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Manager of
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January 26, 2006

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

SUBJECT: **Docket Nos. 50-361 and 50-362**
Response to NRC Request for Information
Proposed Change Number (PCN)-548
Battery and DC Sources Upgrades and Cross-Tie
San Onofre Nuclear Generating Station, Units 2 and 3

Reference: Letter from Dwight E. Nunn (SCE) to Document Control Desk (DCD), dated December 17, 2004, Subject: "Proposed Change Number (PCN)-548), Battery and DC Sources Upgrades and Cross-Tie"

Dear Sir or Madam:

This letter responds to three sets of questions from the NRC staff reviewers regarding the subject license amendment request, PCN-548, included as Enclosure 1.

As part of the review to respond to these questions, several changes were identified to our original submittal (referenced above). The changed pages are included as Enclosure 2. Please note Enclosure 2 includes changes to the numerical value of specific gravity in Limiting Condition for Operation 3.8.6. The inclusion of specific gravity as a surveillance parameter was a carry over from the existing Technical Specifications and a site-specific difference from the implementation of Technical Specification Task Force (TSTF)-360, Revision 1; removing this parameter will make this feature in agreement with TSTF-360, Rev. 1.

In light of the above discussed changes and the intention to remove specific gravity as a surveilled parameter, there will be a complete revision to our original submittal to incorporate changes described in the responses to these questions. The revised amendment will be submitted to the NRC in February 2006 and this will completely supersede our submittal of December 17, 2004.

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A001

If you have any questions or require additional information, please contact Jack Rainsberry at (949) 368-7420.

Sincerely,

Enclosures:
1. Response to NRC Questions (includes three parts).
2. Changed pages to PCN-548.

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

Enclosure 1

Response to NRC Questions

REQUEST FOR ADDITIONAL INFORMATION RESPONSE, PART 1:

PROBABILISTIC SAFETY ASSESSMENT BRANCH (SPSB) REQUEST FOR ADDITIONAL INFORMATION

PROPOSED TECHNICAL SPECIFICATION CHANGE REQUEST FOR BATTERY AND DC SOURCES UPGRADES AND CROSS-TIE (PROPOSED CHANGE NUMBER (PCN)-548)

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3 (DOCKET NOS 50-361 AND 50-362)

NOTES:

A. *In the following, Southern California Edison (SCE) responds to the Request* for Additional Information (RAI) issues concerning the original License Amendment Request (LAR), PCN-548. We have recently demonstrated that battery float current can be measured at ≤ 2.0 Amps. Consequently, there is no longer any reason to carry forward the present Technical Specification requirements to measure and maintain specific gravity in the applicable batteries. A supplement to the LAR will be sent to the NRC in February 2006 removing all reference to specific gravity, thus restoring the LAR to be more like Technical Specification Task Force (TSTF)-360, Rev. 1.
B. In the following, SCE uses regular font for the NRC Question, bold font for the response, and italicized font where the LAR is cited.

Technical

1. This License Amendment Request (LAR) contains a number of technical specification (TS) changes, but only TS 3.8.4 is addressed in the risk calculations. Please qualitatively address the risk impacts associated with the other TS changes (excluding editorial changes) that are included in this LAR.

RESPONSE:

The LAR includes the following additional TS changes. Each of the changes is annotated with the qualitative risk assessment. Most of the requested changes are per the NRC approved TSTF-360, Rev. 1 and IEEE 450-2002 standard practice. The qualitative assessment has been generically made by SCE that those requested changes that conform with the NRC-approved TSTF-360, Rev. 1 and IEEE 450-2002 standard are permissible and would not significantly impact plant risk. Where this is applicable, the qualitative risk assessment refers to TSTF-360, Rev. 1 and/or IEEE 450-2002. Where it is not applicable, a specific risk assessment statement is provided.

- *LCO 3.8.1*
  - *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.*

    - **Risk: The change deletes reference to DC buses. The TS definition of OPERABLE for Buses 3A04 and 3A06 considers the support system DC buses are capable of performing their related support function. Therefore, the change has no impact on plant risk.**

- *LCO 3.8.4*
  - *The specification of the LCO is revised from the "Train A, Train B, Train C, and Train D" electrical power subsystems to "Train A and Train B."*

    - **Risk: The change is one of terminology and NRC approved train labeling convention consistent with the Standard Technical Specifications (STS), NUREG-1432, Rev. 0. Therefore, the change has no impact on plant risk.**

  - *A new Condition A (comparable to existing Condition C, which is deleted) is added: "Required DC electrical power subsystem battery charger or associated control equipment or cabling inoperable."*

    - **Risk: The change is one of clarification consistent with the STS and is comparable to the existing TS Condition C. Therefore, the change has no impact on plant risk.**

  - *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.*

    - **Risk: The change is comparable to the existing TS Condition D. Therefore, the change has no impact on plant risk.**

  - *Existing Condition A is modified, as new Condition C, to specifically cover conditions not included in new Condition A.*

    - **Risk: The change to existing Condition A is one of terminology. It also adds a required action to allow cross-connect to the other DC subsystem on the same DC train. A successful cross-connect is quantitatively evaluated in the risk calculation as described in the LAR submittal.**

      Note: The additional choice of required action to cross-connect within 2 hours allows entry to Condition D. Failure to cross-

connect within 2 hours results in an entry to new Condition E (which is comparable to existing Condition B). When one DC subsystem cannot be restored to OPERABLE status within the allowed action period, the requirement to shut down the unit is maintained. Therefore, there is no change in risk.

- *New Condition D is inserted to provide an upper limit for the duration of the time when DC subsystems are cross-connected.*

  - **Risk: This risk is quantitatively evaluated in the LAR submittal.**

- *Existing Condition B is relabeled Condition E and modified to include the failure to satisfy the new Conditions as entry conditions to mandate plant shutdown.*

  Risk: Existing Condition B provides for action to reduce power when the required actions for existing Condition A are not met. Existing Condition B (relabeled as Condition E) includes the condition where the cross connected DC subsystem buses are not returned to the non-cross connected configuration within 30 days. Cross-connect use for up to 30 days is quantitatively evaluated in the risk calculation as described in the LAR submittal. When one DC subsystem cannot be restored to OPERABLE status within the allowed action period, the requirement to shut down the unit is maintained. Therefore, there is no change in risk.

- *SR 3.8.4.1 is modified 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 extended from 7 to 31 days. Both changes are consistent with TSTF 360 Rev. 1 and IEEE 450-2002.*

  - **Risk: The terminology modification were made per TSTF 360, Rev. 1 and changed surveillance frequency were made per IEEE 450-2002 which are NRC approved practices.**

- *Existing SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 are relocated to the Licensee Controlled Specifications 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.*

  - **Risk: The relocation of surveillance requirements to the LCS is per TSTF 360, Rev. 1.**

- *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, and*
c. *To facilitate upgrade of the batteries, the operability limits are relocated to the Licensee Controlled Specifications (LCS), and the SR revised to:*
   - *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"*

   ➢ **Risk: The changes are per TSTF 360, Rev. 1 and the changed surveillance duration is per IEEE 450-2002 which are NRC-approved practices.**

- *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.*

     ➢ **Risk: The successful cross connect is quantitatively evaluated in the risk calculation as described in the LAR submittal.**

     NOTE 3, "Credit may be taken for unplanned events that satisfy this SR," is deleted as noted previously (see #9) as unhelpful.

     ➢ **Risk: The removal of the statement has no impact on risk.**

  b. *The following change is made per the recommendations of IEEE 450-2002:*
     - *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" (and the reference SR numbers are changed consistent with this amendment request).*

     ➢ **Risk: The modified performance discharge test is a combination of the existing battery performance discharge and service tests. Therefore, there is no impact on risk.**

     - *The 24-month frequency to perform this battery capacity test is extended to 30 months.*

- ➢ **Risk: The test is performed to assess available battery capacity. From IEEE 450-2002 a service test should be scheduled at the discretion of the user at periodic times between performance tests. The changed performance test frequency is in accordance with IEEE 450-2002.**

- *NOTE 2 is added to specify, "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.*

- ➢ **Risk: The battery performance discharge test is a constant current discharge test to assess battery capacity. It is currently allowed by the existing TS's in lieu of SR 3.8.4.3 once per 48 months. Therefore, there is no impact on risk.**

- *Existing SR 3.8.4.8 is revised and relocated per TSTF 360 Rev. 1 to be the new SR 3.8.6.6, as a more appropriate location.*

- ➢ **Risk: The changes and relocation of text are per TSTF 360, Rev. 1.**

- *LCO 3.8.5*
  - *The word "The" is added to the beginning of the LCO. This is an editorial change.*

    ➢ **Risk: This editorial change has no impact on risk.**

  - *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.*

    ➢ **Risk: Condition C is clarified per TSTF 360, Rev. 1 without change to the required action or completion time.**

  - *SR 3.8.5.1 is modified to reflect changes previously described in 3.8.4, DC Sources - Operating:*
    - *The DC sources are OPERABLE when the following SRs are satisfied: 3.8.4.1, 3.8.4.2, and 3.8.4.3.*
    - *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.*

- **Risk: The change is per TSTF 360, Rev. 1 and has no impact on risk.**

- *LCO 3.8.6*

  1. *General comment: LCO 3.8.6 undergoes the most editorial changes of any LCO in this Amendment Request, in updating to the recommendations of IEEE 450-2002. In maintaining compliance with the upgraded IEEE standard, the equivalent level of operational reliability is assured.*

     - **Risk: The editorial changes are per TSTF 360, Rev. 1 and IEEE 450-2002 approved practices.**

  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; subsystems B and D support Train B.

     Note that discussion referring to Table 3.8.6-1 is removed in its entirety. Subsequent discussion in this change will include deletion of this Table, while the Table's requirements are included in new SRs (and any deficiencies in satisfying these are accommodated in the Conditions).

     - **Risk: The re-labeling of LCO 3.8.6 is per TSTF 360, Rev. 1.**

  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 IEEE 450-2002, this table and specific action levels are superceded by new Conditions.*

     - **Risk: The changes are per TSTF 360, Rev. 1 and IEEE 450-2002 approved practices.**

4. *New Condition A is inserted. In this Condition, float voltage of 2.07VDC 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 or specific gravity verification) within 2 hours in addition to restoration of the affected cell float voltage within 24 hours. Note that IEEE 450-2002 provides float current as an alternate test to verify specific gravity.*

    - **Risk: The new condition and action statement are per TSTF 360, Rev. 1.**

5. *New Condition B is inserted. In this Condition, float current exceeds 2 amps or specific gravity is less than 1.195 (this is the equivalent to the Category B and C limits in Table 3.8.6-1 for specific gravity, with float current as an alternative parameter). The Required Actions specify performance of SR 3.8.4.1 (battery terminal voltage) within 2 hours and restoration of either float current or specific gravity within 24 hours.*

    - **Risk: The new condition and action statement are per TSTF 360, Rev. 1 and per existing TS requirements.**

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:*

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

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

    These NOTES are consistent with IEEE 450-2002 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 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.

    - **Risk: The new condition and action statement are per TSTF 360, Rev. 1 and consistent with IEEE 450-2002 in addition to current TS practices.**

7. *New Condition D provides a Required Action and Completion Time should the battery pilot cell temperatures be found low, in accordance with IEEE 450-2002. This surveillance is currently in existing Condition B (for remainder of parameters in Condition B, see item 9, below).*

   - **Risk: The new condition D and action statement (same as existing Condition B) are per TSTF 360, Rev. 1.**

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: "Restore battery parameters for batteries in one train to within limits" with a Completion Time of 2 hours.*

   - **Risk: The new condition E and action statement are per TSTF 360, Rev. 1.**

9. *Existing Condition B is relabeled as Condition F, and*
   a. *Required Actions and Completion Times A through E not met is specified as the reason for entering this Condition, and*
   b. *Technical parameter limits in the Condition are re-specified per the recommendations of IEEE 450-2002:*
      - *"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*
      - *"with average electrolyte temperature of the representative cells <60°F" is replaced with "one or more battery cells float voltage <2.07V and float current >2 amps," and,*
      - *"parameters not within category C values" is replaced with "cells float voltage <2.07V and specific gravity <~~1.175~~ 1.195"* **(Note: as described in the cover letter, this item has been edited above to correct a transcription error in the LAR submittal (bold for an addition, strike-out for a deletion). A clean page of this correction is included in Enclosure 2; this correction will also be included in the forthcoming Supplement).**

   - **Risk: The new condition and action statement are per TSTF 360, Rev 1 and per the recommendations of IEEE 450-2002.**

10. *SR 3.8.6.1*
    In accordance with the recommendations of IEEE 450-2002, this surveillance:
    - *rather than meet Table 3.8.6-1 category A limits, is re-specified to verify ≤2 amps float current or verify pilot cell specific gravity ≥1.200 for each battery.*

- *the specified frequency for this surveillance is extended from 7 days to 31 days.*

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.

> **Risk: The revised condition and action statement are per TSTF 360, Rev. 1 and IEEE 450-2002 standard practice.**

11. *Existing SR 3.8.6.2 is deleted; its verifications are now contained in new SRs 3.8.6.2, 3.8.6.3, and 3.8.6.4.*

> **Risk: The new condition and action statement are per TSTF 360, Rev. 1.**

12. *New SR 3.8.6.2 verifies pilot cell voltage ≥2.07V every 31 days. This is the equivalent of the existing Category A limit of Table 3.8.6-1, which is currently surveilled every 7 days~~92 days and within 7 days after battery discharge or overcurrent~~. This change in surveillance frequency is per the recommendations of IEEE 450-2002.* **(Note: as described in the cover letter, this item has been edited above to correct a transcription error in the LAR submittal (bold for an addition, strike-out for a deletion). A clean page of this correction is included in Enclosure 2; this correction will also be included in the forthcoming Supplement).**

> **Risk: The revised condition and action statement are per TSTF 360, Rev. 1 and IEEE 450-2002 standard practice.**

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 increase in surveillance frequency is per the recommendations of IEEE 450-2002.*

> **Risk: The revised condition and action statement are per TSTF 360, Rev. 1 and IEEE 450-2002 standard practice.**

14. *Existing SR 3.8.6.3 is renumbered to SR 3.8.6.4. This SR replaces verification of average electrolyte temperature 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 new pilot cell surveillance is increased from once per 92 days to once per 31 days~~once per 31 days per TSTF 360, Rev. 1~~. These changes are made per the recommendations of IEEE 450-2002.* **(Note: as described in the cover letter, this item has been edited above to correct a transcription error in the LAR submittal (bold for an addition, strike-out for a deletion). A**

clean page of this correction is included in Enclosure 2; this correction will also be included in the forthcoming Supplement).

- **Risk: The revised condition and action statement are per TSTF 360, Rev. 1 and IEEE 450-2002 standard practice.**

15. *New SR 3.8.6.5 verifies connected cell voltage every 92 days. This is the equivalent of the current Category B limit in Table 3.8.6-1, which is also surveilled every 92 days.*

    - **Risk: The revised condition and action statement are per TSTF 360, Rev. 1 and IEEE 450-2002 standard practice.**

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. This change is per the recommendations of IEEE 450-2002.*

    - **Risk: The revised condition and action statement are per TSTF 360, Rev. 1 and IEEE 450-2002 standard practice.**

17. *Table 3.8.6-1 is deleted in its entirety. As discussed previously, the limits are incorporated in the previous SRs.*

    - **Risk: The revised condition and action statement are per TSTF 360, Rev. 1 and IEEE 450-2002 standard practice.**

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.

- **Risk: The change is one of terminology and NRC approved train labeling convention consistent with the STS. Therefore, the editorial change has no impact on plant risk.**

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.

- **Risk: The change is one of terminology and NRC approved train labeling convention consistent with the STS, NUREG-1432. Therefore, the editorial change has no impact on plant risk.**

§ 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 is verbatim per the recommendations of TSTF 360 Rev. 1, and provides the programmatic changes necessary to warrant the changes previously citing that IEEE standard.

The Bases would similarly be modified to reflect the above changes.

- **Risk: The new program and actions are per TSTF 360, Rev. 1.**

2. The LAR states (page 5 of Attachment I) that it is "expected" to have a pre-alignment procedure. However, there is no commitment for such a procedure. The SPSB staff sees this as an important consideration since it appears that the licensee did not include operator failures in the cross-tie analysis (or set their probabilities to 0). Further, the LAR states that bus voltage current readings in the control room provide indication that the cross-tie is properly connected and also states that the model does not consider cross-tie connection errors since if the cross-tie is not performed properly within 2 hours, then the extended completion time is not allowed and the plant would enter shutdown TS conditions. Is the action to check and verify appropriate bus voltage current readings from the control room expected to be included in the battery cross-tie procedure? Are there other (local) indications that the cross-tie is properly connected and are (or should) these indications expected to be included within the cross-tie procedure? Based on the SONGS human reliability analysis (HRA) approach, what is the estimated human error probability (HEP) associated with performing the cross-tie (with and without procedures) that would result in an improper/non-functional DC bus cross-connection? Is the licensee committing to proceduralize the pre-alignment cross-tie actions, including verification of a proper cross-tie, within the 2 hour completion time?

RESPONSE:

SONGS is committing to control the battery/bus cross-tie using a step-by-step procedure with local independent (second checker) verification and to complete this verification within the 2 hour completion time. It is stated in the LAR that positive verification of the proper alignment of the cross-tie will include use of in-control room

bus voltage and current readings. This was not correct. It will be revised in the forthcoming Supplement and submittal.

In lieu of in-control room bus voltage and current readings, which will not provide sufficient confirmation of the cross-tie, proper local connection of the cross-tie will rely on an approved step-by-step procedure. These procedural steps are performed locally at the buses. The cross-tie switch and main battery breaker positions also feature positive tactile, audible, and visual feedback to the operator when the switch or breaker is moved to the correct position. These multiple feedback cues are used to confirm that the procedural steps have been completed. An independent verifier (second checker) will confirm that the switches and breakers have been correctly manipulated. Local indication of proper cross-tie will be verified by observing the two cross-tie switches (non-automatic molded case breakers) in the closed position and one battery breaker in the open position. In addition, bus voltages and charger current will be verified locally.

<u>HEP Calculation:</u>

As stated in the LAR, the proposed Technical Specification will permit an allowed outage time of 30 days in the cross-connected configuration. Prior to successful alignment of the cross-tie, the allowed outage time is 2 hours. If an operator fails to cross-tie properly, the allowed outage time is, by definition, 2 hours, which matches the current allowed outage time (AOT). Therefore, cross-tie alignment failure was not considered with a 30-day allowed outage time calculation in the LAR. However, as requested in the RAI question, a cross-tie alignment failure probability is calculated. Using NUREG/CR-4772, "Accident Sequence Evaluation Program Human Reliability Analysis Procedure," the mean HEP for performing the cross-tie with a procedure is calculated to be 8E-3/demand. SONGS would assume an HEP = 1.0/demand if the cross-tie were not proceduralized. These values, however, were not used in the LAR's calculation.

3. Please describe the modeling changes incorporated to address the maintenance configuration. As the maintenance configurations would impact the DC bus failure initiating event frequency, battery common cause failure (CCF) grouping (i.e., changes from 4 component group to 3 component group for preventive maintenance configuration), and CCF failure rates (for corrective maintenance, may have higher CCF failure rate for other battery components with the affected battery unless a CCF operability analysis is performed to ensure the other batteries are not susceptible to the same failure cause). Specifically describe changes to the model to represent the above aspects or provide the rational for not making these changes to the model.

RESPONSE:

There are four 1E DC batteries per operating unit. The CCF modeling of batteries includes CCF groupings of two, three, and all four batteries. For example, in the fault tree modeling for battery 2B007, basic events are included in its modeling for

CCF with 2B008, with 2B009, and with 2B010 (i.e., doublets). Basic events for a group of three are included for CCF of 2B007 with 2B008 and 2B009, and with 2B008 and 2B010, and with 2B009 and 2B010. Another is included for CCF of all four batteries (2B007, 2B008, 2B009, and 2B010). Batteries 2B008, 2B009, and 2B010 each have similar groupings in their fault tree logic. If 2B007 is removed from service for preventive maintenance, the CCF modeling (i.e., groupings and probabilities) for the other batteries were not changed. However, if 2B007 is removed from service to perform corrective maintenance, the common cause failure probability of a second battery failing is adjusted upward to the CCF alpha factor for doublets (from 1.05E-6 to 2.62E-3). The common-cause failure probability of two additional batteries failing given 2B007 failed was adjusted to the triplet CCF factor (from 4.79E-7 to 1.20E-3). A similar adjustment was done for the remaining three batteries failing due to common cause given 2B007 failed (i.e., a quadruplet).

4. The LAR states (page 4 of Attachment I) that generic data is used for circuit breakers, battery charges, and batteries and there was a peer review fact and observation (F&O) on this topic. Please describe how the plant-specific experience compares with the generic data for these components.

RESPONSE:

Page 4 of Attachment I of the LAR incorrectly implied only generic data was used. As used in the PRA calculations to support the LAR, the failure probabilities for the batteries and battery chargers are generic failure probabilities [Ref: NUREG/CR-4550] updated with plant-specific data.

The generic battery charger failure rate is 6.0E-7/hr. After Bayesian updating, the battery charger failure rate used for the analysis is 1.68E-6/hr. This indicates that the SONGS battery charger failure rate is higher than the generic failure rate.

The generic probability of battery failure to operate when demanded is 4.0E-4/demand. After Bayesian updating, the battery demand failure probability did not change. That is, the updated demand probability is the same as the generic demand probability. This indicates that the SONGS battery failure rate is consistent with the generic industry failure rate.

The bus cross-ties will utilize switches instead of circuit breakers. The original analysis for the LAR is slightly conservative since the failure probability of switches to close and open are lower than circuit breakers ["Generic Component Failure Data Base for Light Water & Liquid Sodium Reactor PRAs," EG&G Idaho, Inc., EGG-SSRE-8875, 1990]. The use of switches instead of breakers results in a more reliable connection. The cross-tie switches are less prone to spurious opening than circuit breakers since the switches do not have an overcurrent trip mechanism. An overcurrent trip mechanism has a very small potential of spurious, inappropriate operation. Bus protection is maintained on the buses by other supply and load breakers.

5. The LAR states (page 5 of Attachment I) that no credit is taken for swing battery chargers in the base and maintenance cases. However the discussion on CCF (page 6 of Attachment I) indicates that CCFs were developed for the swing and dedicated battery chargers. Please clarify the apparent inconsistency. Specifically, if any credit is taken for the swing battery chargers, please discuss if this will be a proceduralized action, describe the indications available to verify the connections are properly established, and the potential for operator failure to properly align the swing battery chargers (including the estimated HEP associated with performing this action - with and without a procedure).

RESPONSE:

The PRA model was adjusted for this application to reflect the expected design when the LAR for the DC battery and DC bus extension is approved. Swing battery chargers are to be installed in 2006 and will be used to allow isolation of the dedicated charger for test and maintenance. Similar to SONGS' High Pressure Safety Injection (HPSI) and Component Cooling Water (CCW) pumps, proceduralized alignment of the swing battery charger permits testing and maintenance flexibility while maintaining the full system design function within the limiting conditions of operation under the Technical Specifications. The swing pumps and battery chargers also provide additional system reliability and availability; therefore, for completeness, the swing battery chargers were modeled with common cause failures (CCF's) included. However, for this application, the unavailability of the swing battery chargers were set to 1.0 to specifically isolate the risk impact of the battery cross-tie. The swing battery charger is not necessary to perform a battery cross-tie. Since no credit is taken for the swing battery chargers for the application, an HEP was not calculated.

6. The LAR states (page 8 of Attachment I) that 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. Though a PRA that meets Capability Category II for all supporting requirements may be adequate for this specific application, it cannot be and should not be assumed that this is sufficient for all potential risk-informed applications. Such a determination must be made for the specific application. In addition, industry peer review F&Os can be made for supporting requirements that meet Capability Category II (not just those that do not meet Capability Category II). This could mean that though the PRA meets Capability Category II for a specific supporting requirement, a related F&O could make the PRA unacceptable for the application unless it is addressed. Please confirm that all A and B F&Os have been reviewed and addressed for this application (not just those related to supporting requirements that were not met).

RESPONSE:

SONGS affirms that all A and B Facts and Observations (F&Os) were reviewed and addressed individually for this application and not just those related to supporting requirements that were not met.

7. The LAR refers (page 11 of Attachment I) to results from a sensitivity study in which the cross-tie breakers failure probability was set to 0.1 as opposed to 0.0. The staff views this as an important sensitivity study and as such request that the results (CDF and LERF) of this calculation be provided.

RESPONSE:

As requested, the result of the sensitivity analysis are shown in Table RAI-1:

TABLE RAI-1

	Avg Maintenance	
	CDF	**LERF**
Battery B007 OOS – cross-tie fails to close with P=0.0	**3.24E-05**	**1.12E-06**
Battery B007 OOS – cross-tie fails to close with P=0.1	**4.93E-05**	**1.88E-06**

8. Table 1 of Attachment I identifies proactive replacement of multiple jars as a maintenance activity that requires a cross-tie. However, this activity is not reflected in the Table 2 preventive maintenance calculation. Please revise the table to include this activity or provide a justification for its exclusion.

RESPONSE:

Below is the revised Table 2 from the LAR which includes proactive replacement of multiple battery jars. Inclusion of this maintenance activity slightly increased the downtime frequency (line 8) and mean duration (line 9) for preventive maintenance. The resulting change in single AOT risk was small (line 10). The single AOT core damage probability (CDP) changed from 5E-10 to 6E-10, while the single AOT large early release probability (LERP) remains <1E-9. With such small changes, the yearly increase in risk for preventive maintenance is essentially unchanged (line 11).

TABLE 2

SONGS Conditional CDF & LERF Contributions for 'Preventive' Maintenance

		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)*	3.47 /year[b]	
9	Mean Duration of PM	10.26 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 5 service tests in 10 years. This is a total of 7 tests in 10 years times 4 batteries. 7 tests * 4 batteries/10 years = 2.8 tests/year; four 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 = 2.8 + 0.267 + *0.4 = 3.47/year*

[c] Mean duration = [2.8 (7 days) + 0.267 (30 days) + *0.4 (20 days)]/3.47 = 10.26* days

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

Bolded values are measured against RG 1.174/1.177 acceptance guidelines

9. Table 2 of Attachment I calculates the single AOT risk for preventive maintenance based on the mean duration. However, the 12-month cycle that includes the replacement of all 4 batteries will have a much greater battery outage duration (upwards of 140 outage days as opposed to about 27 outage

days for the average year). Please perform a specific calculation of the expected AOT risk for the year involving replacement of all 4 batteries, including the expected outage times associated with other maintenance activities that will require the cross-tie.

RESPONSE:

Our current plans no longer require all four batteries for a unit to be replaced in the same 12 month window. Two of the batteries (B009 and B010) for each unit have been recently replaced on each unit by aligning a qualified spare battery during the replacement period. The remaining two battery replacements for each unit (four total) will not be installed until approximately 2009 (one battery) and 2011 (three batteries). However, as requested, the following table reflects the change in risk should all four batteries be replaced in a twelve month window.

TABLE RAI-2

SONGS Conditional CDF & LERF Contributions for 'Preventive' Maintenance

		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]	7.2 /year[b]	
9	Mean Duration of PM	19.50 days[c]	
10	Single AOT Risk for PM - based on mean duration *(Line 6) * (line 9)/365*	1E-9	<6E-11
11	**Yearly AOT Risk for PM - based on mean duration (RG 1.174)** *(Line 10) * (Line 8)*	**8E-9/yr**	**<4E-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 5 service tests in 10 years. This is a total of 7 tests in 10 years times 4 batteries. 7 tests * 4 batteries/10 years = 2.8 tests/year; *four battery replacements in 1 year or 4/year*; proactive multiple jar replacements for four batteries every 10 years or 0.4/year; total downtime frequency = 2.8 + 4 + *0.4* = *7.2/year*

[c] Mean duration = [2.8 (7 days) + 4 (30 days) + *0.4 (20 days)]/7.2* = *19.50* days

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

Bolded values are measured against RG 1.174/1.177 acceptance guidelines

10. The staff is aware that the SONGS PRA includes external events and yet the LAR discussion does not mention external events considerations (e.g., seismic capability of the replacement batteries and supports, hydrogen generation of batteries). In the context of external events and operational considerations, please compare the replacement batteries against the existing batteries and describe any modeling changes required to reflect these differences. In addition, please discuss/justify the quality of the external events portion of the SONGS PRA for this application, consistent with Regulatory Guide 1.174 Section 2.2.3 and Regulatory Guide 1.177 Section 2.3.1. Include in this discussion any peer reviews that have been performed on this portion of the SONGS PRA and address any F&Os that resulted from these reviews.

RESPONSE:

The seismic portion of the SONGS PRA is based on the SONGS Individual Plant Examination of External Events (IPEEE). In the IPEEE, batteries B007, B008, B009 and B010 were probabilistically screened from further analysis due to the high seismic fragility of the batteries and battery racks. Given the plant specific seismic hazard curve and the battery fragility curves, the batteries were below the screening criteria of 1E-7/year failure likelihood and their seismic fragility was not explicitly included in the PRA model. The replacement batteries have a capacity of 1800 AH each which is larger than the existing batteries. Batteries B009 and B010 had a capacity of 1500 AH each and have been upgraded to the larger capacity batteries. Since the replacement batteries are heavier than the existing batteries, the seismic fragility of the existing battery racks was also evaluated. The seismic fragility of the battery rack anchorage was reduced from a spectral acceleration of 12.5 g to 10.5g which is still greater than the seismic fragility of 10g that was estimated for the batteries in the IPEEE. Therefore, no seismic PRA modeling changes were necessary for the replacement batteries.

Existing batteries B007 and B008 with a capacity of 1260 AH each are planned to be upgraded to the 1800 AH capacity batteries in the future. When the upgrade occurs, the existing battery racks will also be replaced with new racks. Even though the new

battery racks are anticipated to be of high seismic capacity as to not adversely affect the SONGS PRA, the seismic PRA model will be reviewed again when the upgrade is actually designed and implemented.

With respect to hydrogen generation, a calculation was performed to evaluate hydrogen generation for the larger batteries. The calculation demonstrates that it will take at least 2 days to reach the 3% hydrogen concentration limit by volume (4% is permitted by Regulatory Guide 1.7). This is sufficient time for mitigative actions to be taken prior to reaching this hydrogen concentration.

<u>SEISMIC PRA</u>:

The SONGS seismic PRA was reviewed against the ANS External Events Standard by ABS Consulting. This review was documented in EPRI 1009074, "Trial Plant Review of an ANS External Event PRA Standard," 2003. In the report, it states:

"Overall, it is concluded that the SONGS seismic PRA (SPRA) meets the requirements of Capability Category I and in most cases Capability Category II. In order to comply with all technical requirements of Category II, a full uncertainty analysis would be required that includes the uncertainties in the seismic hazard, the uncertainty in the fragilities and the HRA. In addition, a complete sensitivity study would be required to address the effect of correlation assumptions on the computed CDF and LERF. The level of documentation would also have to be enhanced to summarize the information requested in the Standard, or to clearly list or reference all supporting Tier 2 documentation and to expand on the peer review conducted."

The SONGS seismic PRA utilized the mean seismic hazard curve and mean equipment fragility curve. Comprehensive propagation of the uncertainties in the seismic hazard, equipment fragilities and HRA would have provided comprehensive CDF and LERF distributions. For this application, where the risk increase is a measure of acceptability, this comment does not impact the conclusions of the LAR.

In terms of seismic failure correlation, the ANS Standard requires that sensitivity studies be performed to assess the sensitivity of CDF and LERF to the assumptions used for dependency and correlations. SONGS assumed complete seismic correlation for like components in a redundant safety train and no seismic correlation for dissimilar components. In the EPRI report, it states that this conservative treatment is typical and that 'hardly any SPRAs conducted over the past 20 years would satisfy this requirement. The EPRI report also states "At this point in time, meeting this requirement is difficult to meet for two reasons:

1) there is little background and experience on correlation of seismic failures. Assignment of partial correlation on response and capacity would be subjective.

2) the software to treat partial correlation of seismic failures is not readily available to the public."

FIRE PRA:

The fire PRA was independently reviewed by Erin Engineering as part of the Fire Protection Program Self-Assessment. The review was performed against the IPEEE fire PRA. The study, performed in October 2000 and documented in ERIN Report 108-0003.R01, identified several technical and documentation issues that were grouped in 2 bins. The first bin involves 'overly conservative analyses.' The second bin involves 'incomplete treatment of fire scenarios.'

Overly conservative analysis: A major part of the original fire analysis assumed that any fire would result in maximum consequential damage regardless of the location of the fire in the room. This issue was focused on the safety related Train A and B switchgear rooms.

Incomplete treatment of fire scenarios: The study identified that only a large fire in the AFW pump room was analyzed and that smaller partially damaging fires were non-conservatively excluded.

To address these two issues, two studies were performed by ABS Consulting: 1) "Fire Risk Analysis: AFW Pump Room Reassessment, August 31, 2001" and 2) "Fire Risk Analysis: Switchgear Room Reassessment, September 30, 2001." The risk analysis for the switchgear room was revised to remove overly conservative assumptions, and updated with newer techniques and data. With these revisions, the total fire CDF for this zone is 1.9E-6/year. The risk analysis for the AFW pump room was revised to include a comprehensive set of fire scenarios. With these revisions, the total fire CDF for this zone was revised from 6.5E-7/yr to 6.9E-8/yr. Although additional fire scenarios were added which increased risk, the overall risk was reduced due to the presence of two automatic fire suppression systems that were not previously included in the original analysis. These fire revisions were included in the calculations for this LAR.

Peer reviews have not been performed on any other external events.

11. The LAR is based on results from the safety monitor, as opposed to quantified results from the SONGS PRA model. Please describe any reviews, benchmarking, or other approaches used to ensure the technical adequacy of the safety monitor, and address any F&Os that resulted from these reviews.

RESPONSE:

The SONGS Safety Monitor (SM) model and the SONGS WINNUPRA model are virtually identical. The SM model is generated from the WINNUPRA model. The difference in modeling pertains to 1) logically subsuming some event tree sequences into more minimal sequences (see question 12), 2) allowances for code specific differences and 3) allowances for configuration specific modeling (as opposed to average alignments). An example of this configuration specific modeling allowance is permitting the user to choose a specific train alignment of any swing component, whereas WINNUPRA models an average probability of alignment to either train of 50%. In all other significant aspects, the SONGS PRA models for the SM and WINNUPRA are identical.

In terms of processes to ensure technical adequacy of the SONGS SM quantification, SONGS regularly compares the results between the two models to ensure fidelity of the results generated by the Safety Monitor. For example, when model or data changes are made to the model through the SONGS PRA Change Package process, the change is incorporated into the model for both codes. The results are compared to ensure consistency before the models are released for general use for PRA and Maintenance Rule Risk Management Program use.

The June 2003 ASME peer review of SONGS PRA was performed against the Safety Monitor model and results. The top logic modeling of the event trees was discussed during the peer review. The discussions were focused on how top logic modeling captures the event tree sequences. No F&O's, however, regarding the use or development of top logic modeling were generated by the peer review team.

Three facts and observations (F&Os) specifically addressing the Safety Monitor software were generated from the 2003 ASME peer review (Table RAI-3). These F&Os pertained to installation validation and verification (V&V) and did not pertain to other approaches or to technical adequacy. No other external peer reviews have been performed on the Safety Monitor.

Table RAI-3
(Safety Monitor Facts & Observations)

F&O	Text	Level Of Significance Assigned by Review Team
MU-7-1	The ***SAFETY MONITOR*** 3.5 V&V Plan PRA-02-010 Section 4.2 only tests a clean install. The installation program must perform an uninstall first before installing the new software to meet this test configuration with the installed configuration. This did not have an impact on revision 3.5 as the 3.5 version was coincident with installation of Windows 2000, but this will be important with the next revision.	C
MU-7-2	The ***SAFETY MONITOR*** 3.5 V&V Plan PRA-02-010 Section 4.3 and Report PRA-02-011 did not provide any requirement or information on the number of cutsets to be reviewed or which were reviewed when comparing the cutset results from the old and new revisions. The Engineer involved said that only 1000 could be printed out and they looked at the top 500. A sample selection should look at cutsets from within the whole available population (bottom as well as top).	C
MU-7-3	The ***SAFETY MONITOR*** 3.5 V&V Report PRA-02-011 states that the comparison run was performed at 1E-9, however, the PRA is solved for CDF at 1E-10. The comparison between the old and new versions should use the same truncation as normally used for PRA applications to ensure that it is valid.	C

12. Based on the staff site visit, the staff is aware that the licensee converts the SONGS PRA event tree model into a fault tree model that is imported into the safety monitor. In the process of this conversion, and since success branches in the event tree model are not tracked or solved by the licensee, the licensee eliminates "non-minimal" event tree sequences during the conversion. This results in the elimination of entire sequences in which the only difference is the success or failure of a specific branch in the event tree (with the success branch sequence carried forward and the failure branch eliminated). In addition, licensee checks the safety monitor output results against the event tree and cutsets that would have resulted in failures instead of success for the subject success branches (most likely due to support system failures) are then eliminated from the results. However, by performing the elimination during the conversion, the licensee has effectively eliminated the branch point and success or failure of the subject branch point should not be considered in the post-process review of cutsets. The licensee's two elimination steps in concert (one pre-conversion and the other post-quantification) raise the potential for eliminating valid results. Please provide the risk results (baseline and maintenance configuration) without the post-quantification cutset elimination step. In addition, please describe the licensee's approach to LERF quantification

using the safety monitor as this may require the incorporation of sequences that were eliminated during the conversion process to address CDF.

RESPONSE:

SONGS understands that the NRC is concerned with the potential elimination of valid core damage or large early release cutsets when two processes are applied to the same sequence cutsets.

In the first process, event trees are converted into 'top logic' fault trees where some sequences are subsumed into similar more minimal sequences. For example, if a core damage sequence in an event tree contains failures of system A, B, and C (written as ABC) and another core damage sequence from the same event tree contains success of system A and failure of system B and C (written as BC) then ABC is subsumed into BC since BC is a minimal sequence. In this 'super' sequence BC, the success or failure of system A is not relevant since BC is minimal. Therefore, BC correctly includes ABC.

When solving the entire 'top logic' model (which includes all event trees) with the Safety Monitor, cutsets were observed that simultaneously contained failure and success of the same component. In the second process, these cutsets are removed from the results using a post-processing feature of the Safety Monitor. This process is called 'success term deletion.'

Both processes, subsuming and success term deletion, correctly produce core damage and large early release results except possibly when success term deletion is applied to a super sequence containing subsumed sequences. When this occurs, there may be sequences in the super sequence that are deleted that represent valid subsumed sequences. The SONGS PRA does not perform success term deletion on super sequences. To verify this, all of the super sequences were identified and all component success and failure event pairs used for success term deletion were identified and then manually compared to ensure both are not simultaneously applied.

Of the 193 sequences modeled in 15 event trees, 15 super sequences were created from 16 subsumed sequences. The only success term deletion pair used in the SONGS model is DG-OK/DG-FAILURE. This pair was not applied to the super sequences.

The results below represent the results when the success term deletion term pair is not post-processed.

Case	Description	CDF	LERF
0	Base - Normal plant configuration	3.22E-5/yr	1.12E-6/yr
1	Subsystem Battery B007 OOS/Cross-tie connected	3.22E-5/yr	1.12E-6/yr

The results below represent the results when the success term deletion term pair is post-processed.

Case	Description	CDF	LERF
0	Base - Normal plant configuration	3.22E-5/yr	1.12E-6/yr
1	Subsystem Battery B007 OOS/Cross-tie connected	3.22E-5/yr	1.12E-6/yr

With respect to LERF quantification, the core damage cutsets from the top logic solution are directly transferred to the large early release sequences for LERF quantification. Since the event tree core damage sequences were appropriately treated in the top logic, the cutsets transferred to the LERF sequences represent a comprehensive set (i.e., no additional cutsets need to be reincorporated for LERF purposes).

In summary, sequence subsuming and cutset deletion in the SONGS top logic model were performed appropriately and without impact on the results and conclusions.

13. The LAR compares the risk results against the risk acceptance guidelines (Tier 1) required by Regulatory Guides 1.174 and 1.177, but does not discuss Tier 2 (Avoidance of Risk-Significant Plant Configurations) and Tier 3 (Risk-Informed Configuration Risk Management) considerations and does not identify any compensatory measures (e.g., no maintenance in the switchyard during battery replacements). Please provide a discussion of Tier 2 and Tier 3 considerations, consistent with Regulatory Guide 1.177 Sections 2.3.6 and 2.3.7.

RESPONSE:

From Regulatory Guide 1.174, the licensee must appropriately restrict dominant risk-significant configurations associated with the proposed TS change (Tier 2). Based on the low risk increase of the cross-connected configuration (2E-8/yr CDF, <1E-9/yr LERF), there are no Tier 2 plant configurations that should be explicitly avoided.

Specific configurations will be assessed as part of the Tier 3 configuration risk management program (recently renamed the Maintenance Rule Risk Management Program - MRRMP). The MRRMP is an integral part of SONGS Maintenance Rule (MR) program.

The SONGS MRRMP program matches that stated for the Configuration Risk Management Program (CRMP) on page 1.177-15 of Regulatory Guide 1.177. In RG 1.177, the CRMP applies to Systems, Structures and Components (SSCs) for which a risk-informed AOT has been granted. SONGS has chosen to integrate use of the CRMP on a daily basis as part of the MR program and not limit its implementation to a risk-informed AOT. The MRRMP consists of the following proceduralized processes:

- **The Work Control department assesses the planned risk configuration using the Safety Monitor several weeks in advance and again a week in advance to assure that no unacceptable risk configurations are planned. If the risk is unacceptable, then the schedule is first modified to attempt to reduce the risk**

to an acceptable level. Risk management actions will be reviewed and implemented if the unacceptable risk condition cannot be resolved.

- ***On a shiftly basis, the Shift Technical Advisor (STA) runs the Safety Monitor to assess the current configuration and verify that the plant is not in an unacceptable risk configuration. On an emergent change to the plant, the STA runs the Safety Monitor as time permits.***

Editorial

A. Equations 1 and 2 on page 2 of attachment I are not consistent with the equations in Tables 1 and 2. The cited equation should display the conversion of 1 year/365 days in the equation since the CDF is in per year. This would make the equation results unitless (core damage probability).

Response:

SONGS agrees that the units of the equations do not match up. Equations 1 and 2 should read:

ICCDP = [(conditional CDF with a battery out of service) - (baseline CDF with battery available)] X (1 year/365 days) X (30 days)

ICLERP = [(conditional LERF with a battery out of service) - (baseline LERF with battery available)] X (1 year/365 days) X (30 days)

B. The discussion of CCF on page 6 of the attachment refers to "Tables C-1 and C-2," which could not be found in the attachment. Please provide these tables or provide the appropriate reference.

Response:

Following are the requested tables.

Table C-1
COMMON-CAUSE FAILURE PROBABILITIES
Battery Chargers (including swing chargers B021 and B022)

Basic Event	Mean	Common Cause Groupings - Failure to Run
U-BCCC01-1DR	2.70E-07	Battery charger B001, B002, B003, B004, B005, B015, B017, **B021**, **B022** (Global CCF of 3 or more BCs)
U-BCCC02-1DR	6.25E-08	Battery charger B001, B002
U-BCCC03-1DR	6.25E-08	Battery charger B001, B003
U-BCCC04-1DR	6.25E-08	Battery charger B001, B004
U-BCCC05-1DR	6.25E-08	Battery charger B001, B005
U-BCCC06-1DR	6.25E-08	Battery charger B001, B015
U-BCCC07-1DR	6.25E-08	Battery charger B001, B017
U-BCCC23-1DR	6.25E-08	**Battery charger B001, B021**
U-BCCC08-1DR	6.25E-08	Battery charger B002, B003
U-BCCC09-1DR	6.25E-08	Battery charger B002, B004
U-BCCC10-1DR	6.25E-08	Battery charger B002, B005
U-BCCC11-1DR	6.25E-08	Battery charger B002, B015
U-BCCC12-1DR	6.25E-08	Battery charger B002, B017
U-BCCC24-1DR	6.25E-08	**Battery charger B002, B021**
U-BCCC13-1DR	6.25E-08	Battery charger B003, B004
U-BCCC14-1DR	6.25E-08	Battery charger B003, B005
U-BCCC15-1DR	6.25E-08	Battery charger B003, B015
U-BCCC16-1DR	6.25E-08	Battery charger B003, B017
U-BCCC25-1DR	6.25E-08	**Battery charger B003, B021**
U-BCCC17-1DR	6.25E-08	Battery charger B004, B005
U-BCCC18-1DR	6.25E-08	Battery charger B004, B015
U-BCCC19-1DR	6.25E-08	Battery charger B004, B017
U-BCCC26-1DR	6.25E-08	**Battery charger B004, B021**
U-BCCC20-1DR	6.25E-08	Battery charger B005, B015
U-BCCC21-1DR	6.25E-08	Battery charger B005, B017
U-BCCC27-1DR	6.25E-08	**Battery charger B005, B021**
U-BCCC22-1DR	6.25E-08	Battery charger B015, B017

Basic Event	Mean	Common Cause Groupings - Failure to Run
U-BCCC28-1DR	**6.25E-08**	**Battery charger B015, B021**
U-BCCC29-1DR	**6.25E-08**	**Battery charger B017, B021**
U-BCCC30-1DR	**6.25E-08**	**Battery charger B021, B022**
U-BCCC31-1DR	**6.25E-08**	**Battery charger B001, B022**
U-BCCC32-1DR	**6.25E-08**	**Battery charger B002, B022**
U-BCCC33-1DR	**6.25E-08**	**Battery charger B003, B022**
U-BCCC34-1DR	**6.25E-08**	**Battery charger B004, B022**
U-BCCC35-1DR	**6.25E-08**	**Battery charger B005, B022**
U-BCCC36-1DR	**6.25E-08**	**Battery charger B015, B022**
U-BCCC37-1DR	**6.25E-08**	**Battery charger B017, B022**

Bolded items in Table C-1 are additions or changes to the SONGS 2/3 Living PRA reflecting the installation of battery chargers B021 and B022.

Table C-2

COMMON-CAUSE FAILURE PROBABILITIES WITH BATTERY B007 OUT-OF-SERVICE FOR CORRECTIVE MAINTENANCE

Basic Event	Mean	Common Cause Groupings - Failure to Operate
U-BYCC0001-S	2.62E-3	Batteries B007 & B008
U-BYCC0002-S	1.05E-6	Batteries B008 & B009
U-BYCC0003-S	2.62E-3	Batteries B007 & B009
U-BYCC0004-S	1.05E-6	Batteries B009 & B010
U-BYCC0005-S	1.05E-6	Batteries B008 & B010
U-BYCC0006-S	2.62E-3	Batteries B007 & B010
U-BYCC0007-S	1.20E-3	Batteries B007, B008, B009
U-BYCC0008-S	1.20E-3	Batteries B007, B008, B010
U-BYCC0009-S	1.20E-3	Batteries B007, B009, B010
U-BYCC0010-S	4.79E-7	Batteries B008, B009, B010
U-BYCC0011-S	4.53E-3	Batteries B007, B008, B009, B010

REQUEST FOR ADDITIONAL INFORMATION RESPONSE, PART 2:

ELECTRICAL & INSTRUMENTATION & CONTROLS BRANCH (EEIB) REQUEST FOR ADDITIONAL INFORMATION

PROPOSED TECHNICAL SPECIFICATION CHANGE REQUEST FOR BATTERY AND DC SOURCES UPGRADES AND CROSS-TIE (PROPOSED CHANGE NUMBER 548)

SAN ONOFRE NUCLEAR GENERATING STATION (SONGS), UNITS 2 AND 3(DOCKET NOS 50-361 AND 50-362)

In the licensee submittal, neither the licensee's amendment change request nor the UFSAR describe the SONGS safety-related battery sizing criteria, the existing battery size or the modified battery size. It is the staff's understanding that the original independent batteries were sized as 1500 Amp-hour and 1200 Amp-hour batteries and that the new batteries are sized at 1800 Amp-hour. It is your intent to be able to power both channels from one battery during power operation.

Q1. LCO 3.8.4.C.2, LCO 3.8.5.A.1.2
Please describe how you intend to power the loads, which originally required a total of 2700 Amp-hours (1500 + 1200) with a 1800 Amp-hour battery. Compare the battery sizing factors such as Temperature, Design and Aging factors as well as the combined duty cycle profile.

Response:

Subsystem A and B batteries have an 8-hr rating of 1260 amp-hours, and subsystem C and D batteries had an 8-hr rating of 1500 amp-hours. Each subsystem replacement battery has an 8-hr rating of 1800 amp-hours.

The actual loads on these batteries are significantly less than the battery rating. The following Tables show each battery's nominal rating, and the amp-hours removed during a Design Basis Event (DBE) (Loss of Voltage Signal (LOVS)/Safety Injection Actuation Signal (SIAS)) and a Station Blackout (SBO) event.

Train A	Subsystem A	Subsystem C	Combined A&C Cross-Connect	IEEE 485 Calculated Margin
Nominal (8-Hr) Rating	1260 AH	1500 AH	1800 AH	
Available Capacity	908 AH	1081 AH	1297 AH	
DBE Load Demand	262 AH	125 AH	387 AH	5.20%
SBO Load Demand	628 AH	293 AH	808* AH	2.77%

Train B	Subsystem B	Subsystem D	Combined B&D Cross-Connect	IEEE 485 Calculated Margin
Nominal (8-Hr) rating	1260 AH	1500 AH	1800 AH	
Available Capacity	908 AH	1081 AH	1297 AH	
DBE Load Demand	270 AH	109 AH	379 AH	8.45%
SBO Load Demand	644 AH	260 AH	804* AH	4.42%

Note: *During SBO cross connect configuration one Inverter is isolated after 120 minutes.

SONGS Class 1E batteries are sized in accordance with the guidelines of IEEE Standard 485 by using LOVS/SIAS, Degraded Grid Voltage with SIAS Signal (DGVSS) and Station Blackout (SBO) duty cycle profiles. Each subsystem load profile also included a margin of 10.0 Amps for future load growth. The available capacity is calculated for each battery using a Correction Factor of 1.11 for 60°F battery electrolyte temperature, and 1.25 for aging.

As shown in the Table above, all batteries have sufficient capacity for DBE and SBO events.

Q2. SR 3.8.4.2
Confirm that the term Arated Amps@, when referring to the battery charger, is the nameplate continuous output current.

Response:

ARated Amps@ is the nameplate continuous output current rating of each Class 1E battery Charger.

Q3. SR 3.8.4.3
Please confirm that the Service Discharge Test and the Modified Performance Discharge Test will use the combined duty cycle of the cross-connected channels.

Response:

For 1800 Amp-hour batteries, the Service Test and Modified Performance Test will use the combined duty cycle of the cross- connected subsystems.

The existing Service Profile load (which does not include cross-connected Mode 1-4 loads) and Performance Test load will be used to test 1260 amp-hour batteries.

Q4. LCO 3.8.6.B.2.2
An average specific gravity (SG) of all connected cells of 1.195 is indicative of a degraded battery. Please confirm by analysis or test that a SONGS battery with an average SG of 1.195 will have adequate capacity and capability to provide sufficient voltage to the connected safety-related loads.

Response:

Recent work at SONGS demonstrated the capability to measure battery float current at ≤2.0 Amps. Consequently, it will no longer be required to pursue the methodology in the proposed amendment request to continue to measure and maintain battery specific gravity. This change will be made in a Supplement to this amendment request, which will be submitted by the end of February 2006.

Q5. LCO 3.8.6.D.1
Please clarify what action will be taken to confirm that the remaining cells in the battery are above the minimum established design temperature within the same 12-hour completion time.

Response:

No action will be taken. TSTF-360, Rev. 1 LCO 3.8.6.D specifically applies to pilot cells only and does not require confirmation that the remaining cells in the battery are above the minimum established design temperature within the same 12-hour completion time.

Q6. SR 3.8.6.1 [sic], SR 3.8.6.5 Please provide your administrative limit for cell minimum voltage.

Response:

For SR 3.8.6.2 & SR 3.8.6.5, the SONGS administrative limit for cell minimum voltage is 2.13 V. The administrative limit will be added to the LCS.

Q7. SR 3.8.6.6

Please confirm that the SONGS definition for a degraded battery includes a change in measured capacity > 10% from the previous performance capacity discharge test (or modified performance test) or a capacity < 90% of the manufacturer=s rating for the required discharge period.

Response:

The SONGS definition for a degraded battery includes a change in measured capacity > 10% from the previous performance capacity discharge test (or modified performance test) or a capacity < 90% of the manufacturer=s rating for the required discharge period.

REQUEST FOR ADDITIONAL INFORMATION RESPONSE, PART 3:

REQUEST FOR ADDITIONAL INFORMATION (RAI)
BY THE ELECTRICAL & INSTRUMENTATION & CONTROLS BRANCH (EEIB)
FOR SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3
IN THE OFFICE OF NUCLEAR REACTOR REGULATION

The application dated December 17, 2004 (Agency-wide Documents Access Management System (ADAMS) Accession No. ML043570322) was submitted by Southern California Edison (SCE) to reflect direct current (DC) electrical subsystem design upgrades that are in progress at for San Onofre Nuclear Generating Station (SONGS), Units 2 and 3. RAI questions were developed by EEIB to clarify the situation when the units may be operated in the abnormal line-up of a closed cross-tie between the same train subsystem or operated with the swing battery charger in service. These questions are in addition to questions from this branch that have previously been submitted to SCE. The questions are the following:

1. Discuss if the swing battery charger is sized no less than the normal required battery chargers and can be powered from a diesel generator-backed bus under all operating conditions. Include in the discussion, when the swing battery charger is expected to be used, how long it may be used, and what are the restrictions on using the charger. (RAI Category Code 4.b)

   Response:

   The swing battery chargers are rated 400 Amps. The normal required subsystem (dedicated) battery chargers are rated 300 Amps. The swing battery chargers may be used as a full replacement for the existing dedicated battery chargers. The swing battery charger is powered from a diesel generator-backed bus under all operating conditions as required by Technical Specifications (TS's) 3.8.1 and 3.8.2. The swing battery charger can stay in service indefinitely, and there are no TS restrictions on the swing battery charger use.

2. Because there are no proposed completion times (CTs) for restoration of the normal dedicated battery charger whether the swing battery charger is fed from its associated unit or from the other unit, discuss if such a CT should be added to the Technical Specifications (TSs). (RAI Category Code 2.b)

   Response:

   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. Accordingly, as an equivalent charger, no completion time for the swing battery charger is required or proposed.

3. Discuss if the proposed Surveillance Requirement (SR) 3.8.4.2 applies to the swing battery chargers, as well as to the dedicated battery chargers. Explain, if SR 3.8.4.2 does not apply to these chargers, why such a surveillance requirement should not be proposed for the swing battery chargers. (RAI Category Code 4.b)

   Response:

   The swing battery charger requires the same surveillances (TS 3.8.4.2) as the dedicated charger in order to be considered OPERABLE.

4. With the cross-tie connection closed, discuss the limits on the operation of the required battery chargers operating in parallel for the 30-day CT. (RAI Category Code 4.b)

   Response:

   With the cross-tie connection closed, there are no restrictions on battery charger operation as long as the OPERABLE charger(s) can deliver at least 400 amps. The background section of TS B 3.8.4 specifically states:
   "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."

5. Discuss if the battery chargers are designed to operate in parallel with another battery charger such that these battery chargers share the load. (RAI Category Code 4.b)

   Response:

   Swing and dedicated battery chargers are designed to operate in parallel.

6. There is no condition for Limiting Condition for Operation (LCO) 3.8.4, "DC Sources - Operating," for two or more installed chargers being inoperable. Discuss what the proposed TSs would require for this situation, and address why such a condition should not be included in the proposed TSs. (RAI Category Code 2.b)

   Response:

   PCN-548 reflects TSTF-360, Rev 1 and the existing SONGS TS requirements to enter TS 3.0.3, if two or more required battery chargers are INOPERABLE.

7. Proposed LCO 3.8.4 Condition A is for an inoperable required DC electrical power subsystem battery charger. The LCO 3.8.4 Required Actions A.1, and A.2.1 or A.2.2 are to restore the battery terminal to at least the minimum established float voltage and verify that the battery float current, or cell specific gravity, is acceptable. Discuss if the proposed TSs allow a unit to complete the Required Actions A.1, and A.2.1 or A.2.2, by use of a battery charger other than the affected DC bus's

dedicated charger or the installed swing battery charger. Also, discuss how, with the cross-tie connection closed and only one battery charger operable, is it ensured that both batteries are being adequately charged. (RAI Category Code 2.b)

Response:

The proposed TSs allow a unit to complete the Required Actions A.1, and A.2.1 or A.2.2, by use of the affected DC bus's dedicated charger or the installed swing battery charger.

Two batteries will be only momentarily in parallel when placing or removing the cross-tie from service. When cross-tied only one battery is connected to the two cross-tied subsystem buses. When the cross-tie connection is used there is no intention to charge two batteries from the same charger(s).

8. If a dedicated battery charger is inoperable and the DC busses are cross-tied, discuss the situation of a battery that has been discharged for a test, addressing how and when it would be determined that the battery is operable and, if it is not operable, how it will be recharged to restore it to operability. Describe the connection to recharge the discharged battery without loss of both channels powered from the good battery. (RAI Category Code 2.b)

   Response:

   With a dedicated battery charger inoperable and the DC buses cross-tied, the discharged battery will be recharged to restore its operability using a non-1E battery charger. After completion of the recharge and the TS 3.8.6 requirements are satisfied, the tested battery would be returned to OPERABLE status.

9. Upon review of the application, it is the Nuclear Regulatory Commission staff's understanding that the "required battery charger" refers to one of the 8 normally connected battery chargers and the "swing battery charger" refers to one of the 4 battery chargers that can be temporarily connected to 1 of the 2 DC buses in its associated power train. Discuss if the staff's understanding of the application is correct. (RAI Category Code 4.b)

Response:

This characterization is not correct.

A "required battery charger" is one of:

- 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.

Enclosure 2

Changed Pages

Changed Pages 7 and 8 of
Licensee's Evaluation

9. Existing Condition B is relabeled as Condition F, and
   a. Required Actions and Completion Times A through E not met is specified as the reason for entering this Condition, and
   b. Technical parameter limits in the Condition are re-specified per the recommendations of IEEE 450-2002:
      - "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
      - "with average electrolyte temperature of the representative cells <60°F" is replaced with "one or more battery cells float voltage <2.07V and float current >2 amps," and,
      - "parameters not within category C values" is replaced with "cells float voltage <2.07V and specific gravity <1.195."

10. SR 3.8.6.1
    a. In accordance with the recommendations of IEEE 450-2002, this surveillance:
       - rather than meet Table 3.8.6-1 category A limits, is re-specified to verify ≤2 amps float current or verify pilot cell specific gravity ≥1.200 for each battery.
       - the specified frequency for this surveillance is extended from 7 days to 31 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; its verifications are now contained in new SRs 3.8.6.2, 3.8.6.3, and 3.8.6.4.

12. New SR 3.8.6.2 verifies pilot cell voltage ≥2.07V every 31 days. This is the equivalent of the existing Category A limit of Table 3.8.6-1, which is currently surveilled every 7 days. This change in surveillance frequency is per the recommendations of IEEE 450-2002.

13. New SR 3.8.6.3 verifies each connected cell electrolyte level every 31 days. This change in surveillance frequency is per the recommendations of IEEE 450-2002.

14. Existing SR 3.8.6.3 is renumbered to SR 3.8.6.4. This SR replaces verification of average electrolyte temperature 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 IEEE 450-2002.

15. New SR 3.8.6.5 verifies connected cell voltage every 92 days. These changes are made per the recommendations of IEEE 450-2002.

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. This change is per the recommendations of IEEE 450-2002.

17. Table 3.8.6-1 is deleted in its entirety. As discussed previously, the limits are incorporated in the previous SRs.

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 is verbatim per the recommendations of TSTF 360 Rev. 1, and provides the programmatic changes necessary to warrant the changes previously citing that IEEE standard.

The Bases will similarly be modified to reflect the above changes.

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Attachment C

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 float voltage < 2.07 V and float current > 2 amps. ~~with average electrolyte temperature of the representative cells < 60°F.~~ OR One or two ~~more~~ batteries on one train with one or more battery cells float voltage < 2.07 V and specific gravity <1.195. ~~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)

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Attachment D

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 float voltage < 2.07 V and float current > 2 amps. ~~with average electrolyte temperature of the representative cells < 60°F.~~ OR One or two ~~more~~ batteries on one train with one or more battery cells float voltage < 2.07 V and specific gravity <1.195. ~~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)

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Attachment E

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 float voltage < 2.07 V and float current > 2 amps. OR One or two batteries on one train with one or more battery cells float voltage < 2.07 V and specific gravity <1.195.	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 or verify pilot cell specific gravity is ≥ 1.200.	31 days

(continued)

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Attachment F

ACTIONS (Continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time of Condition A, B, D, or E not met. OR One or two batteries on one train with one or more battery cells float voltage < 2.07 V and float current > 2 amps. OR One or two batteries on one train with one or more battery cells ~~float~~ voltage < 2.07 V and specific gravity <1.195.	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 or verify pilot cell specific gravity is ≥1.200.	31 days

(continued)

Changed Page 2
Attachment I

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.

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

Changed Page 6
Attachment I

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. CCF probabilities are summarized in Tables C-1 and C-2.

Uncertainty Analysis:

Parameter uncertainty calculations were not performed since the base case CDF and LERF are essentially the same as those calculated when either two buses 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.

Changed Page 11
Attachment I

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)*	3.47 /year[b]	
9	Mean Duration of PM	10.26 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 5 service tests in 10 years. This is a total of 7 tests in 10 years times 4 batteries. 7 tests * 4 batteries/10 years = 2.8 tests/year; 4 battery replacements every 15 years or 0.267/year; total downtime frequency = 2.8 + 0.267 = 3.07

c Mean duration = [2.8 (7 days) + 0.267 (30 days)]/3.07 = 8.99 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.