the manufacturer's rating AND 24 months when the battery has reached 85% of the expected life with capacity ≥100% of the manufacturer's rating

Table 3.8.6-1 (page 1 of 1)
Battery Surveillance Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE VALUE 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)]	≥ 1.200	≥ 1.195 AND Average of all connected cells ≥ 1.205	Not more than 0.020 below the average of all connected cells AND Average of all connected cells ≥ 1.195

(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 is < 2 amps when on float charge.

(c) Specific gravity measurement may be substituted with the stabilized battery charging or float current for determining the state of charge of the designated pilot cell. This is acceptable only during a maximum of 7 days following a battery charge.

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters—Operating

LCO 3.8.7 The required Channel A, B, C, and D AC ~~Train A, Train B, Train C, and Train D~~ inverters shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------------	
A. One required inverter inoperable.	A.1 Power AC vital bus from its Class 1E constant voltage source transformer.	2 hours
	AND	
	A.2 Restore inverter to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.7.1	Verify correct inverter voltage and alignment to required AC vital buses.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems — Operating

LCO 3.8.9 Train A and Train B AC,; Subsystems A, B, C, and D DC, and Channels A, B, C, and D AC vital bus Trains A, B, C, and D DC; and Trains A, B, C, and D AC vital bus electrical power distribution subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1 Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours AND 16 hours from discovery of failure to meet LCO
B. One or more AC vital bus inoperable.	B.1 Restore AC vital bus subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO
C. One or more DC electrical power distribution subsystem inoperable.	C.1 Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3. <u>AND</u> D.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.9.1	Verify correct breaker alignments and voltage to required AC, DC, and AC vital bus electrical power distribution subsystems.	7 days

5.5 Procedures, Programs, and Manuals (continued)

5.5.2.15 Containment Leakage Rate Testing Program (Continued)

The provisions of Surveillance Requirement 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program. However, test frequencies specified in this Program may be extended consistent with the guidance provided in NEI 94-01, "Industry Guideline For Implementing Performance-Based Option Of 10CFR 50, Appendix J," as endorsed by Regulatory Guide 1.163. Specifically, NEI 94-01 has these provisions for test frequencies extension:

1. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for recommended Type A testing may be extended by up to 15 months. This option should be used only in cases where refueling schedules have been changed to accommodate other factors.

2. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for the recommended surveillance frequency for Type B and Type C testing may be extended by up to 25 percent of the test interval, not to exceed 15 months.

The provisions of Surveillance Requirement 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.2.16 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries For Stationary Applications," of the following:

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

b. Actions to verify that the remaining cells are above 2.07 V when a battery cell or cells have been found less than 2.13 V, and

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

ATTACHMENT E

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Proposed Technical Specifications pages, Unit 2

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and Associated Completion Time of Condition A, B, C, D, or E not met.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours
G. Three or more required AC sources inoperable.	G.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	-------------------NOTES------------------- 1. Bus 3A04 is required when unit crosstie breaker 3A0416 is used to provide a source of AC power. 2. Bus 3A06 is required when unit crosstie breaker 3A0603 is used to provide a source of AC power. --- Verify correct breaker alignment and power availability for each required offsite circuit.	7 days

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources—Operating

LCO 3.8.4 The Train A and Train B DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required battery charger(s) on one train inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	<u>AND</u>	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	<u>AND</u>	
	A.3 Restore required battery charger(s) to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Declare associated battery inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One DC electrical power subsystem inoperable for reasons other than Condition A.	C.1 Restore DC electrical power subsystem to OPERABLE status. <u>OR</u> C.2 Cross connect with same train DC subsystem.**	2 hours 2 hours
D. DC Subsystem Buses cross connected.**	D.1 Restore DC Subsystem Buses to non-cross-connected configuration.	30 days
E. Required Action and Associated Completion Time of Condition C or D not met.	E.1 Be in MODE 3. <u>AND</u> E.2 Be in MODE 5.	6 hours 36 hours

** Note: Requires a battery with a rated capacity of greater than or equal to 1800 amp-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 ≥ rated amps at ≥ the minimum established float voltage for ≥ 8 hours.	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. The battery performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3 once per 48 months. --- 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.	30 months

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3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources—Shutdown

LCO 3.8.5 The 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 two required battery charger(s) inoperable.	A.1	Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	<u>AND</u>		
	A.2	Verify battery float current ≤ 2 amps.	Once per 12 hours
	<u>AND</u>		
	A.3	Restore required battery charger(s) to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1	Declare associated battery inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One or more required DC electrical power subsystem(s) inoperable for reasons other than Condition A.	C.1	Declare affected required feature(s) inoperable.	Immediately
	OR		
	C.2.1	Suspend CORE ALTERATIONS.	Immediately
	AND		
	C.2.2	Suspend movement of irradiated fuel assemblies.	Immediately
	AND		
	C.2.3	Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.	Immediately
	AND		
	C.2.4	Initiate action to restore required DC electrical power subsystem(s) to OPERABLE status.	Immediately

ACTIONS (continued)

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, and 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 Train A and Train B 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 or two batteries on one train with one or more battery cells with float voltage <2.07 V.	A.1 Perform SR 3.8.4.1.	2 hours
	<u>AND</u>	
	A.2 Perform SR 3.8.6.1.	2 hours
	<u>AND</u>	
	A.3 Restore affected cell voltage ≥ 2.07 V.	24 hours
B. One or two batteries on one train with float current > 2 amps.	B.1 Perform SR 3.8.4.1	2 hours
	<u>AND</u>	
	B.2 Restore battery float current to ≤ 2 amps.	12 hours

(continued)

ACTIONS (Continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One or two batteries on one train with one or more cells with electrolyte level less than minimum established design limits.	------------NOTES------------ 1. Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates. 2. Required Action C.2 shall be completed if electrolyte level was below the top of the plates. ----------------------------	
	C.1 Restore electrolyte level to above the top of the plates.	8 hours
	AND	
	C.2 Verify no evidence of leakage.	12 hours
	AND	
	C.3 Restore electrolyte level to greater than or equal to minimum established design limits.	31 days
D. One or two batteries on one train with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits.	12 hours
E. One or more batteries in redundant trains with battery parameters not within limits.	E.1 Restore battery parameters for batteries in one train to within limits.	2 hours

(continued)

ACTIONS (Continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. <u>OR</u> One or two batteries on one train with one or more battery cells with 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

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
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	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 <u>AND</u> 12 months when the battery shows degradation or has reached 85% of the expected life with capacity < 100% of the manufacturer's rating <u>AND</u> 24 months when the battery has reached 85% of the expected life with capacity ≥ 100% of the manufacturer's rating

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters—Operating

LCO 3.8.7 The required Channel A, B, C, and D AC inverters shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------------	
A. One required inverter inoperable.	A.1 Power AC vital bus from its Class 1E constant voltage source transformer.	2 hours
	AND	
	A.2 Restore inverter to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.7.1	Verify correct inverter voltage and alignment to required AC vital buses.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems—Operating

LCO 3.8.9 Train A and Train B AC, Subsystems A, B, C, and D DC, and Channels A, B, C, and D AC vital bus electrical power distribution systems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1 Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours AND 16 hours from discovery of failure to meet LCO
B. One or more AC vital bus inoperable.	B.1 Restore AC vital bus subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO
C. One or more DC electrical power distribution subsystem inoperable.	C.1 Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3. <u>AND</u> D.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.9.1	Verify correct breaker alignments and voltage to required AC, DC, and AC vital bus electrical power distribution subsystems.	7 days

5.5.2.15 Containment Leakage Rate Testing Program (Continued)

The provisions of Surveillance Requirement 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program. However, test frequencies specified in this Program may be extended consistent with the guidance provided in NEI 94-01, "Industry Guideline For Implementing Performance-Based Option Of 10CFR 50, Appendix J," as endorsed by Regulatory Guide 1.163. Specifically, NEI 94-01 has these provisions for test frequencies extension:

1. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for recommended Type A testing may be extended by up to 15 months. This option should be used only in cases where refueling schedules have been changed to accommodate other factors.

2. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for the recommended surveillance frequency for Type B and Type C testing may be extended by up to 25 percent of the test interval, not to exceed 15 months.

The provisions of Surveillance Requirement 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.2.16 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries For Stationary Applications," of the following:

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

b. Actions to verify that the remaining cells are above 2.07 V when a battery cell or cells have been found less than 2.13 V, and

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

ATTACHMENT F

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Proposed Technical Specifications pages, Unit 3

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and Associated Completion Time of Condition A, B, C, D, or E not met.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours
G. Three or more required AC sources inoperable.	G.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	-------------------NOTES------------------- 1. Bus 2A04 is required when unit crosstie breaker 2A0417 is used to provide a source of AC power. 2. Bus 2A06 is required when unit crosstie breaker 2A0619 is used to provide a source of AC power. --- Verify correct breaker alignment and power availability for each required offsite circuit.	7 days

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources—Operating

LCO 3.8.4 The Train A and Train B DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required battery charger(s) on one train inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore required battery charger(s) to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Declare associated battery inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One DC electrical power subsystem inoperable for reasons other than Condition A.	C.1 Restore DC electrical power subsystem to OPERABLE status.	2 hours
	<u>OR</u>	
	C.2 Cross connect with same train DC subsystem.**	2 hours
D. DC Subsystem Buses cross connected.**	D.1 Restore DC Subsystem Buses to non-cross-connected configuration.	30 days
E. Required Action and Associated Completion Time of Condition C or D not met.	E.1 Be in MODE 3.	6 hours
	<u>AND</u>	
	E.2 Be in MODE 5.	36 hours

** Note: Requires a battery with a rated capacity of greater than or equal to 1800 amp-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 ≥ rated amps at ≥ the minimum established float voltage for ≥ 8 hours.	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. The battery performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3 once per 48 months. --- 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.	30 months

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3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources — Shutdown

LCO 3.8.5 The 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 two required battery charger(s) inoperable.	A.1	Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	<u>AND</u>		
	A.2	Verify battery float current ≤ 2 amps.	Once per 12 hours
	<u>AND</u>		
	A.3	Restore required battery charger(s) to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1	Declare associated battery inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One or more required DC electrical power subsystem(s) inoperable for reasons other than Condition A.	C.1	Declare affected required feature(s) inoperable.	Immediately
	<u>OR</u>		
	C.2.1	Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>		
	C.2.2	Suspend movement of irradiated fuel assemblies.	Immediately
	<u>AND</u>		
	C.2.3	Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.	Immediately
	<u>AND</u>		
	C.2.4	Initiate action to restore required DC electrical power subsystem(s) 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, and 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 Train A and Train B 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 or two batteries on one train with one or more battery cells with float voltage < 2.07 V.	A.1 Perform SR 3.8.4.1.	2 hours
	<u>AND</u>	
	A.2 Perform SR 3.8.6.1	2 hours
	<u>AND</u>	
	A.3 Restore affected cell voltage ≥ 2.07 V.	24 hours
B. One or two batteries on one train with float current > 2 amps.	B.1 Perform SR 3.8.4.1	2 hours
	<u>AND</u>	
	B.2 Restore battery float current to ≤ 2 amps.	12 hours

(continued)

ACTIONS (Continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One or two batteries on one train with one or more cells with electrolyte level less than minimum established design limits.	------------NOTES------------ 1. Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates. 2. Required Action C.2 shall be completed if electrolyte level was below the top of the plates. -----------------------------	
	C.1 Restore electrolyte level to above the top of the plates.	8 hours
	AND	
	C.2 Verify no evidence of leakage.	12 hours
	AND	
	C.3 Restore electrolyte level to greater than or equal to minimum established design limits.	31 days
D. One or two batteries on one train with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits.	12 hours
E. One or more batteries in redundant trains with battery parameters not within limits.	E.1 Restore battery parameters for batteries in one train to within limits.	2 hours

(continued)

ACTIONS (Continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR One or two batteries on one train with one or more battery cells with 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 $\leq$ 2 amps.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
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	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 <u>AND</u> 12 months when the battery shows degradation or has reached 85% of the expected life with capacity < 100% of the manufacturer's rating <u>AND</u> 24 months when the battery has reached 85% of the expected life with capacity ≥ 100% of the manufacturer's rating

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters—Operating

LCO 3.8.7 The required Channel A, B, C, and D AC inverters shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.9 with one AC vital bus de-energized. ----------------------------	
A. One required inverter inoperable.	A.1 Power AC vital bus from its Class 1E constant voltage source transformer.	2 hours
	AND	
	A.2 Restore inverter to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	AND	
	B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.7.1	Verify correct inverter voltage and alignment to required AC vital buses.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems—Operating

LCO 3.8.9 Train A and Train B AC, Subsystems A, B, C, and D DC, and Channels A, B, C, and D AC vital bus electrical power distribution systems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1 Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours AND 16 hours from discovery of failure to meet LCO
B. One or more AC vital bus inoperable.	B.1 Restore AC vital bus subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO
C. One or more DC electrical power distribution subsystem inoperable.	C.1 Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours AND 16 hours from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3. <u>AND</u> D.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.9.1	Verify correct breaker alignments and voltage to required AC, DC, and AC vital bus electrical power distribution subsystems.	7 days

5.5 Procedures, Programs, and Manuals (continued)

5.5.2.15 Containment Leakage Rate Testing Program (Continued)

The provisions of Surveillance Requirement 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program. However, test frequencies specified in this Program may be extended consistent with the guidance provided in NEI 94-01, "Industry Guideline For Implementing Performance-Based Option Of 10CFR 50, Appendix J," as endorsed by Regulatory Guide 1.163. Specifically, NEI 94-01 has these provisions for test frequencies extension:

1. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for recommended Type A testing may be extended by up to 15 months. This option should be used only in cases where refueling schedules have been changed to accommodate other factors.

2. Consistent with standard scheduling practices for Technical Specifications Required Surveillances, intervals for the recommended surveillance frequency for Type B and Type C testing may be extended by up to 25 percent of the test interval, not to exceed 15 months.

The provisions of Surveillance Requirement 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.2.16 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries For Stationary Applications," of the following:

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

b. Actions to verify that the remaining cells are above 2.07 V when a battery cell or cells have been found less than 2.13 V, and

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

ATTACHMENT G.1

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Proposed Bases pages (for information only), Unit 2

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources—Operating

BASES

BACKGROUND

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

The 125 VDC electrical power system consists of two independent and redundant safety related Class 1E DC electrical power systems (Train A and Train B). Each train consists of two subsystems each containing one 125 VDC battery, the required battery charger for each battery, and all the associated control equipment and interconnecting cabling.

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

The Train A and Train B DC electrical power systems provide control power for their 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 other loads including inverters which in turn power the AC vital buses.

Train A DC systems (Subsystems A and C) provide power to the Channel A and C inverters feeding the 120 VAC vital bus 1 and 3 electrical power distribution subsystems (Channel A and C). Train B DC system (Subsystems B and D) provide power to the Channel B and D inverters feeding the 120 VAC vital bus 2 and 4 electrical power distribution subsystems (Channel B and D). DC subsystem C also provides DC power to the Auxiliary Feedwater Pump steam inlet valve HV-4716 and the AFWP electric governor.

BASES (continued)

BACKGROUND (continued)

Train A DC systems are capable of providing DC power to both Channel A and Channel C loads when DC subsystems A and C are manually cross-connected. This allows both DC buses to remain operable during battery replacement, testing, or maintenance of any one DC battery or battery charger.

Train B DC systems are capable of providing DC power to both Channel B and Channel D loads when DC subsystem B and D are manually cross-connected. This allows both DC buses to remain operable during battery replacement, testing, or maintenance of any one DC battery or battery charger.

Train	Subsystem	DC Bus	Vital Bus	Battery	Charger	Swing Charger
A	A	D1	Y01	B007	B001	B021
	C	D3	Y03	B009	B003	
B	B	D2	Y02	B008	B002	B022
	D	D4	Y04	B010	B004	

During cross-connecting of subsystem buses A and C or B and D, two batteries will be paralleled for a short duration. An electrical fault during that duration could exceed the interrupting duties of the protective devices. This is an accepted practice during transfer of power sources and is considered to be an acceptable minimal risk. Once the cross-tie alignment is complete, only one battery is aligned to cross-connected buses D1 and D3 or D2 and D4.

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

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution buses. Each subsystem is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing of equipment between redundant Class 1E Subsystems, such as batteries, battery chargers, or distribution panels. Subsystems A and C or B and D share a battery and battery charger(s) when cross-tied.

BASES (continued)

BACKGROUND (continued)

Each battery has adequate storage capacity to meet the duty cycle(s) discussed in the UFSAR, Chapter 8 (Ref. 6). 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 Train A and Train B 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 at the supplied loads is 105 V.

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 120 V for a 58-cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained of a fully charged cell when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. All cells begin to self-discharge when left on open circuit, but cells can be left open circuit for some period of time (> 30 days, refer to the manufacturer's instruction for the maximum storage periods) without any long-term performance degradation. Optimal long-term performance however, is obtained by maintaining a float voltage of 2.20 to 2.28 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge. The nominal float voltage of 2.267 Vpc corresponds to a total float voltage of 131.5 V for a 58-cell battery.

Each Train A and Train B 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 24 hours while supplying normal steady state loads discussed in the UFSAR, Chapter 8 (Ref. 6).

BASES (continued)

BACKGROUND (continued)

Each subsystem has a dedicated battery charger that is rated at 300 Amps. Each Train has a 400 Amp rated swing battery charger that meets all the performance requirements of the dedicated charger and can be manually aligned to either subsystem. The swing charger breakers and interconnecting cables allow alignment to either subsystem within a train. Key interlocks limit swing charger alignment to one subsystem at a time. The Train B swing charger can also be aligned to non-1E 125 VDC Battery Bus D5. Electrical isolation and independence between subsystems required by R.G. 1.75 is maintained by the isolation capability of the battery charger itself and the kirk-key interlocked output circuit breakers. If the swing battery charger is substituted for one of the dedicated battery chargers, the requirements of independence and redundancy between subsystems are maintained.

The swing battery charger and the normal dedicated battery charger are equally qualified. When required, the swing battery charger can replace the normal dedicated battery charger using the provided circuit breakers. The swing battery charger can stay in service indefinitely, and there are no restrictions on swing battery charger use. The swing and dedicated battery chargers are designed to operate in parallel in any combination. The swing battery charger is powered from its respective Train's common MCC which is diesel generator backed as required by LCO 3.8.1, "AC Sources - Operating," or LCO 3.8.2, "AC Sources - Shutdown."

With same train DC buses cross-connected, an OPERABLE charger or chargers with a combined rated capacity greater than or equal to 400 Amps is required.

A "required battery charger" is one of the following:

- the "dedicated charger" aligned to its respective DC bus
- the "swing battery charger" aligned to the respective DC bus
- **two** ""dedicated chargers" aligned to cross-tied DC buses, or
- the "swing battery charger" aligned to cross-tied DC buses.

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.

BASES (continued)

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 UFSAR, Chapter 6 (Ref. 7) and Chapter 15 (Ref. 8), 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 the NRC Policy Statement.

BASES (continued)

LCO

The DC electrical power trains, each train consisting of two batteries, the required battery charger for each battery, and the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the train are required to be OPERABLE by LCO 3.8.9 "Distribution Systems - Operating." This ensures 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 train DC electrical power subsystem does not prevent the minimum safety function from being performed consistent with UFSAR Chapter 8 (Ref. 6).

An OPERABLE DC electrical power train requires two batteries and required chargers to be operating and connected to the associated DC buses.

During the cross-connection period of 30 days, an OPERABLE DC electrical power train (A or B) requires one battery and the required battery charger(s) to be operating and connected to subsystem DC buses A and C or B and D.

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 train with one or two required battery chargers or associated control equipment or cabling inoperable (e.g., the battery 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 the required charger(s) to OPERABLE status in a reasonable time period.

BASES (continued)

ACTIONS

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

Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring 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. 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.

The charger operating in the current limit mode in excess of 2 hours 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).

BASES (continued)

ACTIONS

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

Required Action A.2 requires that the battery float current be verified to be 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 initial 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.

A digital multimeter of high accuracy in an average function mode will be used to measure the steady state float charging current. The multimeter is capable of measuring the low magnitude of DC current (less than 2 amps) and filtering the induced AC noise from the connected inverter. A millivolt shunt located close to the battery terminal provides the battery float charging current signal.

Required Action A.3 limits the restoration time for the required battery charger to 7 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., balance of plant non-Class 1E battery charger). The 7-day Completion Time reflects a reasonable time to effect restoration of the required battery charger to operable status.

B.1

With the required DC electrical power subsystem battery charger or associated control equipment or cabling outside the allowances of the Required Actions for Condition A, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery must be declared inoperable immediately.

BASES (continued)

ACTIONS (continued)

C.1 and C.2

Condition C represents one or more required DC electrical power subsystem(s) on one train inoperable for reasons other than Condition A. Any event that results in a loss of the AC bus supporting the battery charger will eventually result in loss of DC to that subsystem. 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 breaker, etc.) rely upon the operability of the battery(ies). In addition, DC loads with energization transients 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 LCOs 3.8.4, 3.8.5, and 3.8.6 together with additional specific completion times.

Condition C also represents one train 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 system.

If one of the required DC electrical power subsystems is inoperable for reasons other than Condition A or C (e.g., inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems to mitigate a worst-case accident, continued power operation should not exceed 2 hours. The 2-hour Completion Time is based on Regulatory Guide 1.93 (Ref. 9) and reflects a reasonable time to cross connect with same train DC subsystem or 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

BASES (continued)

ACTIONS

C.1 and C.2 (continued)

and safe unit shutdown. Either of Required Actions C.1 or C.2 will restore the DC subsystem train to OPERABLE status. Required Action C.2 includes a Note to ensure the battery aligned to the cross-tied subsystem buses has adequate capacity.

Cross connection of two subsystems on two trains has not been analyzed and is therefore not permitted.

D.1

Condition D represents **one** train with one subsystem battery out of service and two subsystems cross-connected with one battery. This alignment will allow both subsystems to remain OPERABLE for 30 days. The 30-day duration is adequate for replacement of a battery bank and performance of battery discharge testing (online) in Modes 1 through 4. Condition D includes a Note to ensure the battery aligned to the cross-tied subsystem buses has adequate capacity.

The SONGS 2/3 Living PRA determined acceptable risk impact for a period of 30 days while two same train DC subsystems are cross-connected with one battery supporting both buses. The analysis was performed consistent with the guidelines of R.G. 1.74 and R.G 1.177.

Cross connection of two subsystems on two trains has not been analyzed and is therefore not permitted.

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 unit systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 9).

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the 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 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 minimum float voltage established by the battery manufacturer (2.20 Vpc). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). The 7-day frequency is consistent with manufacturer recommendations.

SR 3.8.4.2

This SR verifies the design capacity of the swing and dedicated battery chargers. Regulatory Guide 1.32 recommends that the battery charger supply is 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 ensure that these requirements can be satisfied. Each required battery charger must be capable of supplying rated amps at the minimum established float voltage for 8 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.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.2 (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.

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 IEEE-450 (Ref. 4). For 1800 AH rated batteries, the service test and modified performance discharge test will use the combined duty cycle of the cross-connected subsystems.

The 30 month service test frequency is in accordance with IEEE 450-2002, which requires a service test at the discretion of the user at periodic times between the 60-month performance tests.

This SR is modified by two Notes:
Note 1 allows the performance of a modified performance discharge test in lieu of a service test.
Note 2 continues to allow the once per 48 month performance of the battery performance discharge test in SR 3.8.6.6 in lieu of SR 3.8.4.3. This substitution is acceptable because SR 3.8.6.6 represents a more severe test of battery capacity than does SR 3.8.4.3.

The modified performance discharge test is described in the Bases for SR 3.8.6.6.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.3 (continued)

A battery service test or modified performance test shall be performed after installation of a new battery bank for Operability. Within 2 years after initial installation, a battery performance test shall be performed for collecting baseline data for future battery capacity trending purposes. The application of the modified performance test is the preferred choice at SONGS for Class 1E batteries ≥1800 AH (refer to the Vendor and/or Engineering justification below).

If for any reason a battery has to undergo a service and performance test (e.g., one following the other during scheduled maintenance testing), the service test shall be completed first. Recharging of the battery is required before the performance test is conducted. The "as found" condition prior to the performance test is state of the battery immediately prior to the performance test.

REFERENCES

1. 10 CFR.50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-1978.
4. IEEE-450-2002.
5. IEEE-485-1997.
6. UFSAR, Chapter 8.
7. UFSAR, Chapter 6.
8. UFSAR, Chapter 15.
9. Regulatory Guide 1.93, December 1974.
10. Regulatory Guide 1.32, February 1977.
11. Regulatory Guide 1.129, April 1977.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources—Shutdown

BASES

BACKGROUND

A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources – Operating." When TS 3.8.5 applies, there are two exceptions to what is described in the Bases for LCO 3.8.4:

1. The DC subsystem cross-connect configuration and use is described in the Bases for LCO 3.8.10, 'Distribution Systems – Shutdown"
2. With same train DC buses cross-connected, an OPERABLE charger or chargers with a combined rated capacity greater than or equal to 300 Amps is required. When cross tied, there are no restrictions on battery charger operation. A "required battery charger" is one of the following:
   - the "dedicated charger" aligned to its respective DC bus
   - the "swing battery charger" aligned to the respective DC bus
   - **one** "dedicated charger" aligned to cross-tied DC buses, or
   - the "swing battery charger" aligned to cross-tied DC buses.

APPLICABLE SAFETY ANALYSES

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

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and 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

BASES (continued)

APPLICABLE SAFETY ANALYSES

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 the NRC Policy Statement.

LCO

Each DC electrical power train, consisting of two batteries (unless cross connected per LCO 3.8.10), the required charger for each per battery, and the corresponding control equipment and interconnecting cabling within the train, are required to be OPERABLE to support required trains of distribution systems required OPERABLE by LCO 3.8.10, "Distribution Systems - Shutdown." This ensures the availability of sufficient DC electrical power sources to maintain the unit in a safe shutdown condition 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 mitigate a fuel handling accident are available;

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

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

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

ACTIONS

A.1, A.2 and A.3

Condition A represents one train with one or two required battery chargers or associated control equipment or cabling inoperable (e.g., the battery 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 the required charger(s) to OPERABLE status in a reasonable time period.

BASES (continued)

ACTIONS

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

Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring 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 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. 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 shutdown of refueling activities.

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.

The charger operating in the current limit mode in excess of 2 hours 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).

BASES (continued)

ACTIONS

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

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 initial 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.

Required Action A.3 limits the restoration time for the required battery charger to 7 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., balance of plant non-Class 1E battery charger). The 7-day Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

B.1

With the required DC electrical power subsystem battery charger or associated control equipment or cabling outside the allowances of the Required Actions for Condition A, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery must be declared inoperable immediately.

C.1, C.2.1, C.2.2, C.2.3, C.2.4

Condition C represents one or more required DC electrical power subsystem(s) inoperable for reasons other than Condition A. The ACTIONS provide a tiered response allowing the option to declare required features inoperable immediately with the associated DC power source(s) inoperable.

If two trains are required per LCO 3.8.10, the remaining train with DC power available may be capable of supporting sufficient systems to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare required features inoperable with the associated DC power source(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCO ACTIONS. In many instances, this option may

BASES (continued)

ACTIONS

C.1, C.2.1, C.2.2, C.2.3, C.2.4 (continued)

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 states that Surveillances required by SR 3.8.4.1 through SR 3.8.4.3 are applicable in these MODES. See the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged below their capability to provide the required power supply or otherwise rendered inoperable during the performance of SRs. It is the intent that these SRs must still be capable of being met, but actual performance is not required.

Verification of the battery terminal voltage and battery charger output amps is addresses by LCS 3.8.105.

REFERENCES

1. UFSAR, Chapter 6.
2. UFSAR, Chapter 15.

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 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 licensee controlled program also implements a program specified in Administrative Controls Section 5.5.2.16 for monitoring various battery parameters that is based on recommendations of IEEE Standard 450-2002, "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 120 V for a 58-cell battery (i.e., cell voltage of 2.065 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 ≥ 2.065 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 of 2.20 to 2.28 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge. The nominal float voltage of 2.267 Vpc corresponds to a total float voltage output of 131.5 V for a 58-cell battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature 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.

BASES (continued)

APPLICABLE SAFETY ANALYSES (continued)

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 at least one train of 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.

Battery parameters satisfy Criterion 3 of the NRC Policy Statement.

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 preventative maintenance, testing, and monitoring performed in accordance with the Licensee Controlled Specifications 3.8.104, 3.8.105, and 3.8.106 is conducted as specified in Administrative Controls Section 5.5.2.16.

APPLICABILITY

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

ACTIONS

<u>A.1, A.2, and A.3</u>

A battery cell is degraded when the cell float voltage is <2.07 V. A battery bank may not be degraded with one or more degraded battery cells. Within 2 hours, verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage (perform SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (perform SR 3.8.6.1). This assures that there is still sufficient battery capacity to

BASES (continued)

ACTIONS

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

perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells in one or more batteries <2.07 V, and continued operation is permitted for a limited period up to 24 hours per Required Action A.3.

Since the Required Actions of A.1 and A.2 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 Condition(s), depending on the cause of the failures, is entered. If SR 3.8.6.1 is failed then there is not assurance that there is still sufficient battery capacity to perform the intended function and the battery must be declared inoperable immediately.

B.1 and B.2

One or two batteries in one train with float current of >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. Verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage within 2 hours (perform 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. The charger operating in the current limit mode after 2 hours 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.

BASES (continued)

ACTIONS

B.1 and B.2 (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 there is a 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 a 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 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 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 or two batteries on one train with one or more cells with 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. Electrolyte level limits are visually indicated on each cell via minimum and maximum electrolyte level lines. 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 Administrative Controls Section 5.5.2.16, Battery Monitoring and Maintenance Program). Verification of electrolyte level below the top of the plates, per Administrative Controls Section 5.5.2.16.c, is addressed by LCS 3.8.106.

BASES (continued)

ACTIONS

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

The Required Actions are modified by two Notes: Note 1 indicates that Required Actions C.1 and C.2 are only applicable if electrolyte level is below the top of the plates. Within 8 hours, the electrolyte level is required to be restored to above the top of the plates. Note 2 indicates that Required Action C.2 must be completed if electrolyte level was below the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Administrative Controls Section 5.5.2.16.c 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(ies) may have to be declared inoperable and the affected cells replaced.

D.1

With one or two batteries on one train with pilot cell temperature less than the minimum established design limit, 12 hours is allowed to restore the temperature to within limits. 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.

BASES (continued)

ACTIONS (continued)

E.1

With one or more batteries in redundant trains 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 their required function, given that redundant batteries are involved. With redundant batteries involved this potential could result in a 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 train within 2 hours.

F.1

With one or more batteries 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 one or more batteries in one train with one or more battery cells with 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.

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 and the 7-day frequency is consistent with battery vendor recommendation.

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 $\leq$ 2 amps is established based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

BASES (continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.6.2 and SR 3.8.6.5

SRs 3.8.6.2 and 3.8.6.5 require verification that the pilot or connected cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V. Optimal long-term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge, which could eventually render the battery inoperable. Float voltage less than the administrative limit, but greater than 2.07 Vpc, is addressed in LCS 3.8.106 as required by Administrative Controls Section 5.5.2.16. 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 administrative limit for cell minimum voltage is specified in LCS 3.8.106.

SR 3.8.6.3

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintain adequate electron transfer capability. The minimum established design limit is the minimum mark on the cell jar, which is above the top of the plates. The 31-day frequency is consistent with IEEE-450 (Ref. 3). Battery cells with electrolyte level below the top of the plates are addressed in LCS 3.8.106.

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit, which is specified in LCS 3.8.106. 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 31-day frequency is consistent with IEEE-450 (Ref. 3).

BASES (continued)

SURVEILLANCE REQUIREMENTS (continued)

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. For 1800 AH rated batteries, the modified performance test will use the combined duty cycle of the cross-connected subsystems.

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 for the 1800 AH rated batteries.

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 is conducted in accordance with IEEE 450-2002 Annex I.3. 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. 4). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is <100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that have 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 ≥ 10% below the manufacturer's rating. These frequencies are consistent with the recommendations in IEEE-450 (Ref. 3).

At SONGS, 2 spare cells are normally maintained qualified by installing them in the same seismic battery rack where 58 active cells reside, kept on float charge and inspected by regular Preventive Maintenance (PM). The spare cells are included during battery testing of the 60-cell battery bank to demonstrate their adequacy under the configuration conditions that would be present if they were required for use.

If for any reason a battery has to undergo a service and performance test (e.g., one following the other during scheduled maintenance testing), the service test shall be completed first. Recharging of the battery is requied before the performance test is conducted. The "as found" condition prior to the performance test is state of the battery immediately prior to the performance test.

REFERENCES

1. UFSAR, Chapter 6.

2. UFSAR, Chapter 15.

3. IEEE-450-2002.

4. IEEE-485-1997.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.9 Distribution Systems — Operating

BASES

BACKGROUND

The onsite Class 1E AC, DC, and AC vital bus electrical power distribution systems are divided by train into redundant and independent AC, DC, and AC vital bus electrical power distribution subsystems.

The AC primary electrical power distribution system consists of two 4.16 kV Engineered Safety Feature (ESF) buses, each having at least one separate and independent offsite source of power as well as a dedicated onsite diesel generator (DG) source. Each 4.16 kV ESF bus is normally connected to a preferred offsite source. After a loss of the preferred offsite power source to a 4.16 kV ESF bus, a transfer to the alternate offsite source is accomplished by utilizing a time delayed bus undervoltage relay. If all offsite sources are unavailable, the onsite emergency DG supplies power to the 4.16 kV ESF bus. Control power for the 4.16 kV breakers is supplied from the Class 1E batteries. Additional description of this system may be found in the Bases for LCO 3.8.1, "AC Sources—Operating," and the Bases for LCO 3.8.4, "DC Sources—Operating."

The 120 VAC vital buses are arranged into four channels and each channel is normally powered from its own channel inverter. The alternate power supply for the vital buses are Class 1E constant voltage source transformers powered from one of the trains in the same load group (one transformer per load group), and its use is governed by LCO 3.8.7, "Inverters – Operating." Each constant voltage source transformer is powered from a Class 1E AC bus.

There are four independent 125 VDC electrical power distribution subsystems (two for each Train A and B). Background detail for the DC System is found in the Bases for LCO 3.8.4, "DC Sources – Operating " and the Bases for LCO 3.8.6, "Battery Parameters."

The Class 1E AC electrical power distribution system for each train and the list of all required distribution buses are presented in Table B 3.8.9-1.

BASES (continued)

BACKGROUND (continued)

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

TYPE	VOLTAGE	TRAIN A		TRAIN B	
AC safety buses	4160 V	ESF Bus A04		ESF Bus A06	
	480 V	Load Center B04		Load Center B06	
DC buses	125 V	SUBSYSTEM A	SUBSYSTEM C	SUBSYSTEM B	SUBSYSTEM D
		Bus D1 from battery B007 and required battery charger	Bus D3 from battery B009 and required battery charger	Bus D2 from battery B008 and required battery charger	Bus D4 from battery B010 and required battery charger
AC vital buses	120 V	CHANNEL A	CHANNEL C	CHANNEL B	CHANNEL D
		Bus Y01 from inverter Y001 connected to bus D1	Bus Y03 from inverter Y003 connected to bus D3	Bus Y02 from inverter Y002 connected to bus D2	Bus Y04 from inverter Y004 connected to bus D4

-----NOTES-----

(1) If a support system (e.g., charger or inverter) is declared inoperable and it has its own LCO, entry into LCO 3.8.9 is not required. Only entry into its LCO is required.

(2) An OPERABLE Class 1E battery bank B00X (1800 AH rated) may replace B007, B008, B009, or B010 battery to allow battery maintenance (including replacement) activities.

(3) The "required battery charger" is described in the Bases for LCO 3.8.4, "DC Sources – Operating" and LCO 3.8.5, "DC Sources – Shutdown."

(4) Subsystems A and C (or B and D) share a battery and battery charger(s) when buses D1 and D3 (or D2 and D4) are cross-connected as described in the bases of LCO 3.8.4, "DC Sources – Operating."

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.10 Distribution Systems — Shutdown

BASES

BACKGROUND

A description of the AC, DC, and AC vital bus electrical power distribution systems is provided in the Bases for LCO 3.8.9, "Distribution Systems—Operating" and the Bases for LCO 3.8.5, "DC Sources - Shutdown."

APPLICABLE SAFETY ANALYSES

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

The OPERABILITY of the AC, DC, and AC vital bus electrical power distribution system is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum AC, DC, and AC vital bus electrical power distribution subsystems during MODES 5 and 6 ensures that:

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

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

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

The AC and DC electrical power distribution systems satisfy Criterion 3 of the NRC Policy Statement.

BASES (continued)

LCO

Various combinations of subsystems, equipment, and components are required OPERABLE by other LCOs, depending on the specific unit condition. Implicit in those requirements is the required OPERABILITY of necessary support required features. This LCO explicitly requires energization of the portions of the electrical distribution system necessary to support OPERABILITY of required systems, equipment and components—all specifically addressed in each LCO and implicitly required via the definition of OPERABILITY.

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

Same-train DC subsystem Buses may be cross-tied to an 1800 AH rated battery. This alignment allows both subsystems to remain OPERABLE. There is no time limit to the duration DC subsystem buses may be cross-tied with the Unit shutdown. An 1800 AH rated battery has sufficient capacity to allow both of the associated vital bus inverters to remain OPERABLE. The "required charger" with the Unit shutdown is described in the Bases for LCO 3.8.5, "DC Sources - Shutdown."

APPLICABILITY

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

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

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

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

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

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

BASES (continued)

ACTIONS

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

Although redundant required features may require redundant trains of electrical power distribution subsystems to be OPERABLE, one OPERABLE distribution subsystem train may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare required features associated with an inoperable distribution subsystem inoperable, appropriate restrictions are implemented in accordance with the affected distribution subsystems LCO's Required Actions. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions that could result in loss of required SDM (Mode 5) or boron concentration (Mode 6)). Suspending positive reactivity additions that could result in failure to meet the minimum SDM or boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than what would be required in the RCS for minimum SDM or refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation. Introduction of temperature changes including temperature increases when operating with a positive MTC must also be evaluated to ensure they do not result in a loss of required SDM.

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

Notwithstanding performance of the above conservative Required Actions, a required shutdown cooling (SDC) subsystem may be inoperable. In this case, these Required Actions of Condition A do not adequately address the concerns relating to coolant circulation and heat removal. Pursuant to LCO 3.0.6, the SDC ACTIONS would not be entered.

BASES (continued)

ACTIONS	A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5 (continued) Therefore, the Required Actions of Condition A direct declaring SDC inoperable, which results in taking the appropriate SDC actions. The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required distribution subsystems should be completed as quickly as possible in order to minimize the time the unit safety systems may be without power.
SURVEILLANCE REQUIREMENTS	SR 3.8.10.1 This Surveillance verifies that the AC, DC, and AC vital bus electrical power distribution system is functioning properly, with all the buses energized. The verification of proper voltage availability on the buses ensures that the required power is readily available for motive as well as control functions for critical system loads connected to these buses. The 7-day frequency takes into account the redundant capability of the electrical power distribution subsystems and other indications available in the control room that alert the operator to subsystem malfunctions.
REFERENCES	1. UFSAR, Chapter 6. 2. UFSAR, Chapter 15.

ATTACHMENT G.2

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Proposed Licensee Controlled Specifications pages
(for information only), Unit 2

3.8 ELECTRICAL POWER SYSTEMS

LCS 3.8.104 DC Sources — Operating

The Train A and Train B DC electrical power subsystems shall be OPERABLE.

VALIDITY STATEMENT: Rev. 0 effective 00/00/07, to be implemented within 90 days

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

ACTIONS

---------------------------------------NOTE---------------------------------------
Separate Condition entry is allowed for each subsystem battery.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SR 3.8.104.1 not met	A.1 Enter LCO 3.8.4.A	Immediately
B. SR 3.8.104.2 not met	B.1 Initiate Action Request.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.104.1 Verify battery terminal voltage is ≥ 129.0 V.	SR 3.8.4.1 (7 days)
SR 3.8.104.2 Verify each required battery charger output is < rated amps with float voltage ≥ 131.0 V.	31 days

3.8 ELECTRICAL POWER SYSTEMS

LCS 3.8.105 DC Sources—Shutdown

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

VALIDITY STATEMENT: Rev. 0 effective 00/00/07, to be implemented within 90 days

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

ACTIONS

-----------------------------------NOTE-----------------------------------
Separate Condition entry is allowed for each subsystem battery.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SR 3.8.105.1 not met	A.1 Enter LCO 3.8.5A	Immediately
B. SR 3.8.105.2 not met	B.1 Initiate Action Request.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.105.1	Verify required battery terminal voltage is ≥ 129.0 V.	SR 3.8.4.1 (7 days)
SR 3.8.105.2	Verify each required battery charger output is < rated amps with float voltage ≥ 131.0 V.	31 days

3.8 ELECTRICAL POWER SYSTEMS

LCS 3.8.106 Battery Parameters

Battery parameters for the Train A and Train B batteries shall be within limits.

VALIDITY STATEMENT: Rev. 0 effective 00/00/07, to be implemented within 90 days

APPLICABILITY: When the batteries are required to be OPERABLE.

ACTIONS

-------------------------------------NOTE-------------------------------------
Separate Condition entry is allowed for each subsystem battery.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SR 3.8.106.1 or SR 3.8.106.2 not met	A.1 Initiate Action Request	8 hours
B. SR 3.8.106.3 not met	B.1 Remove affected cell(s) from the connected cells <u>OR</u> B.2 Equalize and test the affected cell(s) per the manufacturer's recommendation.	24 hours <u>OR</u> 48 hours
C. SR 3.8.106.4 not met	C.1 Initiate Action Request	8 hours
D. SR 3.8.106.5 or SR 3.8.106.7 not met	D.1 Enter LCO 3.8.6 Condition D	Immediately
E. SR 3.8.106.6 or SR 3.8.106.8 or SR 3.8.106.9 or SR 3.8.106.10 or SR 3.8.106.11 not met	E.1 Initiate Action Request	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.106.1	Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration or cracks in cells or evidence of electrolyte leakage.	31 days
SR 3.8.106.2	Verify no visible corrosion at terminals and connectors. <u>OR</u> Perform SR 3.8.106.10.	31 days
SR 3.8.106.3	Verify electrolyte level is above the top of the plates.	SR 3.8.6.3 (31 days)
SR 3.8.106.4	Verify battery pilot cell voltage is ≥ 2.13 V.	SR 3.8.6.2 (31 days)
SR 3.8.106.5	-------------------NOTE------------------- Maintain electrolyte temperature ≥ 50°F for batteries rated 1800 AH that are not cross-connected or ≥ 60°F for batteries rated <1800 AH or batteries that are cross-connected. -- Verify the electrolyte temperature for each battery pilot cell (cell averaging not allowed) is above the limit specified in the NOTE above.	SR 3.8.6.4 (31 days)
SR 3.8.106.6	Verify battery connected cell voltage is ≥ 2.13 V.	SR 3.8.6.5 (92 days)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.106.7	-------------------NOTE------------------- Maintain electrolyte temperature ≥ 50°F for batteries rated 1800 AH that are not cross-connected or ≥ 60°F for batteries rated <1800 AH or batteries that are cross-connected. -- Verify the average electrolyte temperature for the specified connected battery cells is above the limit specified in the NOTE above. 10% of connected cells AND All connected cells	 92 days AND 12 months
SR 3.8.106.8	-------------------NOTE------------------- Specific gravity needs to be corrected for electrolyte temperature and level. Level correction is not required, however, when battery charging is ≤ 2 amps when on float charge. -- Verify the specific gravity for each connected battery cell is ≥ 1.200.	 12 months
SR 3.8.106.9	Perform, to the extent possible, a detailed visual inspection of the battery installation in accordance with IEEE 450-2002, Annex E.	12 months
SR 3.8.106.10	Verify connection resistance is ≤ 150×10^{-6} ohm for each inter-cell, inter-rack, inter-tier, and terminal connection.	12 months
SR 3.8.106.11	Verify each battery float current is within the vendor recommended limiting current: > 0 and ≤ 0.75 amps for 1260 AH rated batteries and > 0 and ≤ 1.5 amps for 1800 AH rated batteries.	SR 3.8.6.1 (7 days)

ATTACHMENT H

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

List of Regulatory Commitments

List of Regulatory Commitments

1. Relocate the requirements of existing Surveillance Requirements (SRs) 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 from the Technical Specifications to the Licensee Controlled Specifications (LCS).

2. Appropriate design features will be added to measure float charging current when a swing battery charger is aligned to a Class 1E subsystem battery.

3. Promulgate LCS for upgrade of the battery maintenance practices to conform to industry standard IEEE 450.

ATTACHMENT I

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

PRA Evaluation

OBJECTIVE

The objective of this risk-informed analysis is to support an extension of the Completion Time (CT) of Technical Specification (TS) 3.8.4 for San Onofre Nuclear Generating Station (SONGS) 2/3 1E DC Power System.

BACKGROUND

The SONGS 125V DC Class 1E (1E) batteries have a design life of 20 years. IEEE Standard and NRC regulations require batteries to be tested annually when a battery reaches 85% of service life or falls below 90% of its rated capacity. These batteries will approach their 85% service life within the next two fuel cycles and some batteries are approaching their 90% capacity. In order to avoid the need for annual tests that cannot be completed online within the current CT, SONGS is replacing these batteries.

In addition to replacing 1E DC batteries, the 1E DC power system is to be upgraded to include the capability to 1) cross-tie subsystems A and C (as well as sub-systems B and D) when a battery is removed from service, and 2) align a permanently installed swing charger (one for each train) to either of two DC buses on a single train. The first added feature permits an operator to align two DC buses from the same train together and remove a battery from service for testing or maintenance. This configuration would allow all four DC buses to remain energized with sufficient battery support. The second added feature permits online battery charger testing or maintenance by first aligning the swing battery charger to the supported bus.

The proposed technical specification change would permit a battery to be removed for up to 30 days provided that the supported DC bus is realigned within 2 hours via the new cross-tie capability to its companion same train bus that is supported by a battery. For example, prior to removing battery B007 from bus D1, D1 is to be cross-tied to bus D3 that is supported by battery B009.

This analysis evaluates the increase in risk between the normal alignment and the maintenance alignment with a battery removed from service and the upgraded realignments implemented.

This allowed outage time extension request is unique because the out-of-service component is to be replaced by a designed and installed 'compensatory' measure. The compensatory measure is an alternate power source that can meet the functional requirements of the unavailable component. Without the alternate power source, the TS extension is not allowed and the TS reverts to a format that is effectively the same as the current allowed outage time of 2 hours.

METHODOLOGY

This analysis is performed consistent with the requirements of Regulatory Guides (RG) 1.174 and 1.177 [1,2]. The SONGS 2/3 Living Probabilistic Risk Assessment (PRA) is modified to reflect the proposed design change to the 1E DC system. The modified model is used for all calculations.

Regulatory Guide 1.177:

Regulatory Guide 1.177 requires the licensee to demonstrate that the proposed TS CT change has only a small quantitative impact on plant risk. An incremental conditional core damage probability (ICCDP) of less than 5.0E-7 is considered small for a single TS CT change. An incremental conditional large early release probability (ICLERP) of less than 5.0E-8 is also considered small. As defined in RG 1.177,

ICCDP* = [(conditional CDF[1] with the subject equipment out of service) – (baseline CDF with subject equipment in service)] X (duration of the single CT under consideration)

ICLERP* = [(conditional LERF[2] with the subject equipment out of service) – (baseline LERF with subject equipment in service)] X (duration of the single CT under consideration)

*nominal maintenance unavailabilities are assumed for all other equipment

To demonstrate that the change in risk is small for TS 3.8.4, ICCDP and ICLERP are calculated for a battery out-of-service as follows:

$ICCDP_{battery}$ = [(conditional CDF with a battery out of service) – (baseline CDF with battery available)] X (1 year/365 days) X (30 days) [1]

$ICLERP_{battery}$ = [(conditional LERF with a battery out of service) – (baseline LERF with battery available)] X (1 year/365 days) X (30 days) [2]

These calculations are performed for preventive and corrective maintenance and compared to the RG 1.177 guidelines. Since the allowed outage time extensions are to be applicable to all four electrical sub-systems, calculations should be performed for all four sub-systems. However, to simplify the analysis, the most bounding sub-system is determined and all subsequent calculations are based on the bounding case.

Regulatory Guide 1.174:

The anticipated changes in overall annual core damage frequency (CDF) and large early release frequency (LERF) are calculated and compared to the risk acceptance guidelines in Figures 3 and 4 of RG 1.174. This is calculated using an expected annual frequency and duration of corrective and preventive maintenance multiplied by the CDF/LERF with the subject component out-of-service.

PRA Model:

The SONGS 2/3 Living PRA (as of November 3, 2003) is modified to reflect the proposed design change to the 1E DC system. All calculations are performed with this modified model.

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[1] Core Damage Frequency (CDF)
[2] Large Early Release Frequency (LERF)

ANALYSIS

The proposed design change only impacts the electrical power system fault tree of the SONGS 2/3 Living PRA. The expected usage of the extended allowed outage time is provided by the electrical engineering group within the SONGS Maintenance Engineering Division and listed in Table 1.

The relevant calculations are performed with the following notes and assumptions.

Notes and Assumptions:

1. As part of the proposed design change, each battery is to be replaced with one of a larger capacity. By design, each new 1800 amp-hour (AH) rated 1E DC battery, while cross-connected, will supply sufficient power to support two 1E DC buses. For example, when bus D1 is cross-connected to D3 with Battery B007 removed from service, Battery B009 can meet the concurrent design load requirements for both DC buses D1 and D3.

2. When performing preventive maintenance of a battery, the cross-connect between buses is completed prior to removing the battery from service (i.e., 'make before break'). The probability of operator failure to properly align the cross-tie is zero. If the action is unsuccessful, the TS action to align the cross-tie within two hours will not have been met and therefore the extension to 30 days is not permitted. The order of restoration of the battery to the bus is done in reverse (i.e., the battery breaker is closed to the bus prior to opening the cross-tie breakers).

3. Emergent unavailability (i.e., corrective maintenance) of a battery requires operators to perform local actions to close breakers to cross-connect buses. If the alignment is not performed within 2 hours or performed incorrectly, then the TS action to align has not been met and the extension to 30 days is not permitted. Only when the alignment is properly performed is the extension to 30 days granted. Once aligned, the 1E DC system is identical to the preventive maintenance alignment. Therefore, except for common-cause failure probability considerations, the corrective maintenance calculation is similar to the preventive maintenance calculation.

4. The PRA model reflects the proposed design as described in Document 90090, "Scope: Replacement of Class 1E Batteries And Associated Equipment," SONGS Design Engineering, June 2003.

5. Test and preventive maintenance activities on a battery are assumed not to increase the likelihood of any additional events.

6. All common-cause failures (CCF) of 1E 125VDC batteries have been modeled along with CCF of all battery chargers (including dedicated and swing chargers).

7. Credit for cross connecting DC buses is limited to maintenance activities. Without post-initiator specific procedures, credit for successful post-initiator alignment of the DC bus cross-tie is difficult to assess. Although such credit would improve the baseline risk (i.e., reduce risk), this improvement is minimal since the likelihood of post-initiator failure of a battery is extremely small.

8. Components other than the affected battery are set to their nominal maintenance unavailabilities.

Data Analysis:

Modifications to the model include the addition of 125V circuit breakers, swing battery chargers and upgraded batteries. Since these added components are generically similar to components already existing in the model, it is reasonable to use the same failure data of similar components already in the Living PRA. Therefore, data found in the Living PRA for failures of circuit breakers, battery chargers, and batteries are applicable to the new breakers, batteries, and battery chargers. Probabilities for common-cause failures are adjusted to account for the added components.

The initiating event frequencies for fire are increased for rooms containing DC bus D1 and D2 to account for the addition of the swing battery chargers B021 and B022, respectively, which provide an additional fire source in those rooms. Therefore, the fire frequencies in these rooms increase from 2.1E-5/yr to 4.2E-5/yr.

<u>Maintenance Data</u>:

Table 1 shows the expected maintenance activities for batteries. The activities are shown with the expected frequency and duration. The shaded activities are those activities that require the cross-tie and therefore require entry into TS 3.8.4 action statement. This data is used to assess the expected annual risk impact for comparison to risk acceptance guidelines in RG 1.174.

Table 1
List of Battery Maintenance Activities

Batteries – Preventive Maintenance	Requires Cross-tie? (yes/no)	Frequency	Duration
Pilot cell re-designation	No	Annual	1 hr/battery
Spare cell inspections	No	0.5/year	2 hrs/battery
Monthly battery inspection	No	Monthly	1 hr/battery
Quarterly battery inspection	No	Quarterly	8 hr/battery
Physical inspection of battery	No	Annual	8 hrs (or 1 shift)/battery
Equalize charge	No	Annual	7 days/battery
Single cell equalize charge	No	4-8 years	7 days/battery
Acid adjustment on low specific gravity cells	No	4-8 years	1 day/battery
Performance or Modified Performance Test	Yes	5 years	7 days/battery
Service Test	Yes	2.5 years	7 days/battery
Proactive replacement of battery and battery rack	Yes	15-20 years	30 days/battery
Proactive replacement of multiple jars	Yes	10 years	~~21~~ 20 days/ battery

Human Reliability Analysis (HRA):

The additional operator actions required for this design change are:

Basic Event	Operator Action Description
U-HCD1TOD3-V	Operator Fails To Cross-tie Bus D1 and D3 (Train A)
U-HCD2TOD4-V	Operator Fails To Cross-tie Bus D2 and D4 (Train B)

This design change also required the addition of operator actions to align the swing battery charger. The likelihood of operator failure to align the swing battery charger in the base and maintenance cases was set to 1.0 (i.e., no credit for swing battery chargers).

When performing preventive maintenance on a battery, operators will align the crosstie to the other bus prior to removing the battery to be serviced (also known as "make before break"). Pre-alignment of the crosstie will be proceduralized and successfully implemented prior to removing equipment from service and entering the TS 3.8.4 action statement. Since a revised TS 3.8.4 would allow a CT extension to 30 days only if the bus cross-tie is closed within 2 hours, alignment failure precludes a CT extension. That is, the extension to operate in the cross-tied alignment for 30 days is permitted only upon successful alignment of the alternate power source. Therefore, during preventive maintenance, the probability of failure for operator actions to align the alternate power source is set to zero.

Common-Cause Failure (CCF) Analysis:

Common-cause failures of swing and dedicated battery chargers are directly modeled in the electrical power system fault tree and quantified using the alpha factor method [5]. Common-cause failure of cross-tie and swing battery charger breakers is not required since the breakers are operated in series where a single breaker failure is sufficient to fail power from the alternate source. Common-cause failure modeling for batteries is included in the base model. The CCF probabilities for batteries are not modified for the preventive maintenance case. CCF probabilities for batteries are modified upward, however, for corrective maintenance of a battery. Modifications are necessary since an emergent battery failure may impact other batteries due to common failure mechanisms.

Uncertainty Analysis:

Parameter uncertainty calculations were not performed since the base case CDF and LERF are essentially the same as those calculated when either buses A and C or B and D are cross-tied. This expectation is similarly stated in Section 2.3.5 of Regulatory Guide 1.177. Modeling uncertainties were assessed via sensitivity analysis of key assumptions. This is described in more detail in the following sensitivity analysis section.

Sensitivity Analysis:

Sensitivity analysis was addressed in several areas: cull level, operator action, bounding sub-system and operation in Modes 2 - 4. These areas are discussed specifically below.

Cull Level: Analyses to assess sensitivity to cull level for both CDF and LERF were performed. The base analysis was performed at a cull level of 5E-10/yr and 5E-11/yr for CDF and LERF, respectively. Sensitivity runs for CDF with cull levels of 1E-10/yr and 1E-11/yr were performed. Similar runs for LERF were performed at 1E-11/yr and 1E-12/yr. The calculated CDF/LERF and increase in baseline CDF/LERF are very small and less than 1E-7/yr and 1E-8/yr, respectively. Reducing the cull levels did not change the single AOT risk from that calculated using a cull level of 5E-10/yr (CDF) and 5E-11/yr (LERF).

Operator Action: Sensitivity analysis on operator action values was not performed for alignments. Operator actions to align the cross-tie to another DC bus to perform preventive maintenance were assumed to be successful since alignment must be successful prior to removing equipment for preventive maintenance (i.e., also known as "make before break"). Successful alignment will be based on an approved step-by-step procedure with independent verification (second checker). Also, the completion time extension to 30 days is dependent on successful alignment to the other bus within 2 hours. If successful alignment is not or cannot be performed in 2 hours, then the extension is not permitted and the allowed outage time remains at 2 hours (as it is in the current TS). Therefore, since operator success is a condition of the extension, no sensitivity analysis is required.

Bounding Sub-system: To determine the most limiting of the four sub-systems to be assessed for this application, sensitivity calculations were performed to assess which sub-system, when aligned to its alternate power source, would result in the highest risk increase. The differences in the core damage and large early release frequencies between each of the sub-systems were calculated to be very small and insignificant. Therefore, sub-system A was arbitrarily chosen for all calculations.

Impact of Peer Review Comments: Sensitivity calculations were performed in response to several facts and observations (F & O's) from the pilot peer review of the SONGS 2/3 Living PRA against the ASME PRA Standard [4]. These sensitivity analyses are discussed in the PRA Quality Section.

Operations in Modes 2 – 4: The requested TS is applicable in Modes 1 – 4. Although it is unlikely that SONGS would operate in Mode 2 – 4 for 30 days, sensitivity calculations were also performed for Modes 2 – 4. The results are provided in the following Table:

		CDF base	CDF maint	delta CDF	ICCDP	LERF base	LERF maint	delta LERF	ICLERP
Mode 2	**startup**	3.457E-05	3.458E-05	1E-8	8E-10	1.226E-06	1.226E-06	<1E-9	<1E-10
Mode 3	**Hot Standby**	2.786E-05	2.786E-05	<1E-9	<1E-10	7.702E-07	7.702E-7	<1E-10	<1E-11
Mode 4	**AFW cooling (no TDAFWP)**	5.014E-05	5.030E-05	1.6E-7	1E-08	3.037E-06	3.037E-06	<1E-9	<1E-10

In Modes 2 – 4, the ICCDP and ICLERP are consistent with RG 1.177 risk acceptance guidelines of 5E-7 and 5E-8 for ICCDP and ICLERP, respectively. Calculation of impact on an annual frequency (for comparison with RG 1.174 acceptance guidelines), based on intended annual usage, was not performed since the AOT extension is not expected to be used in Modes 2 - 4.

PRA QUALITY:

PRA Adequacy Determination Process:

PRA adequacy refers to 1) baseline PRA model quality and 2) adequacy of the PRA calculation for the application.

Determination of baseline PRA technical quality/adequacy is based on assessing the current quality status of the SONGS 2/3 PRA as reviewed in a number of cumulative quality PRA reviews over recent years. Most recently, the SONGS 2/3 PRA was reviewed against the ASME PRA standard [3]. This review identified a number of ASME PRA Standard supporting requirements that are less than capability category II. This peer review provides insight into the current quality status of the SONGS 2/3 PRA.

The technical adequacy of the PRA for the application is based on an assumption that a capability category II for all supporting requirements is inherently sufficient to meet adequacy requirements for risk-informed applications, including risk-informed CT applications. In cases where a peer review has identified supporting requirements as less than capability category II, then technical adequacy for the application is deemed sufficient when the peer review 'facts & observations,' that are the basis of the reduced capability category determination, can be shown to have little or no impact on the calculated results and no impact on the decisions and conclusions of the application. The assessment of impact is addressed by either 1) sensitivity calculations or 2) bounding risk-informed arguments.

Baseline PRA Adequacy:

Several measures have been implemented in the development of the SONGS 2 and 3 Living PRA to ensure quality. Changes in the model that impact assumptions, success criteria, basic event probabilities, and system and plant models formally undergo several levels of review, and depending on the complexity of the change, may also include peer and/or technical expert panel review.

A comprehensive independent peer review of the SONGS 2 and 3 Level 1 and Level 2 internal events living PRA for full power and shutdown operations was conducted between August 1996 and April 1997 by an outside consultant (Scientech, Inc.). During this review, documents, procedures, and supporting calculations and analyses were examined. The review was based primarily on the guidance provided in the PRA procedure guides such as NUREG/CR-2300, "PRA Procedures Guide: A Guide to the Performance of PRAs for Nuclear Power Plants," and NUREG/CR-4550, Revision 1, "Analysis of Core Damage Frequency," as well as PRA applications documents such as EPRI TR-105396, "PSA Applications Guide," and NUREG-1489, "Review of NRC Staff Uses of PRA." The results of all independent review activities performed by internal and external reviewers were documented in the SONGS PRA Change Package process and tracked in the PRA Punch List Database. In June 2003, a pilot application of the ASME PRA Standard peer review process for the SONGS 2/3 Living PRA was performed [4]. The results of this pilot application are documented in WCAP-16165 Rev. 0 [3].

Adequacy Of The PRA Calculation For The Application:

The ASME peer review team provided a list of comments (known as 'facts and observations' or F & O's). These F & O's were identified based on a review of the SONGS 2/3 Living PRA versus the high level and supporting requirements of the ASME PRA Standard. Each F & O was graded based on the type of finding (i.e., technical adequacy or correctness, editorial, suggestion, or complementary). Seventy-five (75) comments are of type A/B. By definition, A/B F & O's are:

"Important and necessary to address to assure the technical adequacy of the PRA, the capability of the PRA or the robustness of the PRA update process."

All type A/B F & O's (75) were reviewed for possible impact on the results and conclusions of this report. These F & O's cover supporting requirements with all capability categories. Almost all SRs with capability category of less than II have an associated F & O. Ten F & O's were determined to potentially have an impact on the results and are included at the end of this attachment. Sensitivity calculations were performed on each of these ten F & O's. The results of these calculations show that none of the F & O's impact the results or conclusions.

There are three (3) supporting requirements with capability category I that did not have an associated F & O from the peer review. These three supporting requirements were assessed to determine the impact, if any, on the application.

Supporting Requirement AS-A9:

Capability Category I	Capability Category II
USE generic thermal hydraulic analyses (e.g., as performed by a plant vendor for a class of similar plants) to determine the accident progression parameters (e.g., timing, temperature, pressure, steam) that could potentially affect the operability of the mitigating systems.	**USE realistic, applicable (i.e., from similar plants) thermal hydraulic analyses** to determine the accident progression parameters (e.g., timing, temperature, pressure, steam) that could potentially affect the operability of the mitigating systems.

SONGS uses plant-specific thermal/hydraulic (T/H) analyses (MAAP and RETRAN) in lieu of generic design basis T/H analyses when such analyses is deemed overly conservative. SCE believes that the SONGS living PRA meets capability category II for the supporting requirements. Additionally, more extensive use of realistic, applicable T/H analyses would equally impact the base and maintenance (cross-tied) calculations for the application. Therefore, capability category I for this supporting requirement is considered sufficient for this application.

Supporting Requirement DA-C10:

Capability Category I	Capability Categories II & III
When using surveillance test data, REVIEW the test procedure to determine whether a test should be credited for each possible failure mode. COUNT only completed tests or unplanned operational demands as success for component operation.	When using surveillance test data, REVIEW the test procedure to determine whether a test should be credited for each possible failure mode. COUNT only completed tests or unplanned operational demands as success for component operation. **If the component failure mode is decomposed into sub-elements (or causes) that are fully tested, then USE tests that exercise specific sub-elements in their evaluation. Thus, one sub-element sometimes has many more successes than another**

The requirements for capability category II, as written, state that if the component failure mode is decomposed, then the PRA should include those tests that exercise the specific elements. Since decomposing failure modes into sub-elements is not required, it could be argued that SONGS does in fact meet capability category II. Interpretation notwithstanding, rigorous decomposition of failure modes would be applicable to both the base and maintenance cases and therefore are equally affected by it. Consequently, capability category I for this supporting requirement is considered acceptable for this application.

Supporting Requirement QU-D3:

Capability Category I	Capability Categories II & III
No requirement to compare results to those from similar plants	COMPARE results to those from similar plants and IDENTIFY causes for differences in significant contributors.

SCE believes that the SONGS 2/3 Living PRA meets capability category II/III. A comparison of PRA cutsets and dominant contributors for all Combustion Engineering (CE) pressurized water reactors (PWRs) was performed and documented in CE NPSD-1029, Supplement 1, "Summary Report for Comparison of PSA Cutsets for Dominant Contributors for CE PWRs, Phase 5, CEOG Task 1046." San Onofre's results compare favorably with similar CE plants.

RESULTS:

Table 2 provides results for removing a 1E DC battery for preventive maintenance. Lines 4 and 5 show CDF/LERF results when a battery is out of service (OOS) and in-service, respectively. The results show that the cross-tie alignment yields minimal change in risk. This result is expected because of the availability and high reliability of an alternate aligned qualified source of power.

TABLE 2

SONGS Conditional CDF & LERF Contributions for Preventive Maintenance (PM)

		TS 3.8.4	
		CDF[d]	LERF[d]
1	Present Allowed Outage Time (AOT)	2 hours	
2	Proposed AOT - aligned to alternate power source	30 days	
3	Baseline (CDF/LERF) - nominal maintenance	*3.235E-5/yr*	*1.425E-6/yr*
4	Conditional CDF/LERF for PM (Component UNAVAILABLE, others nominal maintenance)	*3.237E-5/yr*	*1.425E-6/yr*
5	Conditional CDF/LERF for PM (Component AVAILABLE, others nominal maintenance)	*3.235E-5/yr*	*1.425E-6/yr*
6	Increase in CDF/LERF for PM *(Line 4 – Line 5)*	2E-8/yr	<1E-9/yr
7	**Single AOT Risk (ICCDP/ICLERP) for PM - proposed AOT (RG 1.177): 30 days** *(Line 6)*30/365*	**2E-9**	**<9E-11**
8	Downtime Frequency for PM[a] *(from Table 1)*	3.07 /year[b]	
9	Mean Duration of PM	10.69 days[c]	
10	Single AOT Risk for PM - based on mean duration *(Line 6) * (line 9)/365*	<6E-10	<3E-11
11	**Yearly AOT Risk for PM - based on mean duration (RG 1.174)** *(Line 10) * (Line 8)*	**<2E-9/yr**	**<1E-10/yr**

a Frequency represents the combined downtime frequency of all four sub-systems.

b Preventive maintenance consists of tests and proactive battery replacements: 2 performance tests in 10 years and 4 service tests in 10 years. This is a total of 6 tests in 10 years times 4 batteries. 6 tests * 4 batteries/10 years = 2.4 tests/year; 4 battery replacements every 15 years or 0.267/year; *proactive multiple jar replacements for four batteries every 10 years or 0.4/year;* total downtime frequency = 2.4 + 0.267 + *0.4 = 3.07/year*

c Mean duration = [2.4 (7 days) + 0.267 (30 days) + *0.4 (20 days)]/3.07 = 10.69* days

d Cull level = 5E-10/yr CDF, 5E-11/yr LERF
Bolded values are measured against RG 1.174/1.177 acceptance guidelines

The change in LERF (line 6) is smaller than the last significant digit in the calculation (1E-9/yr). To test whether the calculation is performed correctly and the model changes completed accurately, the cross-tie breakers were set to 0.1 failure probability instead of 0.0. In this test case, valid cutsets with an increase in CDF/LERF were expected and observed. This confirms that the same identical case was not performed for base and maintenance cases. However, since the change in LERF is less than the last significant digit of the Safety Monitor output (1E-9), calculations for lines 7, 10, and 11 are based on ΔLERF < 1E-9/yr.

Regulatory Guide 1.177:

From line 7, the single CT risk for the removal of a battery is much less than the RG 1.177 guideline of 5E-7 for ICCDP and 5E-8 for ICLERP. Line 7 is calculated by taking the increase in risk in line 6 and integrating over the proposed AOT duration of 30 days.

Regulatory Guide 1.174:

From Line 11, the annual increase in risk takes into account the expected frequency and duration of outages of the batteries. This value is less than the RG 1.174 guideline of 1E-6/yr for CDF and 1E-7/yr for LERF.

Corrective Maintenance:

Since initial commercial operation, battery maintenance has been predominantly preventive maintenance. Except in one case, corrective battery maintenance has been limited to activities that did not require entry into a TS action statement and/or did not involve a battery that would be unable to perform its design functions. One case involving a single cell's voltage below TS limits was corrected within the current TS CT of 2 hours. The corrective action was to jumper in an available spare cell. Battery maintenance activities are otherwise proactive in anticipation of degrading cell capacity or to correct potential personnel safety concerns. In all instances of past battery or jar replacement, the batteries would have been able to meet their design requirement at the time of replacement. Batteries, by their nature, do not exhibit rapid, immediate failure but rather degrade over time. With the SONGS trending and surveillance program, degradation to the degree in which a battery is unable to perform (i.e., fail) is predictable and can be maintained through proactive replacement. Although immediate failure requiring corrective maintenance is unlikely, such a calculation with conservative assumptions for frequency and duration is included in this analysis.

For the purposes of assessing the sensitivity of risk to corrective maintenance, a bounding standby failure frequency of a battery must be developed. It's conservatively assumed that one battery failure has occurred since commercial operation of Units 2 and 3 (approximately 42 years of operation). The results of this sensitivity evaluation are included in Table 3.

TABLE 3

SONGS Conditional CDF & LERF Contributions for Corrective Maintenance (CM)

		TS 3.8.4	
		CDF[d]	LERF[d]
1	Present Completion Time (CT)	2 hours	
2	Proposed CT - aligned to alternate power source	30 days	
3	Baseline (CDF/LERF) - nominal maintenance	*3.235E-5/yr*	*1.425-06*
4	Conditional CDF/LERF for CM (Component UNAVAILABLE, others nominal maintenance)	*7.811E-5/yr*	*6.345E-6/yr*
5	Conditional CDF/LERF for CM (Component AVAILABLE, others nominal maintenance)	*3.235E-5/yr*	*1.425E-6/yr*
6	Increase in CDF/LERF for CM *(Line 4 – line 5)*	4.576E-5/yr	4.920E-6/yr
7	Single AOT Risk (ICCDP/ICLERP) for CM *(Line 6)*30/365*	~~1.87~~3.76E-06	4.04E-7
8	Downtime Frequency for CM[a] *(From Table 1)*	0.024/yr[b]	
9	Mean Duration of CM	30 days[c]	
10	Single AOT Risk for CM - based on mean duration *(Line 6) * (line 9)/365*	3.76E-06	4.04E-7
11	Yearly AOT Risk for CM - based on mean duration *(Line 10) * (Line 8)*	9.03E-8/yr	9.71E-9/yr

a Frequency represents the combined downtime frequency of all four sub-systems.

b Downtime frequency: In one instance, corrective maintenance was required to jumper in a spare cell to replace a cell that fell below the TS required minimum voltage. The action to jumper a cell was completed within the current 2 hour TS CT. Since no other battery failures have occurred at SONGS Units 2 and 3, for purposes of determining downtime frequency, one battery failure requiring full battery replacement is assumed to have occurred since initial power operation. That is, one failure in 42 years or 0.024/year.

c Mean duration: Battery replacement and testing requires 30 days

d Cull level = 5E-10/yr CDF, 5E-11/yr LERF

Corrective maintenance requiring 30 days to complete represents replacement of a failed battery. Although the ICCDP/ICLERP (line 7) are greater than the RG 1.177 guidelines, the conservative assumption on frequency of usage/duration provides results that are consistent with the RG 1.174 guidelines.

CONCLUSIONS:

The objective of this risk-informed analysis is to support an extension of the completion time (CT) of Technical Specification 3.8.4 for SONGS 2/3 1E DC Power System (battery). Calculations were performed to assess the incremental core damage and large early release probabilities and the expected annual CDF and LERF for the proposed TS change. The results are compared against NRC RG 1.174 and RG 1.177 acceptance guidelines.

Regulatory Guide 1.177:

As shown in line 6 of Table 2, the increases in core damage and large early release frequencies with two same train DC buses cross-connected are less than 1E-7/year and 1E-8/yr, respectively. The changes in risk are small because a fully qualified alternate power source is aligned when a battery is removed for maintenance. The calculated incremental conditional core damage probability (ICCDP) and incremental conditional large early release probability (ICLERP) (line 7 of Table 2) are less than the acceptance guidelines from NRC Regulatory Guide 1.177 of 5E-7 and 5E-8, respectively.

Regulatory Guide 1.174:

In line 11 of Table 2, the expected frequency of TS 3.8.4 usage and duration are combined with the core damage frequency while in the TS to assess the expected annual risk impact of the TS change. The expected annual risk impact is measured against NRC Regulatory Guide 1.174. The expected annual increase in risk is < 1E-7/year for CDF and <1E-8/year for LERF, which are less than the RG 1.174 acceptance guidelines.

Therefore, the flexibility of the enhanced DC system to allow cross-connection to the other sub-system on the same train supports a Technical Specification 3.8.4 allowed outage time extension to 30 days as measured against the risk acceptance guidelines of RG 1.174 [1] and RG 1.177 [2].

SUMMARY:

The PRA results compare favorably against Regulatory Guides 1.174 and 1.177 in large part because a qualified alternate source of power is aligned prior to removing a battery. When aligned to the alternate power source, each DC bus remains energized with a highly reliable source.

REFERENCES:

[1] U.S. NRC Regulatory Guide 1.174, "An Approach For Using Probabilistic Risk Assessment In Risk-Informed Decisions On Plant-Specific Changes To The Licensing Basis," July 1998.

[2] U.S. NRC Regulatory Guide 1.177, "An Approach For Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," August 1998.

[3] "Pilot Application of ASME PRA Standard Peer Review Process For the San Onofre Nuclear Generating Station Units 2 and 3 PRA," WCAP-16165, CEOG Task 1037, November 2003.

[4] "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," ASME RA-S-2002, ASME, April 2002.

[5] "Common-Cause Failure Parameter Estimations," NUREG/CR-5497, October 1998.

FACTS & OBSERVATIONS (F & O's) FROM THE PILOT APPLICATION OF THE ASME PRA STANDARD PEER REVIEW PROCESS

When assessing the impact of a Fact & Observation, the impact on the delta or difference in the non-aligned case versus the aligned case was assessed. With the 1E Direct Current (DC) sub-system crosstie, there is one battery supporting two buses. With respect to each bus, the bus is still supported by one battery. The failure rate of each sub-system remains the same. However, the failure probability of two sub-systems simultaneously increases because of the common battery. A failure of one of the cross-tied buses or its power source may also fail both sub-systems simultaneously. Peer review comments have an impact on results if the comment results in an increase in risk for the cross-connected (one battery/two bus cross-tied) case without a commensurate increase in risk for the base ('two battery/two bus) case. The following 10 F & O's were determined to potentially have an impact on the results.

F&O	Capability Category of SR	Observation	Proposed Resolution from Peer Review Team	DC CT Extension Impact
DA-C3-02	NM	Some significant components (e.g., LPSI pumps, AFW pumps, and Service Water pumps) were assumed some demand rate as 12 years ago and adopted the demand data collected from 1985 to 1991 as current demand data. Especially, the demand data of Tank 121 was adopted from the P140 demand data from control room log from 1997 to 2001, but, P140 did not apply its own data, instead of, P140 applied the demand data from 1985 to 1991. Furthermore, most of the components applied a time period 54 months, but P140 applied 10 months only without reasonable reason documented.	None provided	Turbine driven AFW pump P140 sensitivity was tested by doubling the failure to start probability and testing with Sub-system A battery B007 in-service and out-of-service. The calculation shows a delta risk with the doubled failure rate of P140 to be 1E-7/year CDF. A very minimal increase that does not impact the conclusions or the request for a TS 3.8.4 CT extension. Pumps from other systems are expected to have an even smaller impact on a delta risk calculation.

F&O	Capability Category of SR	Observation	Proposed Resolution from Peer Review Team	DC CT Extension Impact
DA-C3-03	NM	SCE assumed that 70% T/D AFW pump failed to run is due to overspeed and it is recoverable. There is no bases can be found to support this assumption. Plant data showed 0 failure to run in 295 hours and 0 failure to start on 38 demands. Furthermore, there is no justification to apply this recoverable credit to failure to start not the failure to run. (Note that Failure to start has higher failure rate than failure to run.)	None provided	The non-recovery probability for P140 (L-TP140NR--S) was doubled. The calculation shows a delta risk of less than 1E-7/year CDF. Therefore, this F&O has no impact on the conclusions.
DA-C14-01	NM	Recovery of common cause failure of AFW and Diesel Generators does no use plant-specific data and the applicable Common Cause has not been reviewed. Common cause failure to run events for the EDGs and AFW pumps are recovered using data from an EPRI report. It is not clear that the data from that reference report (NSAC-161) applies to common cause failure events.	Review plant specific data to identify actual or potential common cause failure of the AFW and diesel generators and document that these failures can be recovered. Update recovery rates and common cause failure factors using plant-specific data.	Sensitivity calculations were performed by adjusting the recovery of CCF of AFW pumps and EDGs. When setting these recoveries to 1.0 together, the base case CDF (LERF) increased from 3.24E-5/yr (1.12E-6/yr) to 3.25E-5 (1.13E-6/yr). The cross-tied case went from 3.24E-5/yr (1.12E-6/yr) to 3.26E-5 (1.13E-6/yr). The ICCDP and ICLERP for 30 days are 8E-9 and 8E-10, respectively.
DA-D3-01	III	Consider modifying the SONGS 2/3 Generic Data for TP and BC. A mean of 3.0E-2 for turbine driven pump failure to start on demand appears to be significantly conservative before factoring the SONGS failure experience with condensate trips. PLG-500 has a value of 1.3E-7 EF 4. The SONGS experience that is included in the generic data should be removed for determining the generic component, as long as it is included in the Bayesian update. A mean of 6.0E-7 for battery charger failure to operate appears to be non-conservative since a value of 1E-5 EF 5 is available from EGGSSRE-8875.	Review current PRA data studies and update generic data for these components.	The failure rate of the battery chargers was increased by a factor of 16.7 to 1E-5/hr with a 24 hour failure probability = 2.4E-4. The CCF values of battery chargers were also increased by a factor of 16.7. X-tied CDF= 3.227E-5/y Base CDF = 3.226E-5/y ΔCDF = 1E-8/y ICCDP = 8E-10 X-tied LERF= 1.125E-6/y Base LERF= 1.125E-6/y ΔLERF < 1E-9/y ICLERP < 1E-10 Note: cull level for CDF and LERF set to 5E-10.

F&O	Capability Category of SR	Observation	Proposed Resolution from Peer Review Team	DC CT Extension Impact
				TP: Reducing the failure rate of the turbine driven pump by several orders of magnitude as suggested by the F & O would reduce the frequencies of all cutsets involving the pump and DC power. This essentially eliminates any contribution of the TD AFW pump to this application. Therefore, this F&O has no impact on the conclusions.
HR-G4-05	II	Human action should only be used as interviewed. This means scenarios where indication is lost (e.g., Loss of 125 VDC pre-trip and post trip) the human actions that credited this indication should not be used.	Use human actions as interviewed	All Initiating events (IE's) except for Loss of DC (LDC1 & LDC2) were set to 0.0. The initiating frequency for LDC1 & LDC2 were set to 1.0. All resulting cutsets were reviewed for any operator actions (HC events, that is: post-initiator operator actions). The only operator actions that are relevant are operator manually closing breakers for AFW pumps P141 and P504. The probability of these actions is 0.1, but they are multiplied by 10 to account for loss of indication (from loss of DC). Therefore, the loss of indication was already accounted for in the calculation for the main report. Also, with the above settings, the following results were calculated: X-tied CDF= 1.79E-5/y Base CDF = 1.79E-5/y ΔCDF < 1E-7/y ICCDP < 8E-9 X-tied LERF= 9.61E-6/y Base LERF= 9.61E-6/y ΔLERF < 1E-8/y ICLERP < 8E-10 Note: cull level for CDF and LERF set to 5E-

F&O	Capability Category of SR	Observation	Proposed Resolution from Peer Review Team	DC CT Extension Impact
				10. No impact from this F&O.
QU-A2-01	II	The uncertainty analysis attempting to address the correlation of parameter inputs does appear to yield results that would be expected. The results of the case accounting for the impact of parameter correlation yielded a reduction in the mean CDF as compared to the uncorrelated results. This should not be the case. It appears that either the inputs are incorrect (for example, the translation from the histogram to code inputs) or there is a computational problem.	Make sure that inputs for both cases are appropriate and/or benchmark code to assure appropriate treatment to resolve problem.	No impact. Resolution of this F & O will equally affect the base and maintenance case. Therefore, a delta risk calculation is unaffected by this F&O.

F&O	Capability Category of SR	Observation	Proposed Resolution from Peer Review Team	DC CT Extension Impact
QU-A4-01	I/II/III	Recoveries - Post Processing (Appendix A-7 Post Processing Explanation Report) - a number of post processing action (9 of 23) increase the basic event probability in the minimum cutset, some by significant factors (i.e., multiplication factors of 34.2 and 90.9). Applying increasing factors after solution will allow cutsets which should have been above the truncation limit and part of the solution to be missing from the final analysis, since they were dropped by the truncation and were not present to have the multiplier applied. This also impacts the importance of components for applications such as the Maintenance Rule.	Incorporate these corrections into the fault trees. Missing cutsets will impact both the overall solution of CDF/LERF as well as individual importances.	No impact. Truncation limit dropped to 1E-12 for CDF and LERF. X-tied CDF= 3.753E-5/y Base CDF = 3.746E-5/y ΔCDF = 7E-8/y ICCDP = 6E-9 X-tied LERF= 1.723E-6/y Base LERF= 1.719E-6/y ΔLERF = 4E-9/y ICLERP = 3E-10
QU-B3-01	NM	The truncation limits selected for CDF and LERF were not selected sufficiently low enough to capture an adequate number of cutsets, especially for applications involving component importance such as the Maintenance Rule. One industry rule of thumb is to use a truncation that captures 90% of the CDF obtained when 1% change in CDF occurs when dropping the truncation one decade. From the figures provided in IPE-MR-000, there was a 4.2% drop at 5E-12 truncation for CDF and 9.0% drop at 1E-12 truncation for LERF for the lowest solved analyses. Therefore the value assumed to be "close" to the final value was not valid. Even though the selected truncation captures 94% of the lowest analyzed value for CDF and 92% for LERF, it is capturing a much lower ratio of the actual CDF and LERF. The statement in the reports that 95% of the CDF is being captured is not accurate. This is also why the number of minimum cutsets is less than usually observed at other utilities. From experience, the truncation would be expected to be about a decade lower for CDF and between 1-2 decades for LERF. (Note: SR QU-B3 requires that truncation be such that no significant accident sequences are inadvertently eliminated. The NRC quantitative interpretation of significant is that you need to have enough cutsets such have 95% of final CDF/LERF for solution with convergence sufficient to	My experience is that truncation usually falls between 5 to 6 decades below the CDF or LERF value. The industry thumb-rule can be used. Since a fast analysis engine is being used the time needed for the solutions should not be excessive. Enough calculations need to be performed that it is clear that the "curve" has truly flattened and the selected value adequately captures CDF and LERF.	Sensitivity analysis was performed to assess the impact of lower truncation levels (1E-11, 1E-12). Lower truncation levels did not impact the results and conclusions. Therefore, this F & O will equally affect the base and maintenance case. Therefore, a delta risk calculation is unaffected by this F&O.

F&O	Capability Category of SR	Observation	Proposed Resolution from Peer Review Team	DC CT Extension Impact
		demonstrate the 95% of CDF/LERF.		

F&O	Capability Category of SR	Observation	Proposed Resolution from Peer Review Team	DC CT Extension Impact
QU-F3-01	NM	There was some discussion in Section 12.5 of the Main Report of the assessment of impact of assumptions that could impact PRA results. This focused on results of a series of sensitivity cases that were run. Within this set of cases, the impacts of selected modeling assumptions were quantified and evaluated individually. However, SR QU-F3 (and also SR QU-E2 and QU-E4) of the ASME Standard should be interpreted as requiring a more structured approach to: (a) identifying what the key assumptions and key sources of uncertainty are, and (b) for evaluating and documenting both individual and, to the extent practical, cumulative or overlapping impacts. Some items of particular interest would be assumptions that may introduce significantly conservative bias into the results (e.g., the simplifying assumptions made for loss of control room HVAC), and assumptions that result in the screening of potential contributors from the model (e.g., the process used in the internal flooding analysis), or assumptions and uncertainties associated with success criteria. Some additional guidance is provided in the SRs noted above..	The presence of impacts of such assumptions and sources of uncertainties can affect risk-informed decisions made using the PRA. Consider developing a process for identifying key assumptions and key sources of uncertainty in the PRA, and developing meaningful sets of sensitivity cases to identify their impacts.	Sensitivity analyses were performed on specific assumptions that may affect the base case differently than the maintenance case. These are discussed in the sensitivity analysis section of this report.
QU-F6-01	NM	The main report describes the overall results and provides some sensitivity analyses. No description of the limitations of the PRA model was identified. In the self-assessment, the focus of SCE's response was on limitations in scope (i.e., shutdown, Level 3, etc.). However, the internal events CDF/LERF model has limitations in and of its self.	Add a section to the main report that discusses limitations of the PRA model.	Sensitivity analyses were performed on specific assumptions that may affect the base case differently than the maintenance case. These are discussed in the sensitivity analysis section of this report.

F&O	Capability Category of SR	Observation	Proposed Resolution from Peer Review Team	DC CT Extension Impact
SY-A11-01	I/II/III	The DG mission time is limited to 8 hrs. This is based on the data that no LOOP in excess of 8 hrs have occurred in this region. There is some likelihood that a LOOP in excess of 8 hrs. Assigning a zero likelihood to this possibility seems overly optimistic. In Recoveries, Post Processing Basis Code #1, Changes the Mission Time of the Diesel Generators from 24 hours to 8 hours for internal initiators. The basis for this change is recovery of offsite power having a high probability of recovery within 8 hours. However, recovery of offsite power requires manual operator action and such action is not being added to the recovered cutset to account for failure to restore power.	Model the full spectrum of possible LOOP durations up to 24 hrs. If the 8 hour mission time is retained, add an operator action with this recovery to account for restoration of offsite power.	No impact. The run times were extended to 24 hrs with the following results: X-tied CDF= 3.221E-5/y Base CDF = 3.220E-5/y ΔCDF = 1E-8/y ICCDP = 8E-10 X-tied LERF= 1.121E-6/y Base LERF= 1.121E-6/y ΔLERF < 1E-9/y ICLERP < 1E-10 Note: cull level for CDF and LERF set to 5E-10.

ATTACHMENT J

Proposed Change Notice (PCN) 548, Rev. 2

Batteries Upgrade and DC Cross-tie Capability

San Onofre Nuclear Generating Station, Units 2 and 3

Review Aid

PCN 548 Rev 2
Review Aid for March 2007 NRC Submittal

Updated 3/19/07

Markup

Of

Common Technical Specification Pages,

Licensee Controlled Specification Pages,

And

Bases Technical Specification Pages

LEGEND:

TSTF-360	**Technical Specification Task Force, "DC Electrical Rewrite"**
IEEE-450	**IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications**

Color coded wording indicates the following:

GREEN	**Wording in TSTF-360, Rev 1 not used on SONGS.**
	Note: Wording not applicable to SONGS for specific reasons identified or replaced to provide SONGS specific terminology.
BLUE	**Proposed SONGS Tech Spec wording same as TSTF-360, Rev 1.**
	Note: Verbatim wording from TSTF-360, Rev 1 used on SONGS.
RED	**Proposed SONGS Tech Spec wording not used in TSTF-360, Rev 1.**
	Note: Modified wording for clarification purposes and/or added wording to describe specific/alternate methods used on SONGS.
BLACK	**Existing SONGS Tech Spec wording (or clarification comments).**

Background:

The proposed change revises terminology of trains, channels, systems and subsystems to make the San Onofre Nuclear Generating Station (SONGS) licenses consistent with industry convention.

The proposed change includes improvements to the various electrical specifications reflected in Technical Specification Task Force (TSTF) – 360, Revision 1, "DC Electrical Rewrite" and additional requirements developed by the TSTF-360 industry working group in 2006.

The proposed change revises battery surveillance frequencies to follow the battery maintenance practices accepted by the NRC mainly using the guidelines of TSTF-360 and industry standard IEEE 450-2002.

Note:
Where prudent, engineering evaluation and concurrence from the battery manufacturer have been used to justify the proposed changes; i.e., it is recognized that IEEE 450-2002 is not of itself approved by the NRC for use and application.

Attachments:

1) Battery Maintenance Requirements and LCO/LCS References (Table 1)
2) DC System Configuration Diagrams (Sketch 1 and 2).

DC Sources – Operating

LCO 3.8.4 The Train A and Train B DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required battery charger(s) on one train inoperable. ~~(Same objective, however wording different from TSTF 360, R1)~~	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage. ~~(Same as TSTF 360, R1)~~ AND A.2 Verify battery float current ≤ 2 amps. ~~(Same as TSTF 360, R1)~~ AND A.3 Restore required battery charger(s) to OPERABLE status. ~~(In TSTF 360, R1. Not in existing SONGS LCO because not part of current licensing basis. Decided to add to LCO via a revision to the license amendment).~~	2 hours ~~(Same as TSTF 360, R1)~~ Once per 12 hours ~~(Same as TSTF 360, R1)~~ 7 days ~~(Same as TSTF 360, R1)~~
B. Required Action and associated Completion Time of Condition A not met. ~~(Added, not in TSTF 360, R1)~~	B.1 Declare associated battery inoperable. ~~(Added, not described in TSTF 360, R1)~~	Immediately ~~(Added, not in TSTF 360, R1)~~
C. One DC electrical power subsystem inoperable for reasons other than Condition A. ~~(Same as TSTF 360, R1)~~	C.1 Restore DC electrical power subsystem to OPERABLE status ~~(Same as TSTF 360, R1)~~ OR C.2 Cross connect with same train DC subsystem. ** ~~(Added to allow alternate configuration, not described in TSTF 360, R1)~~	2 hours ~~(Same as TSTF 360, R1)~~ 2 hours ~~(Added, not in TSTF 360, R1)~~
D. DC Subsystem Buses cross connected. ** ~~(Added to allow alternate configuration, not described in TSTF 360, R1)~~	D.1 Restore DC Subsystem Buses to non-cross-connected configuration. ~~(Added to allow alternate configuration, not described in TSTF 360, R1)~~	30 days ~~(Added to allow alternate configuration, not described in TSTF 360, R1)~~

E. Required Action and Associated Completion Time of Condition C or D not met. ~~(Same as TSTF 360, R1, added Condition D applicability)~~	E.1 Be in MODE 3. ~~(Same as TSTF 360, R1)~~ AND E.2 Be in MODE 5. ~~(Same as TSTF 360, R1)~~	6 hours ~~(Same as TSTF 360, R1)~~ 36 hours ~~(Same as TSTF 360, R1)~~

**Note: Requires a battery with a rated capacity of greater than or equal to 1800 Amp-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. ~~(Same as TSTF 360, R1)~~	7 days ~~(7 days per TSTF 360, R1. 31 days per IEEE 450-2002)~~
SR 3.8.4.2	Verify each battery charger supplies ≥ rated amps at ≥ the minimum established float voltage for ≥ 8 hours. ~~(Essentially same as TSTF 360, R1, rated amps will be specified in the TS Bases)~~ ~~OR~~ ~~Verify each battery charger can recharge the battery to the fully charged state within 24 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.~~ ~~(In TSTF 360, R1. Not necessary for SONGS LCO)~~	24 months ~~(18 months per TSTF 360, R1. 24 months per IEEE 450-2002)~~
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. ~~(Same as TSTF 360, R1)~~ ~~2. This Surveillance shall not be performed in MODE 1, 2, 3 or 4. However, credit may be taken for unplanned events that satisfy this SR.~~ ~~(In TSTF 360, R1. Not necessary for SONGS)~~ 2. The battery performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3 once per 48 months. ~~(Added to continue to allow alternate method for existing batteries)~~ --- 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. ~~(Same as TSTF 360, R1)~~	30 months ~~(18 months per TSTF 360, R1. 30 months per IEEE 450-2002)~~

3.8.5 DC Sources – Shutdown

LCO 3.8.5 The 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 two required battery charger(s) inoperable. ~~(Same objective, however wording different from TSTF 360, R1)~~ ~~AND~~ ~~The redundant Train battery and charger OPERABLE.~~ ~~(In TSTF 360, R1. Not in SONGS LCO because not part of current licensing basis).~~	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage. ~~(Same as TSTF 360, R1)~~ AND A.2 Verify battery float current ≤ 2 amps. ~~(Same as TSTF 360, R1)~~ AND A.3 Restore required battery charger(s) to OPERABLE status. ~~(In TSTF 360, R1. Not in existing SONGS LCO because not part of current licensing basis. Decided to add to LCO via a supplement to the license amendment).~~	2 hours ~~(Same as TSTF 360, R1)~~ Once per 12 hours ~~(Same as TSTF 360, R1)~~ 7 days ~~(Same as TSTF 360, R1)~~
B. Required Action and associated Completion Time of Condition A not met. ~~(Added, Condition B & C combined in TSTF 360, R1)~~	B.1 Declare associated battery inoperable. ~~(Added, Condition B & C combined in TSTF 360, R1)~~	Immediately ~~(Added, Condition B & C combined in TSTF 360, R1)~~

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One or more required DC electrical power subsystem(s) inoperable for reasons other than Condition A. ~~(Same objective asTSTF 360, R1)~~ ~~OR~~ ~~Required Action and associated Completion Time of Condition A not met.~~ ~~(In TSTF 360, R1. See Condition B in SONGS LCO)~~	C.1 Declare affected required feature(s) inoperable. ~~(Same as TSTF 360, R1)~~	Immediately ~~(Same as TSTF 360, R1)~~
	OR	
	C.2.1 Suspend CORE ALTERATIONS. ~~(Same as TSTF 360, R1)~~	Immediately ~~(Same as TSTF 360, R1)~~
	AND	
	C.2.2 Suspend movement of irradiated fuel assemblies. ~~(Same as TSTF 360, R1)~~	Immediately ~~(Same as TSTF 360, R1)~~
	AND	
	C.2.3 Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration. ~~(Same objective as TSTF 360, R1, wording from current SONGS LCO used)~~	Immediately ~~(Same as TSTF 360, R1)~~
	AND	
	C.2.4 Initiate action to restore required DC electrical power subsystem(s) to OPERABLE status. ~~(Same as TSTF 360, R1)~~	Immediately ~~(Same as TSTF 360, R1)~~

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, and SR 3.8.4.3. ~~(Same as TSTF 360, R1)~~	In accordance with applicable SRs ~~(Same as TSTF 360, R1)~~

3.8.6 Battery Parameters

LCO 3.8.6 Battery parameters for the Train A and Train B batteries shall be within limits.

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

---NOTE---

Separate Condition entry is allowed for each battery.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two batteries on one train with one or more battery cells with float voltage <2.07 V. ~~(Same as TSTF 360, R1)~~	A.1 Perform SR 3.8.4.1. ~~(Same as TSTF 360, R1)~~	2 hours ~~(Same as TSTF 360, R1)~~
	AND	
	A.2 Perform SR 3.8.6.1. ~~(Same as TSTF 360, R1)~~	2 hours ~~(Same as TSTF 360, R1)~~
	AND	
	A.3 Restore affected cell voltage ≥ 2.07 V. ~~(Same as TSTF 360, R1)~~	24 hours ~~(Same as TSTF 360, R1)~~
B. One or two batteries on one train with float current > 2 amps. ~~(Same as TSTF 360, R1)~~	B.1 Perform SR 3.8.4.1 ~~(Same as TSTF 360, R1)~~	2 hours ~~(Same as TSTF 360, R1)~~
	AND	
	B.2 Restore battery float current to ≤ 2 amps. ~~(Same as TSTF 360, R1)~~	12 hours ~~(Same as TSTF 360, R1)~~
C. One or two batteries on one train with one or more cells with electrolyte level less than minimum established design limits. ~~(Same as TSTF 360, R1)~~ ~~NOTE~~ ~~Required Action C.2 shall be completed if electrolyte was below the top of plates.~~ ~~(Moved text to Required Action Note 2)~~	------------------NOTES------------------ 1. Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of the plates. ~~(Same as TSTF 360, R1)~~ 2. Required Action C.2 shall be completed if electrolyte level was below the top of the plates. ~~(Same as TSTF 360, R1. Moved Note from Condition column to Required Action)~~ --	
	C.1 Restore electrolyte level to above the top of the plates. ~~(Same as TSTF 360, R1)~~	8 hours ~~(Same as TSTF 360, R1)~~
	AND	
	C.2 Verify no evidence of leakage. ~~(Same as TSTF 360, R1)~~	12 hours ~~(Same as TSTF 360, R1)~~
	AND	
	C.3 Restore electrolyte level to greater than or equal to minimum established design limits. ~~(Same as TSTF 360, R1)~~	31 days ~~(Same as TSTF 360, R1)~~

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One or two batteries on one train with pilot cell electrolyte temperature less than minimum established design limits. ~~(Same as TSTF 360, R1)~~	D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits. ~~(Same as TSTF 360, R1)~~	12 hours ~~(Same as TSTF 360, R1)~~
E. One or more batteries in redundant trains with battery parameters not within limits. ~~(Same as TSTF 360, R1)~~	E.1 Restore battery parameters for batteries in one train to within limits. ~~(Same as TSTF 360, R1)~~	2 hours ~~(Same as TSTF 360, R1)~~
F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. ~~(Same as TSTF 360, R1)~~ <u>OR</u> One or two batteries on one train with one or more battery cells with float voltage < 2.07 V and float current > 2 amps. ~~(Same as TSTF 360, R1)~~	F.1 Declare associated battery inoperable. ~~(Same as TSTF 360, R1)~~	Immediately ~~(Same as TSTF 360, R1)~~

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. ~~(Same as TSTF 360, R1)~~	7 days ~~(7 days per TSTF 360, R1. 31 days per IEEE 450 2002)~~
SR 3.8.6.2	Verify each battery pilot cell voltage is ≥ 2.07 V. ~~(Same as TSTF 360, R1)~~	31 days ~~(Same as TSTF 360, R1)~~
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits. ~~(Same as TSTF 360, R1)~~	31 days ~~(Same as TSTF 360, R1)~~
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits. ~~(Same as TSTF 360, R1)~~	31 days ~~(Same as TSTF 360, R1)~~
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ 2.07 V. ~~(Same as TSTF 360, R1)~~	92 days ~~(Same as TSTF 360, R1)~~
SR 3.8.6.6	Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test. ~~(Same as TSTF 360, R1)~~ ~~Note:~~ ~~This Surveillance shall not be performed in Mode 1, 2, 3, or 4. However credit may be taken for unplanned events that satisfy this SR.~~ ~~(Not possible at SONGS)~~	60 months ~~(Same as TSTF 360, R1)~~ <u>AND</u> 12 months when the battery shows degradation or has reached 85% of the expected life with capacity < 100% of the manufacturer's rating ~~(Same as TSTF 360, R1)~~ <u>AND</u> 24 months when the battery has reached 85% of the expected life with capacity ≥ 100% of the manufacturer's rating ~~(Same as TSTF 360, R1)~~

5.5 Procedures, Programs, and Manuals

5.5.2.16 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries For Stationary Applications," of the following:

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

~~(Same as TSTF 360, R1)~~

b. Actions to verify that the remaining cells are above 2.07 V when a battery cell or cells have been found less than 2.13 V, and

~~(Added, based on TSTF 360 industry workgroup feed back, not in TSTF 360, R1)~~

c. Actions to equalize and test battery cells that had been discovered with electrolyte level below the ~~minimum established design limit~~ top of the plates.

~~(Clarification, wording different from TSTF 360, R1)~~

LCS 3.8.104 DC Sources - Operating

The Train A and Train B DC electrical power subsystems shall be OPERABLE.

~~(Added, not in TSTF 360, R1)~~

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

---NOTE---
Separate Condition entry is allowed for each subsystem battery.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SR 3.8.104.1 not met	A.1 Enter LCO 3.8.4.A	Immediately
B. SR 3.8.104.2 not met	B.1 Initiate action request	8 hours

SURVEILLANCE REQUIREMENTS LCS 3.8.104

SURVEILLANCE		FREQUENCY
SR 3.8.104.1	Verify battery terminal voltage is ≥ 129.0 V.	SR 3.8.4.1 (7 days) ~~(Per TSTF 360, 31 days per IEEE 450-2002)~~
SR 3.8.104.2	Verify each required battery charger output is < rated amps with float voltage ≥ 131.0 V.	31 days ~~(per IEEE 450-2002)~~

LCS 3.8.105 DC Sources - Shutdown

DC electrical power subsystems shall be OPERABLE to support the DC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution Systems – Shutdown."

~~(Added, not in TSTF 360, R1)~~

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

---NOTE---

Separate Condition entry is allowed for each subsystem battery.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SR 3.8.105.1 not met	A.1 Enter LCO 3.8.5.A	Immediately
B. SR 3.8.105.2 not met	B.1 Initiate action request	8 hours

SURVEILLANCE REQUIREMENTS LCS 3.8.105

SURVEILLANCE		FREQUENCY
SR 3.8.105.1	Verify required battery terminal voltage is ≥ 129.0 V.	SR 3.8.4.1 (7 days) ~~(Per TSTF 360, 31 days per IEEE 450-2002)~~
SR 3.8.105.2	Verify each required battery charger output is < rated amps with float voltage ≥ 131.0 V.	31 days ~~(per IEEE 450-2002)~~

LCS 3.8.106 Battery Parameters

Battery parameters for the Train A and Train B batteries shall be within limits.

~~(Added LCS, not in TSTF 360, R1)~~

APPLICABILITY: When the batteries are required to be OPERABLE.

---NOTE---
Separate Condition entry is allowed for each subsystem battery.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SR 3.8.106.1 or SR 3.8.106.2 not met	A.1 Initiate action request	8 hours
B. SR 3.8.106.3 not met	B.1 Remove affected cell(s) from the connected cells OR B.2 Equalize and test the affected cell(s) per the manufacturer's recommendation.	24 hours OR 48 hours
C. SR 3.8.106.4 not met	C.1 Initiate action request	8 hours
D. SR 3.8.106.5 or SR 3.8.106.7 not met	D.1 Enter LCO 3.8.6 Condition D	Immediately
E. SR 3.8.106.6 or SR 3.8.106.8 or SR 3.8.106.9 or SR 3.8.106.10 or SR 3.8.106.11 not met	E.1 Initiate action request	8 hours

SURVEILLANCE REQUIREMENTS LCS 3.8.106

SURVEILLANCE		FREQUENCY
SR 3.8.106.1	Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration or cracks in cells or evidence of electrolyte leakage.	31 days ~~(per IEEE 450-2002)~~
SR 3.8.106.2	Verify no visible corrosion at terminals and connectors. OR Perform SR 3.8.106.10.	31 days ~~(per IEEE 450-2002)~~
SR 3.8.106.3	Verify electrolyte level is above the top of the plates	SR 3.8.6.3 (31 days) ~~(implement TS 5.5.2.16.c)~~
SR 3.8.106.4	Verify battery pilot cell voltage is ≥ 2.13 V	SR 3.8.6.2 (31 days) ~~(implement TS 5.5.2.16.a)~~

SR 3.8.106.5	------------------------------NOTE------------------------------ Maintain electrolyte temperature ≥ 50°F for batteries rated 1800 AH that are not cross-connected or ≥ 60°F for batteries rated <1800 AH or batteries that are cross-connected. -- Verify the electrolyte temperature for each battery pilot cell (cell averaging not allowed) is above the limit specified in the NOTE above.	SR 3.8.6.4 (31 days) ~~(per IEEE 450-2002)~~
SR 3.8.106.6	Verify battery connected cell voltage is ≥ 2.13 V.	SR 3.8.6.5 (92 days) ~~(implement TS 5.5.2.16.a)~~
SR 3.8.106.7	------------------------------NOTE------------------------------ Maintain electrolyte temperature ≥ 50°F for batteries rated 1800 AH that are not cross-connected or ≥ 60°F for batteries rated <1800 AH or batteries that are cross-connected. -- Verify the average electrolyte temperature for the specified connected battery cells is above the limit specified in the NOTE above. 10% of connected cells <u>AND</u> All connected cells.	92 days ~~(per IEEE 450-2002)~~ <u>AND</u> 12 months ~~(per IEEE 450-2002)~~
SR 3.8.106.8	------------------------------NOTE------------------------------ Specific gravity needs to be corrected for electrolyte temperature and level. Level correction is not required, however, when battery charging current is ≤ 2 amps when on float charge. -- Verify the specific gravity for each connected battery cell is ≥ 1.200.	12 months ~~(per IEEE 450-2002)~~
SR 3.8.106.9	Perform, to the extent possible, a detailed visual inspection of the battery installation in accordance with IEEE 450-2002, Annex E.	12 months ~~(per IEEE 450-2002)~~
SR 3.8.106.10	Verify connection resistance is ≤150×10^{-6} ohm for each inter-cell, inter-rack, inter-tier, and terminal connection.	12 months ~~(per IEEE 450-2002)~~
SR 3.8.106.11	Verify each battery float current is within the vendor recommended limiting current: > 0 and ≤ 0.75 amps for 1260 AH rated batteries and > 0 and ≤ 1.5 amps for 1800 AH rated batteries.	SR 3.8.6.1 (7 days) ~~(per battery manufacturer)~~

B 3.8.4 DC Sources — Operating

BASES

BACKGROUND

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

The 125 VDC electrical power system consists of two independent and redundant safety related Class 1E DC electrical power systems (Train A and Train B). Each ~~subsystem consists of two 125 VDC batteries~~ train consists of two subsystems each containing one 125 VDC battery ~~(each battery with 50% capacity)~~, the ~~associated~~ required battery charger~~(s)~~ for each battery, and all the associated control equipment and interconnecting cabling.

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

The Train A and Train B DC electrical power ~~sub~~systems provide control power for their ~~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 other loads, including ~~the~~ inverters~~,~~ which in turn power the AC vital buses.

Train A DC systems (Subsystems A and C) provide power to the Channel A and C inverters feeding the 120 VAC vital bus 1 and 3 electrical power distribution subsystems (Channel A and C). Train B DC system (Subsystems B and D) provide power to the Channel B and D inverters feeding the 120 VAC vital bus 2 and 4 electrical power distribution subsystems (Channel B and D). DC subsystem C also provides DC power to the Auxiliary Feedwater Pump steam inlet valve HV-4716 and the AFWP electric governor.

Train A DC systems are capable of providing DC power to both Channel A and Channel C loads when DC subsystems A and C are manually cross-connected. This allows both DC buses to remain operable during battery replacement, testing, or maintenance of any one DC battery or battery charger.

Train B DC systems are capable of providing DC power to both Channel B and Channel D loads when DC subsystem B and D are manually cross-connected. This allows both DC buses to remain operable during battery replacement, testing, or maintenance of any one DC battery or battery charger.

Train	Subsystem	DC Bus	Vital Bus	Battery	Charger	Swing Charger
A	A	D1	Y01	B007	B001	B021
	C	D3	Y03	B009	B003	
B	B	D2	Y02	B008	B002	B022
	D	D4	Y04	B010	B004	

During cross connecting of subsystem buses A and C, or B and D, two batteries will be paralleled for a short duration. An electrical fault during that duration could exceed the interrupting duties of the protective devices. This is an accepted practice during transfer of power sources and is considered to be an acceptable minimal risk. Once the cross-tie alignment is complete, only one battery is aligned to cross connected buses D1 and D3 or D2 and D4.

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

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution ~~centers~~ buses. Each subsystem is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing of equipment between redundant Class 1E subsystems, such as batteries, battery chargers, or distribution panels. Subsystems A and C, or B and D share a battery and battery charger(s) when cross-tied.

Each battery has adequate storage capacity to meet the duty cycle(s) discussed in the UFSAR, Chapter 8 (Ref. 6). 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 Train A and Train B 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 at the supplied loads is 105 V.

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 120 V for a 58-cell battery (i.e., cell voltage of 2.065 Volts per cell (Vpc)). The open circuit voltage is the voltage maintained of a fully charged cell when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. All cells begin to self-discharge when left on open circuit, but cells can be left open circuit for some period of time (>30 days, refer to the manufacturer's instruction for the maximum storage periods) without any long-term performance degradation. Optimal long-term performance however, is obtained by maintaining a float voltage of 2.20 to ~~2.25~~ 2.28 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge. The nominal float voltage of ~~2.25~~ 2.267 Vpc corresponds to a total float voltage ~~output~~ of 131.5 V for a 58-cell battery ~~as discussed in the FSAR, Chapter 8 (Ref. 6)~~.

Each Train A and Train B 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 24 hours while supplying normal steady state loads discussed in the UFSAR, Chapter 8 (Ref. 6).

Each subsystem has a dedicated battery charger that is rated at 300 amps. Each Train has a 400 amp rated swing battery charger that meets all the performance requirements of the dedicated charger and can be manually aligned to either subsystem. The swing charger breakers and interconnecting cables allow alignment to either subsystem within a train. Key interlocks limit swing charger alignment to one subsystem at a time. The Train B swing charger can also be aligned to non-1E 125 VDC Battery Bus D5. Electrical isolation and independence between subsystems required by R.G. 1.75 is maintained by the isolation capability of the battery charger itself and the kirk-key interlocked output circuit breakers. If the swing battery charger is substituted for one of the dedicated battery chargers, the requirements of independence and redundancy between subsystems are maintained.

The swing battery charger and the normal dedicated battery charger are equally qualified. When required, the swing battery charger can replace the normal dedicated battery charger using the provided circuit breakers. The swing battery charger can stay in service indefinitely, and there are no restrictions on swing battery charger use. The swing and dedicated battery chargers are designed to operate in parallel in any combination. The swing battery charger is powered from its respective Train's common MCC which is diesel generator backed as required by Technical Specification 3.8.1 or 3.8.2.

With same train DC buses cross-connected, an OPERABLE charger or chargers with a combined rated capacity greater than or equal to 400 amps is required.

A "required battery charger" is one of the following:

- the "dedicated charger" aligned to its respective DC bus,
- the "swing battery charger" aligned to the respective DC bus,
- **two** "dedicated chargers" aligned to cross-tied DC buses, or
- the "swing battery charger" aligned to cross-tied DC buses.

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 UFSAR, Chapter 6 (Ref. 7) and Chapter 15 (Ref. 8), 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 the NRC Policy Statement.

LCO

The DC electrical power trains, each train consisting of two batteries, the required battery charger for each battery, and the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the train are required to be OPERABLE by LCO 3.8.9 "Distribution Systems – Operating." This ~~to~~ ensures 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 train DC electrical power subsystem does not prevent the minimum safety function from being performed consistent with UFSAR Chapter 8 (Ref. 6).

An OPERABLE DC electrical power train requires two batteries and required ~~respective~~ chargers to be operating and connected to the associated DC buses.

During the cross-connection period of 30 days, an OPERABLE DC electrical power train (A or B) requires one battery and the required battery charger(s) to be operating and connected to subsystem DC buses A and C or B and D.

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 train with one or two required battery chargers or associated control equipment or cabling inoperable (e.g., the battery 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~~ the required charger(s) to OPERABLE status in a reasonable time period.

Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring 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. 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.

The charger operating ~~if the charger operates~~ in the current limit mode ~~after~~ in excess of 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 to be 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 initial 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.

A digital multimeter of high accuracy in an average function mode will be used to measure the steady state float charging current. The multimeter is capable of measuring the low magnitude of DC current (less than 2 amps) and filtering the induced AC noise from the connected inverter. A millivolt shunt located close to the battery terminal provides the battery float charging current signal.

Required Action A. 3 limits the restoration time for the required ~~inoperable~~ battery charger to 7 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., balance of plant non-Class 1E battery charger). The 7 day completion time reflects a reasonable time to effect restoration of the required ~~qualified~~ battery charger to operable status.

B.1

With the required DC electrical power subsystem battery charger or associated control equipment or cabling outside the allowances of the Required Actions for Condition A, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery must be declared inoperable immediately.

C1 and C 2

Condition C represents one or more required DC electrical power subsystem(s) on one train inoperable for reasons other than Condition A ~~train with one or two battery(ies) inoperable. With one or two battery(ies) inoperable, the DC bus is being supplied by the OPERABLE battery charger(s)~~. Any event that results in a loss of the AC bus supporting the battery charger will eventually ~~also~~ result in loss of DC to that Subsystem ~~Train~~. 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.) ~~likely~~ rely upon the operability of the battery(ies). In addition, DC loads with ~~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 LCOs ~~Specifications~~ 3.8.4, 3.8.5, and 3.8.6 together with additional specific completion times.

Condition C also represents one train 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 ~~train~~. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution system ~~train~~.

If one of the required DC electrical power subsystems is inoperable for reasons other than Condition A or C (e.g., inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems to mitigate a worst-case accident, continued power operation should not exceed 2 hours. The 2-hour Completion Time is based on Regulatory Guide 1.93 (Ref. 9) and reflects a reasonable time to cross connect with same train DC subsystem or 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. Either of Required Actions C1 or C.2 will restore the DC subsystem train to OPERABLE status. Required Action C.2 includes a Note to ensure the battery aligned to the cross tied subsystem buses has adequate capacity.

Cross connection of two subsystems on two trains has not been analyzed and is therefore not permitted.

D.1

Condition D represents **one** train with one subsystem battery out of service and two subsystems cross-connected with one battery. This alignment will allow both subsystems to remain OPERABLE for 30 days. The 30-day duration is adequate for replacement of a battery bank and performance of battery discharge testing (online) in Modes 1 through 4. Condition D includes a Note to ensure the battery aligned to the cross-tied subsystem buses has adequate capacity.

The SONGS 2/3 Living PRA determined acceptable risk impact for a period of 30 days while two same train DC subsystems are cross-connected with one battery supporting both buses. The analysis was performed consistent with the guidelines of R.G. 1.74 and R.G 1.177.

Cross connection of two subsystems on two trains has not been analyzed and is therefore not permitted.

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 unit systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 9).

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the 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 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 minimum float voltage established by the battery manufacturer (2.20 Vpc ~~or 127.6 V at the battery terminals~~). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). The 7-day Frequency is consistent with manufacturer recommendations.

SR 3.8.4.2

This SR verifies the design capacity of the swing and dedicated battery chargers. Regulatory Guide 1.32 (Ref. 10) recommends that the battery charger supply is 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 ensure that these requirements can be satisfied. Each required battery charger must be capable of supplying rated amps at the minimum established float voltage for 8 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 coincident 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.~~

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 IEEE 450 (Ref. 4). For 1800 AH rated batteries, the service test and modified performance discharge test will use the combined duty cycle of the cross-connected subsystems. The 30 month service test Frequency is in accordance with IEEE 450-2002, which requires a service test at the discretion of the user at periodic times between the 60 month performance tests.

~~The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 and Regulatory Guide 1.129, which state that the battery service test should be performed during refueling operations, or at some other intervals between battery performance tests not to exceed 18 months.~~

This SR is modified by two Notes: Note 1 allows the performance of a modified performance discharge test in lieu of a service test. Note 2 continues to allow the once per 48 month performance of the battery performance discharge test in SR 3.8.6.6 in lieu of SR 3.8.4.3. This substitution is acceptable because SR 3.8.6.6 represents a more severe test of battery capacity than does SR 3.8.4.3.

The modified performance discharge test is described in the Bases for SR 3.8.6.6.

A battery service test or modified performance test shall be performed after installation of a new battery bank for Operability. Within 2 years after initial installation, a battery performance test shall be performed for collecting baseline data for future battery capacity trending purposes. The application of the modified performance test is the preferred choice at SONGS for Class 1E batteries ≥1800 AH (refer to the Vendor and/or Engineering justification below).

If for any reason a battery has to undergo a service and performance test (e.g., one following the other during scheduled maintenance testing), the service test shall be completed first. Recharging of the battery is required before the performance test is conducted. The "as found" condition prior to the performance test is state of the battery immediately prior to the performance test.

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

~~The modified performance discharge test may consist of just two rates, for instance the one minute rate 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 represent 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 test. The battery terminal voltage for the modified performance 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.~~

REFERENCES

1. 10 CFR.50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-1978.
4. IEEE-450-2002.
5. IEEE-485-1997.
6. UFSAR, Chapter 8.
7. UFSAR, Chapter 6.
8. UFSAR, Chapter 15.
9. Regulatory Guide 1.93, December 1974.

10. Regulatory Guide 1.32, February 1977.

11. Regulatory Guide 1.129, April 1977.

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." When TS 3.8.5 applies, there are two exceptions to what is described in the Bases for LCO 3.8.4:

1. The DC subsystem cross-connect configuration and use is described in the bases for LCO 3.8.10, 'Distribution Systems – Shutdown"
2. With same train DC buses cross-connected, an OPERABLE charger or chargers with a combined rated capacity greater than or equal to 300 amps is required. When cross tied, there are no restrictions on battery charger operation. A "required battery charger" is one of the following:

   - the "dedicated charger" aligned to its respective DC bus,
   - the "swing battery charger" aligned to the respective DC bus,
   - **one** "dedicated charger" aligned to cross-tied DC buses, or
   - the "swing battery charger" aligned to cross-tied DC buses.

APPLICABLE SAFETY ANALYSES

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

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and 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 the NRC Policy Statement.

LCO

Each DC electrical power train, ~~each subsystem~~ consisting of two batteries (unless cross connected per LCO 3.8.10), the required ~~one battery~~ charger for each ~~per~~ battery, and the corresponding control equipment and interconnecting cabling within the train, are required to be OPERABLE to support required trains of distribution systems required OPERABLE by LCO 3.8.10, "Distribution Systems — Shutdown." This ensures the availability of sufficient DC electrical power sources to maintain ~~operate~~ the unit in a safe shutdown condition ~~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 needed to mitigate a fuel handling accident are available;

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

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

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

ACTIONS

A.1, A.2 and A.3

Condition A represents one train ~~inoperable~~ with one or two required battery chargers or associated control equipment or cabling inoperable (e.g., the battery 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~~ the required charger(s) to OPERABLE status in a reasonable time period.

Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring 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 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. 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 of refueling activities ~~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~~ in excess of 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 initial 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.

Required Action A.3 limits the restoration time for the required ~~inoperable~~ battery charger to 7 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., balance of plant non-Class 1E battery charger). The 7 day completion time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

B.1

With the required DC electrical power subsystem battery charger or associated control equipment or cabling outside the allowances of the Required Actions for Condition A, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery must be declared inoperable immediately.

C1, C2.1, C2.2, C.2.3, C.2.4

Condition C represents one or more required DC electrical power subsystem(s) inoperable for reasons other than Condition A. The ACTIONS provide a tiered response allowing the option to declare required features inoperable immediately with the associated DC power source(s) inoperable.

If two trains are required per LCO 3.8.10, the remaining train with DC power available may be capable of supporting sufficient systems to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare required features inoperable with the associated DC power source(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCO ACTIONS. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend 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 states that Surveillances required by SR3.8.4.1 through SR 3.8.4.3 are applicable in these MODES. See the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged below their capability to provide the required power supply or otherwise rendered inoperable during the performance of SRs. It is the intent that these SRs must still be capable of being met, but actual performance is not required.

Verification of the battery terminal voltage and battery charger output current~~amps~~ is addressed by LCS 3.8.105.

REFERENCES

1. UFSAR, Chapter 6.

2. UFSAR, Chapter 15.

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, ~~specific gravity~~ for the DC 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 licensee controlled program also implements a program specified in Administrative Controls Section ~~Specification~~ 5.5.2.16 for monitoring various battery parameters that is based on recommendations of IEEE Standard 450-2002, "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 120 V for a 58-cell battery (i.e., cell voltage of 2.065 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 ≥ 2.065 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 of 2.20 to 2.28 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge. The nominal float voltage of 2.267 Vpc corresponds to a total float voltage output of 131.5 V for a 58-cell battery.

APPLICABLE SAFETY ANALYSES

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

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

Battery parameters satisfy Criterion 3 of the NRC Policy Statement.

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 preventative maintenance, testing, and monitoring performed in accordance with the Licensee Controlled Specifications 3.8.104, 3.8.105 and 3.8.106 is conducted as specified in Administrative Controls Section ~~Specification~~ 5.5.2.16.

APPLICABILITY

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

ACTIONS

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

A battery cell is degraded when the cell float voltage is <2.07 V. A battery bank may not be degraded with one or more degraded battery cells ~~in one or more batteries in one train <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 (perform SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (perform 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 in one or more batteries <2.07 V, and continued operation is permitted for a limited period up to 24 hours per Required Action A.3.

Since the Required Actions of A.1 and A.2 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 Condition(s), depending on the cause of the failures, is entered. If SR 3.8.6.1 is failed then there is not assurance that there is still sufficient battery capacity to perform the intended function and the battery must be declared inoperable immediately.

B.1 and B.2

One or two ~~more~~ batteries in one train with float current of >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 within 2 hours (perform 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. ~~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 a 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 a 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 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 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 or two ~~more~~ batteries on ~~in~~ one train with one or more cells with 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. Electrolyte level limits are visually indicated on each cell via minimum and maximum electrolyte level lines. 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 Administrative Controls Section ~~Specification~~ 5.5.2.16, Battery Monitoring and Maintenance Program). Verification of electrolyte level below the top of the plates, per Administrative Controls Section 5.5.2.16.c, is addressed by LCS 3.8.106.

The Required Actions are modified by ~~a~~ two Notes: Note 1 ~~that~~ indicates that ~~they~~ Required Actions C.1 and C.2 are only applicable if electrolyte level is below the top of the plates. Within 8 hours, the electrolyte level is required to be restored to above the top of the plates. Note 2 indicates that Required Action C.2 must be completed if electrolyte level was below the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Administrative Controls Section ~~Specification~~ 5.5.2.16.c ~~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 ~~recommendation~~ testing, the battery(ies) may have to be declared inoperable and the affected cells replaced.

D.1

With one or two ~~more~~ batteries on one train with pilot cell temperature less than the minimum established design limit, 12 hours is allowed to restore the temperature to within limits. 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 one or more batteries in redundant trains 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 their required function, given that redundant batteries are involved. With redundant batteries involved this potential could result in a 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 train within 2 hours.

F.1

With one or more batteries with any battery parameter ~~is~~ 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 one or more batteries in one train with one or more battery cells with 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.

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).~~ and the 7-day Frequency is consistent with battery vendor recommendation.

This SR is modified by a Note: The Note ~~that~~ states that 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 ~~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 SR 3.8.6.5

SRs 3.8.6.2 and 3.8.6.5 require verification that the pilot or connected cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V. Optimal long-term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer~~, which corresponds to 130.5 V at the battery terminals, or 2.25 Vpc~~. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge, which could eventually render the battery inoperable. Float voltage less than the administrative limit ~~in this range or less~~, but greater than 2.07 Vpc, ~~are~~ is addressed in LCS 3.8.106 as required by Administrative Controls Section ~~Specification~~ 5.5.2.16. ~~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 administrative limit for cell minimum voltage is specified in LCS 3.8.106.

SR 3.8.6.3

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintain~~s~~ adequate electron transfer capability. The minimum established design limit is the minimum mark on the cell jar, which is above the top of the plates. The 31 day Frequency is consistent with IEEE-450 (Ref. 3). Battery cells with electrolyte level below the top of the plates are addressed in LCS 3.8.106.

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit, which is specified in LCS 3.8.106. 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 31 day 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. For 1800 AH rated batteries, the modified performance test will use the combined duty cycle of the cross-connected subsystems.

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 for the 1800 AH rated batteries.

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 is conducted in accordance with IEEE 450-2002 Annex I.3. ~~It may consist of just two rates; for instance the one minute rate for the battery or the largest current load of the duty cycle, followed by the est 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 f 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. 4). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. 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 life and capacity is <100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that have ~~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 ≥ 10% below the manufacturer's rating. These frequencies are consistent with the recommendations in IEEE-450 (Ref. 3).

Spare cell(s) are normally maintained qualified by installing them in the same seismic battery rack where the OPERABLE cells reside, kept on float charge and surveilled as if they were OPERABLE. The spare cells are included during battery discharge testing to demonstrate their adequacy under the discharge conditions that would be present if they were OPERABLE.

If for any reason a battery has to undergo a service and performance test (e.g., one following the other during scheduled maintenance testing), the service test shall be completed first. Recharging of the battery is required before the performance test is conducted. The "as found" condition prior to the performance test is state of the battery immediately prior to the performance test.

REFERENCES

1. UFSAR, Chapter 6.

2. UFSAR, Chapter 15.

3. IEEE-450-2002.

4. IEEE-485-1997.

5.5 Procedures, Programs, and Manuals

The following section was added to the Procedures, Programs, and Manuals Section of the Technical Specifications:

5.5.2.16 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," of the following:

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

b. Actions to verify that the remaining cells are above 2.07 V when a battery cell or cells have been found less than 2.13 V, and

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

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.9 Distribution Systems – Operating

BASES

BACKGROUND

The onsite Class 1E AC, DC, and AC vital bus electrical power distribution systems are divided by train into redundant and independent AC, DC, and AC vital bus electrical power distribution subsystems.

The AC primary electrical power distribution system consists of two 4.16 kV Engineered Safety Feature (ESF) buses, each having at least one separate and independent offsite source of power as well as a dedicated onsite diesel generator (DG) source. Each 4.16 kV ESF bus is normally connected to a preferred offsite source. After a loss of the preferred offsite power source to a 4.16 kV ESF bus, a transfer to the alternate offsite source is accomplished by utilizing a time delayed bus undervoltage relay. If all offsite sources are unavailable, the onsite emergency DG supplies power to the 4.16 kV ESF bus. Control power for the 4.16 kV breakers is supplied from the Class 1E batteries. Additional description of this system may be found in the Bases for LCO 3.8.1, "AC Sources–Operating," and the Bases for LCO 3.8.4, "DC Sources–Operating."

The 120 VAC vital buses are arranged into four channels and each channel is normally powered from its own channel inverter. The alternate power supply for the vital buses are Class 1E constant voltage source transformers powered from one of the trains in the same load group (one transformer per load group), and its use is governed by LCO 3.8.7, "Inverters – Operating." Each constant voltage source transformer is powered from a Class 1E AC bus.

There are four independent 125 VDC electrical power distribution subsystems (two for each Train A and B). Background detail for the DC System is found in the Bases for LCO 3.8.4, "DC Sources – Operating" and the bases for LCO 3.8.6, "Battery Parameters.

The Class 1E AC electrical power distribution system for each train and the list of all required distribution buses are presented in Table B 3.8.9-1.

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

TYPE	VOLTAGE	TRAIN A		TRAIN B	
AC safety buses	4160 V	ESF Bus A04		ESF Bus A06	
	480 V	Load Center B04		Load Center B06	
DC buses	125 V	SUBSYSTEM A	SUBSYSTEM C	SUBSYSTEM B	SUBSYSTEM D
		Bus D1 from battery B007 and required battery charger	Bus D3 from battery B009 and required battery charger	Bus D2 from battery B008 and required battery charger	Bus D4 from battery B010 and required battery charger
AC vital buses	120 V	CHANNEL A	CHANNEL C	CHANNEL B	CHANNEL D
		Bus Y01 from inverter Y001 connected to bus D1	Bus Y03 from inverter Y003 connected to bus D3	Bus Y02 from inverter Y002 connected to bus D2	Bus Y04 from inverter Y004 connected to bus D4

NOTES:

~~(1) Each train of the AC, DC, and AC vital bus electrical power distribution systems is a subsystem.~~

(1) If a support system (e.g., charger or inverter) is declared inoperable and it has its own LCO, entry into LCO 3.8.9 is not required. Only entry into its LCO is required.

(2) An OPERABLE Class 1E battery bank B00X may replace B007, B008, B009 or B010 battery to allow battery maintenance (including replacement) activities.

(3) The "required battery charger" is described in the bases for LCO 3.8.4, "DC Sources – Operating" and LCO 3.8.5, "DC Sources – Shutdown".

(4) Subsystems A and C (or B and D) share a battery and battery charger(s) when buses D1 and D3 (or D2 and D4) are cross-connected as described in the bases of LCO 3.8.4, "DC Sources – Operating" and LCO 3.8.5, "DC Sources – Shutdown".

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.10 Distribution Systems - Shutdown

BASES

BACKGROUND

A description of the AC, DC, and AC vital bus electrical power distribution systems is provided in the Bases for LCO 3.8.9, "Distribution Systems - Operating" and the Bases for LCO 3.8.5, "DC Sources - Shutdown".

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature (ESF) systems are OPERABLE. The AC, DC, and AC vital bus electrical power distribution systems are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System, and containment design limits are not exceeded.
The OPERABILITY of the AC, DC, and AC vital bus electrical power distribution system is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum AC, DC, and AC vital bus electrical power distribution subsystems during MODES 5 and 6 ensures that:

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

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

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

The AC and DC electrical power distribution systems satisfy Criterion 3 of the NRC Policy Statement.

LCO

Various combinations of subsystems, equipment, and components are required OPERABLE by other LCOs, depending on the specific unit condition. Implicit in those requirements is the required OPERABILITY of necessary support required features. This LCO explicitly requires energization of the portions of the electrical distribution system necessary to support OPERABILITY of required systems, equipment and components—all specifically addressed in each LCO and implicitly required via the definition of OPERABILITY.

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

Same-train DC subsystem Buses may be cross-tied to an 1800 AH rated battery. This alignment allows both subsystems to remain OPERABLE. There is no time limit to the duration DC subsystem buses may be cross-tied with the Unit shutdown. An 1800 AH rated battery has sufficient capacity to allow both of the associated vital bus inverters to remain OPERABLE. The "required charger" with the Unit shutdown is described in the Bases for LCO 3.8.5, "DC Sources – Shutdown".

APPLICABILITY

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

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

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

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

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

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

ACTIONS

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

Although redundant required features may require redundant trains of electrical power distribution subsystems to be OPERABLE, one OPERABLE distribution subsystem train may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare required features associated with an inoperable distribution subsystem inoperable, appropriate restrictions are implemented in accordance with the affected distribution subsystems LCO's Required Actions. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions that could result in loss of required SDM (Mode 5) or boron concentration (Mode 6)). Suspending positive reactivity additions that could result in failure to meet the minimum SDM or boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than what would be required in the RCS for minimum SDM or refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation. Introduction of temperature changes including temperature increases when operating with a positive MTC must also be evaluated to ensure they do not result in a loss of required SDM.

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

Notwithstanding performance of the above conservative Required Actions, a required shutdown cooling (SDC) subsystem may be inoperable. In this case, these Required Actions of Condition A do not adequately address the concerns relating to coolant circulation and heat removal. Pursuant to LCO 3.0.6, the SDC ACTIONS would not be entered.
Therefore, the Required Actions of Condition A direct declaring SDC inoperable, which results in taking the appropriate SDC actions.

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

SURVEILLANCE REQUIREMENTS

SR 3.8.10.1

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

REFERENCES

1. UFSAR, Chapter 6.

2. UFSAR, Chapter 15.

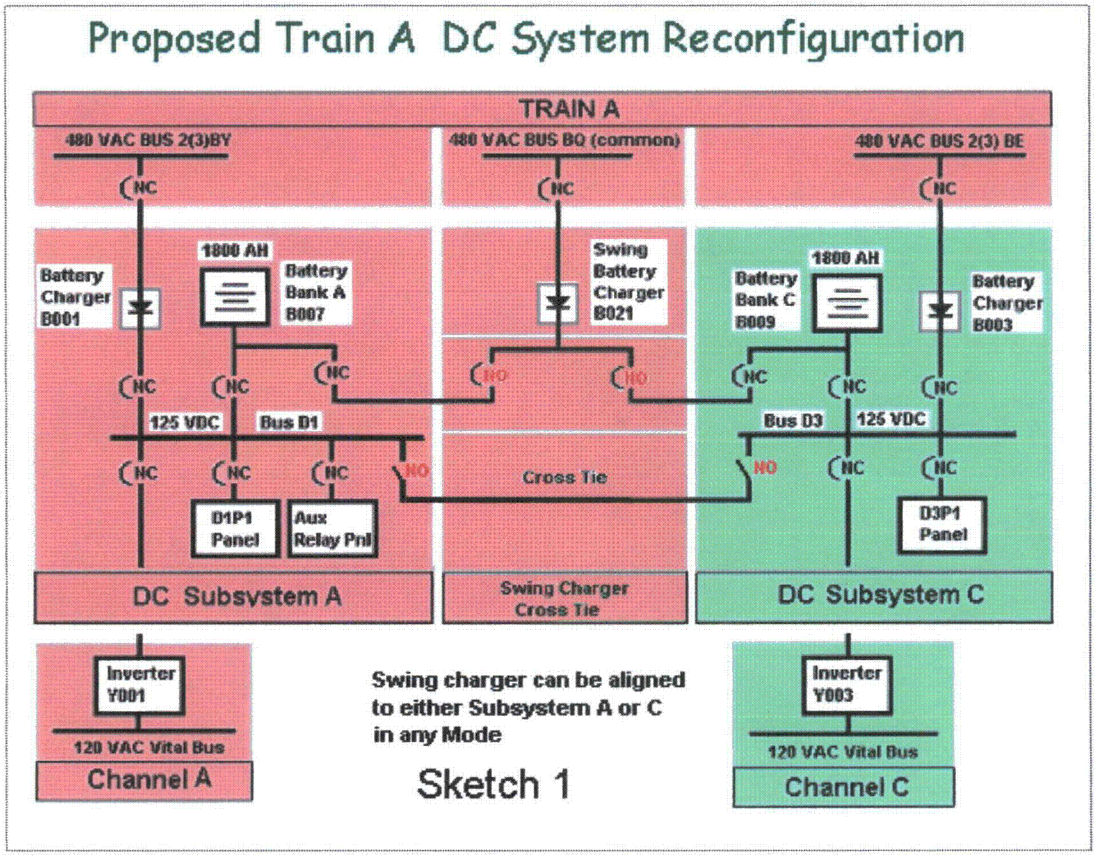
Attachment 1: Battery Maintenance Requirements and LCO/LCS References (Table 1)

IEEE 450-2002 Requirements (Recommended Practice for Battery Maintenance, Testing & Replacement)	LCO & LCS References	NRC & TSTF-360	450-2002 Sect 5.2.1 Items a thru k	450-2002 Sect 5.2.2 Items a, b, c	450-2002 Sect 5.2.3 Items a, b, c, d	450-2002 Sect 6.1, 6.2, 6.3 and 6.4
Description of Parameter	Surveillances	Weekly (7days)	Monthly (31 days)	Quarterly (92 days)	Yearly (12 months)	1 to 5 Yrs (12 to 60 months)
Float voltage measured at battery terminals	SR 3.8.4.1 SR 3.8.104.1	√	a)			
General appearance and cleanliness of the battery, the battery rack and/or battery cabinet, and the battery area	SR 3.8.106.1		√ b)			
Charger output current and voltage	SR 3.8.104.2		√ c)			
Electrolyte level of all cells	SR 3.8.6.3 SR 3.8.106.3		√ d)			
Cracks in cells or evidence of electrolyte leakage	SR 3.8.106.1		√ e)			
Any evidence of corrosion at terminals, connectors, racks, or cabinets	SR 3.8.106.1 SR 3.8.106.2		√ f)			
Ambient temperature and ventilation	See Note 1		√ g)			
Pilot cell voltage and electrolyte temperature	SR 3.8.6.2 SR 3.8.106.4 SR 3.8.6.4 SR 3.8.106.5		√ h)			
Battery float charging current or pilot cell specific gravity (Not Used)	SR 3.8.6.1 SR 3.8.106.11	√	i)			
Unintentional battery grounds	See Note 1		j)			
All battery monitoring systems are operational, if installed	NA		k)			
Voltage of each cell	SR 3.8.6.5 SR 3.8.106.6			√ a)		
Specific gravity of 10% of the cells of the battery if battery float charging current is not used to monitor state of charge	NA			b)		
Electrolyte temperature of 10% or more of the battery cells	SR 3.8.106.7			√ c)		
Specific gravity and temperature of each cell.	SR 3.8.106.8 SR 3.8.106.7				√ a)	
Cell condition (See Note 2 & IEEE Annex E)	SR 3.8.106.9				√ b)	
Cell to cell and terminal connection resistance. (See IEEE Annex F)	SR 3.8.106.10				√ c)	
Structural integrity of the battery rack and/or cabinet.	SR 3.8.106.9				√ d)	
Battery Charger Test (IEEE Section 6.3)	SR 3.8.4.2					√ 24 months
Battery Service Test (IEEE Section 6.3)	SR 3.8.4.3					√ 30 months (See Note 3)
Battery Performance Discharge Test (IEEE Section 6.2)	SR 3.8.6.6					√ 60 months (See Note 3)
Modified Performance Discharge Test (Service & Performance test- IEEE Sect 6.4)	SR 3.8.6.6					√ 30 months (See Note 4)

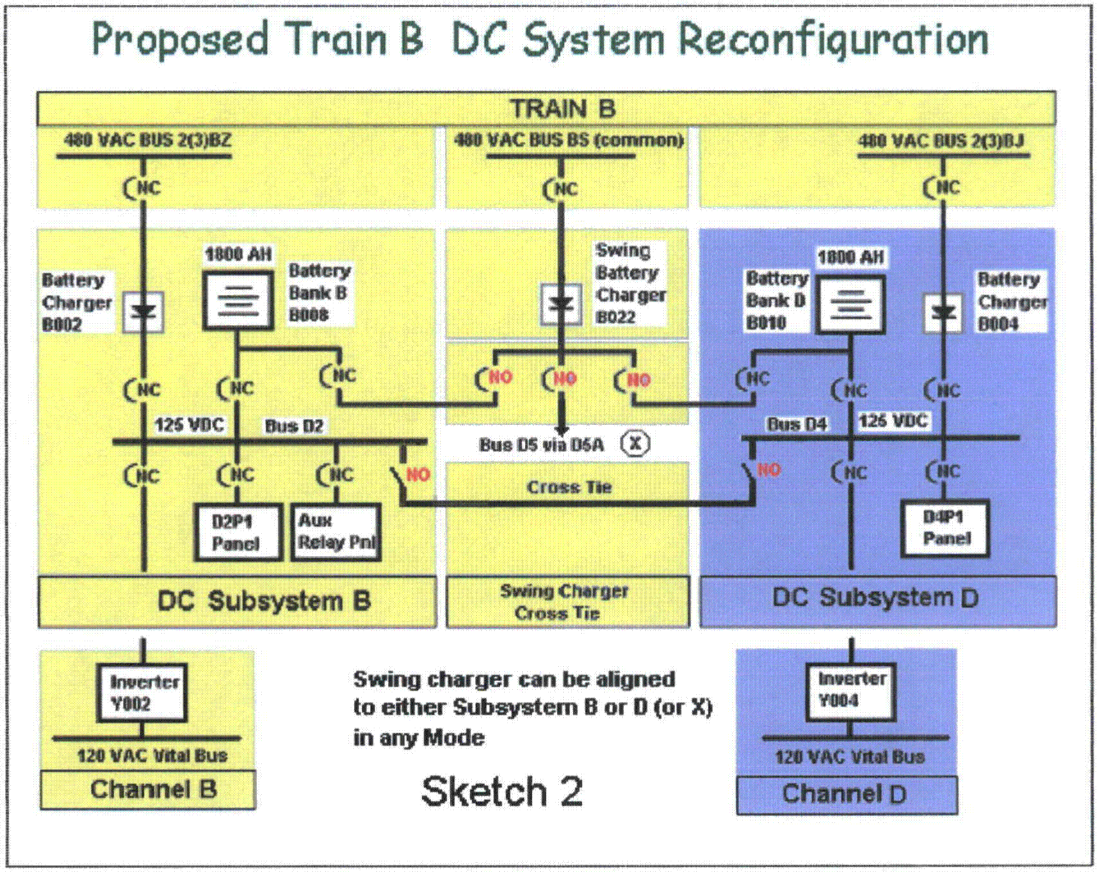
Notes (√ indicates applicable to SONGS):

1) Parameters are monitored during operator's shift and alarmed in the SONGS Control Room.
2) Detailed annual visual inspection of each cell in contrast to the monthly inspection of general appearance and cleanliness of the battery.
3) Separate battery service and performance tests will be performed for batteries less than 1800 AH.
4) Only the "Modified Performance Discharge Test" is intended to be used for the 1800 AH batteries to establish consistent trend data throughout the battery life.

Attachment 2: DC System Configuration Diagrams (Sketch 1 and 2)



Sketch 1



Sketch 2