ROUTING AND TRANSMITTAL SLIP			DATE:February 29, 2000
TO:	Susan Fridley, PDR MAIL STOP: **O-P1-17**		
SUBJECT: Transmittal of TSTFs, TSTF-340, R.3 and TSTF-360, R.0 Attached is an original request plus attachments for proposed changes to the Standard Technical Specifications which should be docketed in the PDR but **NOT** distributed. Please send a copy to the File Center to be entered into ADAMS for the Official Record Copy. Thanks. Please contact me if you have any questions.			
FROM:	Pat Coates RTSB/DRIP/NRR	PHONE NO: 415-1161	MAIL STOP: O-7H3

NUCLEAR ENERGY INSTITUTE

James W. Davis
DIRECTOR
OPERATIONS DEPARTMENT,
NUCLEAR GENERATION

February 24, 2000

Dr. William D. Beckner, Branch Chief
Technical Specifications Branch
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: Transmittal of TSTFs

PROJECT NUMBER: 689

Dear Dr. Beckner:

Enclosed are two Technical Specification NUREGs NEI Technical Specification Task Force (TSTF) Travelers.

TSTF-340, Rev. 3 incorporates some editorial corrections to TSTF-340, Rev. 2, which the staff has stated will be approved. We have discussed the editorial corrections with the staff and they requested this revision.

TSTF-360, Rev. 0 proposes a rewrite of the DC electrical specifications and replaces TSTF-198 through 203. TSTF 198 through 203 are being formally withdrawn with this submittal of TSTF 360.

Please contact me at (202) 739-8105 or Vince Gilbert at (202) 739-8138 if you have any questions or need to meet with industry experts on these recommended changes.

Sincerely,

James W. Davis

Enclosures

c: Patricia Coates
Stewart L. Magruder, NRR-DRPM
Technical Specification Task Force

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Industry/TSTF Standard Technical Specification Change Traveler

Allow 7 day Completion Time for a turbine-driven AFW pump inoperable

Classification: 3) Improve Specifications

NUREGs Affected: ☑ 1430 ☑ 1431 ☑ 1432 ☐ 1433 ☐ 1434

Description:

Present specifications have a 72 hour Completion Time for any inoperable AFW pump with an Action to be in MODE 4 within 18 hours if the 72 hour Completion Time is not met. The proposed change would allow a 7 day Completion Time for the turbine-driven AFW pump if the inoperability occurs in MODE 3. The Completion Time would be reduced to 6 hours since the plant is already in MODE 3.

Justification:

This change will reduce the number of unnecessary MODE changes and requests for enforcement discretion by providing added flexibility in MODE 3 to repair and test the turbine-driven AFW pump following a refueling outage.

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NRC Contact:	Harbuck, Craig	301-415-3140	cch@nrc.gov

Revision History

OG Revision 0 Revision Status: Closed

Revision Proposed by: NRC

Revision Description:
Original Issue

TSTF Review Information

TSTF Received Date: 25-Sep-97 Date Distributed for Review 12-Oct-98

OG Review Completed: ☑ BWOG ☑ WOG ☑ CEOG ☑ BWROG

TSTF Comments:

Change is confusing. TSTF agrees with concept but needs better presentation. Tom Weber to provide a revision.

TSTF Resolution: Rejected Date: 20-Nov-98

OG Revision 1 Revision Status: Closed

Revision Proposed by: TSTF

Revision Description:
The TSTF proposes a revision to NRC TSB-15. The NRC's proposed change allows a steam driven AFW pump to be inoperable for 7 days in MODE 3 following a refueling outage, if MODE 2 had not been entered. The justification was the minimal decay heat levels under this Condition, the redundant capabilities afforded by the AFW system, the time needed to perform repairs and testing of the turbine-driven pump, and the low probability of a DBA occurring during this time period that would require the operation of the turbine driven pump. All of these arguments, except the minimal decay heat level, would apply any time a turbine driven AFW pump is inoperable (including turbine driven AFW pump inoperability due to a single steam supply being OPERABLE). In addition, the decay heat level is not limiting because the motor driven AFW pumps are capable of removing the decay heat and alternate

OG Revision 1 Revision Status: Closed

methods, such as feed and bleed, are also available to remove decay heat if necessary. Therefore, the TSTF proposes that the 7 day AOT (with 10 day maximum with the LCO not met) be available anytime a turbine driven AFW pump is inoperable. This revision reflects this proposal.

TSTF Review Information

TSTF Received Date: 01-Jun-99 Date Distributed for Review 15-Jun-99

OG Review Completed: ☑ BWOG ☑ WOG ☑ CEOG ☑ BWROG

TSTF Comments:
(No Comments)

TSTF Resolution: Approved Date: 15-Jun-99

NRC Review Information

NRC Received Date: 23-Jun-99

NRC Comments:
8/31/99 - NRC will recommend reject. TSTF will provide a revision to address the issues of (1) the inoperability of the turbine pump being in MODE 3 and (2) the TS markups and Bases being consistent with the proposed change and (3) revise Actions to address the different MODES.

10/6/99 - NRC requests a revision to enhance the justification and provide Bases words that indicate that one steam supply creates the system being inoperable.

Final Resolution: Superceded by Revision Final Resolution Date: 13-Oct-99

TSTF Revision 1 Revision Status: Closed

Revision Proposed by: NRC

Revision Description:
Revised to incorporate NRC comments. The Revision 0 description is enhanced and additional Bases are provided to indicate that one steam supply inoperable results in the system being inoperable.

TSTF Review Information

TSTF Received Date: 03-Nov-99 Date Distributed for Review

OG Review Completed: ☐ BWOG ☐ WOG ☐ CEOG ☐ BWROG

TSTF Comments:
(No Comments)

TSTF Resolution: Withdrawn Date:

TSTF Revision 2 Revision Status: Closed

Revision Proposed by: TSTF

Revision Description:
Revised to return to original intent of NRC TSB-15. Revised NRC proposal to consolidate Condition A and proposed Condition B to improve readability and to be more consistent with ITS usage rules.

TSTF Revision 2 Revision Status: Closed

TSTF Review Information

TSTF Received Date: 08-Dec-99 Date Distributed for Review 08-Dec-99

OG Review Completed: ☑ BWOG ☑ WOG ☑ CEOG ☑ BWROG

TSTF Comments:

WOG - Justification should refer to "enforcement discretion" instead of "waiver of compliance" and inserted Bases should be consolidated to reduce duplication.

TSTF Resolution: Approved Date: 14-Dec-99

NRC Review Information

NRC Received Date: 27-Dec-99

NRC Comments:

(No Comments)

Final Resolution: Superceded by Revision Final Resolution Date: 22-Jan-00

TSTF Revision 3 Revision Status: Active Next Action:

Revision Proposed by: TSTF

Revision Description:

TSTF-340, Rev. 2, is replaced with Revision 3 which makes several editorial corrections to increase standardization.

* The addition to Condition A is revised to refer to a "refueling" instead of a "refueling outage" for consistency with similar requirements in other specifications (for example, see the Surveillances in Section 3.2).
* The Bases for Required Action A.1 are revised to describe the existing and the new entry Conditions and to refer to "refueling" instead of "refueling outage."
* Bases are added describing the Note added to Condition A in accordance with the ITS format and content.

TSTF Review Information

TSTF Received Date: 22-Jan-00 Date Distributed for Review

OG Review Completed: ☐ BWOG ☐ WOG ☐ CEOG ☐ BWROG

TSTF Comments:

(No Comments)

TSTF Resolution: Date:

Incorporation Into the NUREGs

File to BBS/LAN Date: TSTF Informed Date: TSTF Approved Date:

NUREG Rev Incorporated:

Affected Technical Specifications

Action 3.7.5.A	EFW system	NUREG(s)- 1430 Only
Action 3.7.5.A Bases	EFW system	NUREG(s)- 1430 Only
Action 3.7.5.A	AFW system	NUREG(s)- 1431 1432 Only
Action 3.7.5.A Bases	AFW system	NUREG(s)- 1431 1432 Only

INSERT 1

OR

--------- NOTE ------
Only applicable if MODE 2 has not been entered following refueling.

One turbine driven EFW pump inoperable in MODE 3 following refueling.

INSERT 2

a. For the inoperability of a steam supply to the turbine driven EFW pump, the 7 day Completion time is reasonable since there is a redundant steam supply line for the turbine driven pump.

b. For the inoperability of a turbine driven EFW pump while in MODE 3 immediately subsequent to a refueling outage, the 7 day Completion time is reasonable due to the minimal decay heat levels in this situation.

c. For both the inoperability of a steam supply line to the turbine driven pump and an inoperable turbine driven EFW pump while in MODE 3 immediately following a refueling outage, the 7 day Completion time is reasonable due to the availability of redundant OPERABLE motor driven EFW pumps; and due to the low probability of an event requiring the use of the turbine driven EFW pump.

INSERT 5

Condition A is modified by a Note which limits the applicability of the Condition to when the unit has not entered MODE 2 following a refueling. Condition A allows one EFW train to be inoperable for 7 days vice the 72 hour Completion Time in Condition B. This longer Completion Time is based on the reduced decay heat following refueling and prior to the reactor being critical.

INSERT 3

OR --------- NOTE ------ Only applicable if MODE 2 has not been entered following refueling. ---------- One turbine driven AFW pump inoperable in MODE 3 following refueling.	

INSERT 4

a. For the inoperability of a steam supply to the turbine driven AFW pump, the 7 day Completion time is reasonable since there is a redundant steam supply line for the turbine driven pump.

b. For the inoperability of a turbine driven AFW pump while in MODE 3 immediately subsequent to a refueling outage, the 7 day Completion time is reasonable due to the minimal decay heat levels in this situation.

c. For both the inoperability of a steam supply line to the turbine driven pump and an inoperable turbine driven AFW pump while in MODE 3 immediately following a refueling outage, the 7 day Completion time is reasonable due to the availability of redundant OPERABLE motor driven AFW pumps; and due to the low probability of an event requiring the use of the turbine driven AFW pump.

INSERT 6

Condition A is modified by a Note which limits the applicability of the Condition to when the unit has not entered MODE 2 following a refueling. Condition A allows one AFW train to be inoperable for 7 days vice the 72 hour Completion Time in Condition B. This longer Completion Time is based on the reduced decay heat following refueling and prior to the reactor being critical.

TSTF-340, Rev.3

3.7 PLANT SYSTEMS

3.7.5 Emergency Feedwater (EFW) System

LCO 3.7.5 [Three] EFW trains shall be OPERABLE.

---NOTE---
Only one EFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One steam supply to turbine driven EFW pump inoperable.	A.1 Restore ~~steam supply~~ affected equipment to OPERABLE status.	7 days AND 10 days from discovery of failure to meet the LCO
B. One EFW train inoperable [for reasons other than Condition A] in MODE 1, 2, or 3.	B.1 Restore EFW train to OPERABLE status.	72 hours AND 10 days from discovery of failure to meet the LCO

(continued)

Insert 1

APPLICABILITY (continued)

In MODE 4, with RCS temperature above [212]°F, the EFW System may be used for heat removal via the steam generators. In MODE 4, the steam generators are used for heat removal until the DHR System is in operation.

In MODES 5 and 6, the steam generators are not used for DHR and the EFW System is not required.

ACTIONS

A.1

or if a turbine driven pump is inoperable while in MODE 3 immediately following refueling,

With one of the two steam supplies to the turbine driven EFW pump inoperable, action must be taken to restore the steam supply to OPERABLE status within 7 days. The 7 day Completion Time is reasonable, based on the following reasons:

inoperable equipment to an

Insert 2

a. The redundant OPERABLE steam supply to the turbine driven EFW pump(s);

b. The availability of the redundant OPERABLE motor driven EFW pump; and

c. The low probability of an event occurring that would require the inoperable steam supply to the turbine driven EFW pump(s).

The second Completion Time for Required Action A.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any continuous failure to meet this LCO.

The 10 day Completion Time provides a limitation time allowed in this specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 72 hours and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.

Insert 5

B.1

When one of the required EFW trains (pump or flow path) is inoperable, action must be taken to restore the train to

(continued)

TSTF-340, Rev 3

3.7 PLANT SYSTEMS

3.7.5 Auxiliary Feedwater (AFW) System

LCO 3.7.5 [Three] AFW trains shall be OPERABLE.

---NOTE---
Only one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One steam supply to turbine driven AFW pump inoperable.	A.1 Restore ~~steam supply~~ affected equipment to OPERABLE status.	7 days AND 10 days from discovery of failure to meet the LCO
B. One AFW train inoperable in MODE 1, 2 or 3 [for reasons other than Condition A].	B.1 Restore AFW train to OPERABLE status.	72 hours AND 10 days from discovery of failure to meet the LCO

(continued)

Insert 3

TSTF-340, Rev 3

BASES

LCO (continued)

of the MSIVs, and shall be capable of supplying AFW to any of the steam generators. The piping, valves, instrumentation, and controls in the required flow paths also are required to be OPERABLE.

The LCO is modified by a Note indicating that one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4. This is because of the reduced heat removal requirements and short period of time in MODE 4 during which the AFW is required and the insufficient steam available in MODE 4 to power the turbine driven AFW pump.

APPLICABILITY

In MODES 1, 2, and 3, the AFW System is required to be OPERABLE in the event that it is called upon to function when the MFW is lost. In addition, the AFW System is required to supply enough makeup water to replace the steam generator secondary inventory, lost as the unit cools to MODE 4 conditions.

In MODE 4 the AFW System may be used for heat removal via the steam generators.

In MODE 5 or 6, the steam generators are not normally used for heat removal, and the AFW System is not required.

ACTIONS

A.1 or if a turbine driven pump is inoperable while in MODE 3 immediately following refueling,

If one of the two steam supplies to the turbine driven AFW train is inoperable, action must be taken to restore OPERABLE status within 7 days. The 7 day Completion Time is reasonable, based on the following reasons:

the inoperable equipment to an

a. The redundant OPERABLE steam supply to the turbine driven AFW pump;

b. The availability of redundant OPERABLE motor driven AFW pumps; and

c. The low probability of an event occurring that requires the inoperable steam supply to the turbine driven AFW pump.

(continued)

TSTF-340, Rev.3

BASES

ACTIONS

A.1 (continued)

The second Completion Time for Required Action A.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any continuous failure to meet this LCO.

The 10 day Completion Time provides a limitation time allowed in this specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 7 days and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.

Insert 6

B.1

With one of the required AFW trains (pump or flow path) inoperable in MODE 1, 2, or 3 [for reasons other than Condition A], action must be taken to restore OPERABLE status within 72 hours. This Condition includes the loss of two steam supply lines to the turbine driven AFW pump. The 72 hour Completion Time is reasonable, based on redundant capabilities afforded by the AFW System, time needed for repairs, and the low probability of a DBA occurring during this time period.

The second Completion Time for Required Action B.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any continuous failure to meet this LCO.

The 10 day Completion Time provides a limitation time allowed in this specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 72 hours and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.

C.1 and C.2

When Required Action A.1 [or B.1] cannot be completed within the required Completion Time, or if two AFW trains are

(continued)

TSTF-340, Rev 3

3.7 PLANT SYSTEMS

3.7.5 Auxiliary Feedwater (AFW) System

LCO 3.7.5 [Three] AFW trains shall be OPERABLE.

---NOTE---
Only one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4.

APPLICABILITY: MODES 1, 2, and 3,
[MODE 4 when steam generator is relied upon for heat removal].

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One steam supply to turbine driven AFW pump inoperable.	A.1 Restore ~~steam supply~~ affected equipment to OPERABLE status.	7 days AND 10 days from discovery of failure to meet the LCO
B. One AFW train inoperable [for reasons other than Condition A] in MODE 1, 2, or 3.	B.1 Restore AFW train to OPERABLE status.	72 hours AND 10 days from discovery of failure to meet the LCO

(continued)

Insert 3

TSTF-340, Rev 3

BASES

LCO (continued)

The LCO is modified by a Note indicating that only one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4. This is because of reduced heat removal requirements, the short period of time in MODE 4 during which AFW is required, and the insufficient steam supply available in MODE 4 to power the turbine driven AFW pump.

APPLICABILITY

In MODES 1, 2, and 3, the AFW System is required to be OPERABLE and to function in the event that the MFW is lost. In addition, the AFW System is required to supply enough makeup water to replace steam generator secondary inventory, lost as the unit cools to MODE 4 conditions.

In MODE 4, the AFW System may be used for heat removal via the steam generator.

In MODES 5 and 6, the steam generators are not normally used for decay heat removal, and the AFW System is not required.

ACTIONS

Or if a turbine driven pump is inoperable while in MODE 3 immediately following refueling,

A.1

the inoperable equipment to an

If one of the two steam supplies to the turbine driven AFW pumps is inoperable, action must be taken to restore OPERABLE status within 7 days. The 7 day Completion Time is reasonable based on the following reasons:

a. The redundant OPERABLE steam supply to the turbine driven AFW pump;

b. The availability of redundant OPERABLE motor driven AFW pumps; and

c. The low probability of an event requiring the inoperable steam supply to the turbine driven AFW pump.

Insert 4

The second Completion Time for Required Action A.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any continuous failure to meet this LCO.

(continued)

BASES

TSTF-340, Rev.3

ACTIONS

A.1 (continued)

The 10 day Completion Time provides a limitation time allowed in this specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 7 days and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.

Insert 6

B.1

With one of the required AFW trains (pump or flow path) inoperable, action must be taken to restore OPERABLE status within 72 hours. This Condition includes the loss of two steam supply lines to the turbine driven AFW pump. The 72 hour Completion Time is reasonable, based on the redundant capabilities afforded by the AFW System, the time needed for repairs, and the low probability of a DBA event occurring during this period. Two AFW pumps and flow paths remain to supply feedwater to the steam generators. The second Completion Time for Required Action B.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any continuous failure to meet this LCO.

The 10 day Completion Time provides a limitation time allowed in this specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 72 hours and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.

C.1 and C.2

When either Required Action A.1 or B.1 cannot be completed within the required Completion Time, [or if two AFW trains are inoperable in MODES 1, 2, and 3], the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 4 within [18] hours.

(continued)

Industry/TSTF Standard Technical Specification Change Traveler

DC Electrical Rewrite

Classification: 3) Improve Specifications

NUREGs Affected: ☑ 1430 ☑ 1431 ☑ 1432 ☑ 1433 ☑ 1434

Description:

LCOs 3.8.4, 3.8.5, and 3.8.6 are revised to:
(1) Provide a specific Action & increased Completion Time for an inoperable battery charger.
(2) Relocate preventative maintenance SRs to licensee controlled programs.
(3) Provide alternate testing criteria for battery charger testing.
(4) Replace battery specific gravity monitoring with float current monitoring.
(5) Relocate (to a licensee controlled program based on IEEE-450 and/or the ISTS Bases):
  (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.
(6) Provide specific Actions and increased Completion Times for out-of-limits conditions for cell voltage, electrolyte level, and electrolyte temperature.
(7) Enhanced Bases are provided for each above change. Additionally, optional presentations for Battery restoration times are discussed in Bases Reviewer's Note.
(8) Eliminate the "once per 60 month" restriction on replacing the battery service test with the battery modified performance discharge test.

Justification:

The proposed Bases have undergone revision to include substantial information and basis for the proposed Specifications. The "justification" presented in these Bases (particularly for the proposed Required Actions) is not repeated in these justifications, but is intended to further support the proposed changes.

(1) Current NUREG STS 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 changer 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 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 Reg 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 STS 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 7-day restoration time for an inoperable battery charger. However, this time is contingent on a focused and tier approach to 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 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 (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) followed by a 7-day restoration period, 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, & 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 preventative 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 preventative 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 preventative 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 3.8.2.5, the bracketed values of resistance specified in the NUREG are vendor 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 is 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.

Furthermore, these surveillances are recommended by IEEE-450, and as such, will be addressed by a plant program based on IEEE-450 practices that is being committed to with the adoption of these changes.

(3) NUREG STS SR 3.8.4.6 (being revised to SR 3.8.4.2) requires specific parameters for battery charger performance testing. This test is intended to confirm the charger design capacity. Alternate acceptance criteria are proposed that would allow an actual in service demonstration that the 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. This meets the intent of the existing test and allows for normal in-place demonstration of the charger capability thereby minimizing the time when the charger would be disconnected from the DC bus.

(4) This change proposes to replace battery specific gravity monitoring with float current monitoring. This has been the focus of significant discussion within IEEE-450 committee and between the NRC technical staff. Due to the technical nature of the rationale and justifications, specific "white paper" discussions have been drafted to address this change. They are provided in attachments and, in addition to details provided in the proposed Bases, serve as the justification for this change.

* Attachment 1: <<John Coyle paper - Battery Primer>>
* Attachment 2: <<Kyle Floyd paper - to be provided at a later date>>

(5) (a) NUREG STS LCO 3.8.6 on battery cell voltage and electrolyte level parameters contains various levels (Categories) of limitations. The Category A & 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 & B values represent appropriate monitoring levels and appropriate preventative maintenance level 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 preventative 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 Tech Specs 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 Bases, which are under the change control of 10 CFR 50.59. The Tech Specs 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 the grid life. As such the "minimum established float voltage" can be adequately controlled outside of the Technical Specifications.

(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 avoiding an unnecessary plant shutdown. The Bases for each Required Action provides specific justification for each proposed action.

(7) Currently, the existing standard allowed outage time for DC System related inoperabilities is the same 2 hours regardless of whether the DC inoperability is a single charger, a single battery, or the entire train/division without any DC power. The range of possible degradations to the DC System would seem to dictate the possibility of a range of specific limitations associated with each level of degradation. 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 this Action (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, the Bases Reviewer's Note discusses the appropriate reformatting to for the optimum presentation.

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 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.

NOTE: The INSERTS begin with a re-typed version of the Specs (no Bases) for info-only. These re-typed Specs are made generic to ALL OGs by adopting "{ }" notations for values/wording that are vendor-specific. The "[ ]" notation applies normally as throughout the NUREGs.

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Revision History

OG Revision 0 **Revision Status: Active** **Next Action: TSTF**

Revision Proposed by: TSTF

Revision Description:
Original Issue

TSTF Review Information

TSTF Received Date: 10-Feb-2000 Date Distributed for Review

OG Review Completed: ☐ BWOG ☐ WOG ☐ CEOG ☐ BWROG

TSTF Comments:
(No Comments)

TSTF Resolution: Date:

Incorporation Into the NUREGs

File to BBS/LAN Date: TSTF Informed Date: TSTF Approved Date:

NUREG Rev Incorporated:

Affected Technical Specifications

Bkgnd 3.8.4 Bases	DC Sources - Operating
S/A 3.8.4 Bases	DC Sources - Operating
Ref. 3.8.4 Bases	DC Sources - Operating
Action 3.8.4.A	DC Sources - Operating Change Description: New
Action 3.8.4.A	DC Sources - Operating Change Description: Relabeled C
Action 3.8.4.A Bases	DC Sources - Operating Change Description: New
Action 3.8.4.A Bases	DC Sources - Operating Change Description: Relabeled C

Action 3.8.4.B	DC Sources - Operating Change Description: New
Action 3.8.4.B	DC Sources - Operating Change Description: Relabeled D
Action 3.8.4.B Bases	DC Sources - Operating Change Description: New
Action 3.8.4.B Bases	DC Sources - Operating Change Description: Relabeled D
SR 3.8.4.1	DC Sources - Operating
SR 3.8.4.1 Bases	DC Sources - Operating
SR 3.8.4.2	DC Sources - Operating Change Description: Deleted
SR 3.8.4.2 Bases	DC Sources - Operating Change Description: Deleted
SR 3.8.4.3	DC Sources - Operating Change Description: Deleted
SR 3.8.4.3 Bases	DC Sources - Operating Change Description: Deleted
SR 3.8.4.4	DC Sources - Operating Change Description: Deleted
SR 3.8.4.4 Bases	DC Sources - Operating Change Description: Deleted
SR 3.8.4.5	DC Sources - Operating Change Description: Deleted
SR 3.8.4.5 Bases	DC Sources - Operating Change Description: Deleted
SR 3.8.4.6	DC Sources - Operating Change Description: Relabled SR 3.8.4.2
SR 3.8.4.6 Bases	DC Sources - Operating Change Description: Relabled SR 3.8.4.2
SR 3.8.4.7	DC Sources - Operating Change Description: Relabled SR 3.8.4.3
SR 3.8.4.7 Bases	DC Sources - Operating Change Description: Relabled SR 3.8.4.3
SR 3.8.4.8	DC Sources - Operating Change Description: Deleted - Moved to SR 3.8.6.6

SR 3.8.4.8 Bases	DC Sources - Operating
	Change Description: Deleted - Moved to SR 3.8.6.6
S/A 3.8.5 Bases	DC Sources - Shutdown
Ref. 3.8.5 Bases	DC Sources - Shutdown
Action 3.8.5.A	DC Sources - Shutdown
	Change Description: Relabled B
Action 3.8.5.A	DC Sources - Shutdown
	Change Description: New
Action 3.8.5.A Bases	DC Sources - Shutdown
	Change Description: New
Action 3.8.5.A Bases	DC Sources - Shutdown
	Change Description: Relabled B
SR 3.8.5.1	DC Sources - Shutdown
SR 3.8.5.1 Bases	DC Sources - Shutdown
3.8.6	Battery Cell Parameters
	Change Description: Renamed "Battery Parameters"
3.8.6 Bases	Battery Cell Parameters
	Change Description: Renamed "Battery Parameters"
Bkgnd 3.8.6 Bases	Battery Cell Parameters
S/A 3.8.6 Bases	Battery Cell Parameters
LCO 3.8.6	Battery Cell Parameters
	Change Description: Table 3.8.6-1 Deleted
LCO 3.8.6	Battery Cell Parameters
LCO 3.8.6 Bases	Battery Cell Parameters
	Change Description: Table 3.8.6-1 Deleted
LCO 3.8.6 Bases	Battery Cell Parameters
Ref. 3.8.6 Bases	Battery Cell Parameters
Action 3.8.6.A	Battery Cell Parameters
	Change Description: Deleted
Action 3.8.6.A	Battery Cell Parameters
	Change Description: New
Action 3.8.6.A Bases	Battery Cell Parameters
	Change Description: Deleted

Action 3.8.6.A Bases	Battery Cell Parameters
	Change Description: New
Action 3.8.6.B	Battery Cell Parameters
	Change Description: Relabled E
Action 3.8.6.B	Battery Cell Parameters
	Change Description: New
Action 3.8.6.B Bases	Battery Cell Parameters
	Change Description: New
Action 3.8.6.B Bases	Battery Cell Parameters
	Change Description: Relabled E
Action 3.8.6.C	Battery Cell Parameters
	Change Description: New
Action 3.8.6.C Bases	Battery Cell Parameters
	Change Description: New
Action 3.8.6.D	Battery Cell Parameters
	Change Description: New
Action 3.8.6.D Bases	Battery Cell Parameters
	Change Description: New
SR 3.8.6.1	Battery Cell Parameters
	Change Description: Deleted
SR 3.8.6.1	Battery Cell Parameters
	Change Description: New
SR 3.8.6.1 Bases	Battery Cell Parameters
	Change Description: New
SR 3.8.6.1 Bases	Battery Cell Parameters
	Change Description: Deleted
SR 3.8.6.2	Battery Cell Parameters
	Change Description: Deleted
SR 3.8.6.2	Battery Cell Parameters
	Change Description: New
SR 3.8.6.2 Bases	Battery Cell Parameters
	Change Description: New
SR 3.8.6.2 Bases	Battery Cell Parameters
	Change Description: Deleted
SR 3.8.6.3	Battery Cell Parameters
	Change Description: Deleted

SR 3.8.6.3	Battery Cell Parameters
	Change Description: New
SR 3.8.6.3 Bases	Battery Cell Parameters
	Change Description: New
SR 3.8.6.3 Bases	Battery Cell Parameters
	Change Description: Deleted
SR 3.8.6.4	Battery Cell Parameters
	Change Description: New
SR 3.8.6.4 Bases	Battery Cell Parameters
	Change Description: New
SR 3.8.6.5	Battery Cell Parameters
	Change Description: New
SR 3.8.6.5 Bases	Battery Cell Parameters
	Change Description: New
SR 3.8.6.6	Battery Cell Parameters
	Change Description: New
SR 3.8.6.6 Bases	Battery Cell Parameters
	Change Description: New

ATTACHMENT 1

Battery Primer for Nuclear Power Plants
01/07/2000

Purpose:

At the request of NEI & EXCEL, a Primer for decisions relative to Batteries & DC systems follows. The Primer discusses the difference between operability of the DC system and various battery performance parameters and suggested maintenance activities, identified in IEEE 450. The discussion provides technical rationales for preparation of the Tech Spec Bases. It includes lessons learned from battery manufacturers, battery experts, technical papers, experience, field and laboratory tests, and discussions at SCC 29 and the IEEE 308 working group, SC 4.1. The discussion supplements prior discussions held between John Coyle, Kurt Uhlir, Kyle Floyd, Bob Beavers, Dan Williamson, John Knox, Saba Saba, and Nanette Gilles during an IEEE SCC 29 Nuclear Task Force review of several drafts of DC Technical Specifications.

References, Communications & papers:

1) Storage Batteries, George Wood Vinal, June, 1967. Library of Congress #54-12826
2) IEEE 450 -1995
3) IEEE 485 - 1997
4) IEEE 308 Interpretation (See Enclosure to this Attachment)
5) Return to Service white paper by Kyle Floyd

Assumptions, Rules, Design Criteria:

The Discussions centered around battery systems commonly found in Nuclear Power plants serving as 1E backup power for safety related systems.

1) The battery grid has a flat plate lead calcium or flat plate lead antimony construction.
2) The active component of the Positive Plate, when charged, consists of lead dioxide.
3) The active component of the Negative plate, when charged, consists of lead oxide.
4) The Cells of the Battery are vented to atmosphere.
5) The Cells of the Battery are flooded with electrolyte.
6) The battery has a rubber or plastic separator.
7) The positive plate material is covered by a mat on both sides. The mat maintains electrical contact between loose lead dioxide particles and the positive plate.
8) The nominal Specific gravity added to the Cell when filled is 1.215 plus .010 minus .005.

9) When a cell has no current flow, it is at it's open circuit potential. At any voltage above this potential, the plates are charging. At a potential below this voltage, the plates have been discharged. The open circuit voltage of a cell with 1.215 specific gravity uniformly mixed, is approximately 2.061 volts. E(open circuit) = approximately 0.846 + SG. The equation that approximates the open circuit voltage is defined by the Nernst Equation. The NERNST equation provides a theoretical voltage for an ideal battery with no current flow. It can be expressed as a ratio of tetravalent lead ions to divalent lead ions.

Nernst Equation (Vinal, pg. 179, equation 9)

$E=E_0 + [(R \times T) /(2 \times F)] \ln [Pb^{4+} / Pb^{2+}] = 1.87 + .029 \log [Pb^{4+} / Pb^{2+}]$

The equation can be restated as internal (open circuit) cell voltage = base cell voltage plus [(Universal Gas Constant x Temperature)/(2 x Faradays constant)] x natural log of the ratio of the concentrations of the reactants (active material). As temperature rises the cell voltage rises. P

The equation can be used to plot the open circuit voltage over a range of reactants. As the ratio of the reactants increases, the cell voltage rises as the natural log of the ratio. [1/1 = 0, 10/1 = 2.3, 100/1 = 4.6, 1000/1 = 6.9].

Reactant Ratio	E (volts)
1	1.87
10	1.99
100	2.00
1000	2.07
10000	2.14

As Acid concentration increases, hydroxl ions decrease (OH^- decreases, PH lowers). As OH^- decreases, tetravalent lead ions increase w. The ratio increases and voltage rises. (Vinal, pg. 190)
Estimated and Measured values for the density of specific gravity to E (25 degrees C) are provided below. (Vinal, pg. 192, Table 39) The relationship between E and the specific gravity is established at the gravity of interest, 1.215.

SG	$\%H_2SO_4$	Estimated E	Measured E	Measured E - SG
1.03	4.55	1.878	1.878	
1.05	7.44	1.905	1.907	
1.1	14.72	1.960	1.961	
1.15	21.38	2.005	2.006	
1.2	27.68	2.048	2.049	.849
1.25	33.8	2.095	2.095	.845
1.28	37.4	2.125	2.125	.845
1.30	39.7	2.144	2.144	.844

To find the voltage for 1.215 specific gravity, the value (x volts) is extrapolated between a battery with a 1.2 specific gravity (.849 volts) and a battery with a 1.25 specific gravity (.845 volts). Solving for x:

(.849 - .845) / (1.2 - 1.25) = (.849 - **x**) / (1.2- 1.215)

x = .846

.846 + 1.215 = 2.061 volts (approximately 2.06 volts)

The plates are charging above 2.06 volts. The plates have discharged when below 2.06 volts. The cell is fully charged at 2.06 volts.

10) Negative Plate pellets (PbO or Sponge Lead) shrink over time. Organic or Inorganic Expanders are used to maintain the pellet size and grid contact. The expander changes the polarization of the Positive and Negative plates resulting in undercharging of the positive plate. Small amounts of Platinum (or other substances) are added to the electrolyte at the time of initial charge. The Platinum is attracted to the surface of the negative plate and intermingles with the PbO. The Platinum maintains the correct negative polarity, and consequentially the correct positive plate polarities. This assures consistent charging over time. As the battery ages the Platinum molecules are over-plated and it's stabilizing influence diminishes.
11) The battery is normally in the float voltage range recommended by the manufacturer. This range maintains the plates in a condition that the polarity of the positive & negative plate does not convert from lead dioxide/oxide to lead sulfate & the grid life is 20 years.
12) A cell, when removed from charge with no load (open circuited) will gradually drift from the potential that it was at to the open circuit voltage. A battery removed from charge that is supplying loads will drop quickly to less than 2.0 volts per cell.
13) The battery performance is generally limited by the charge on the positive plate. The charge on the positive plate is important. There is usually excess sulfuric acid (electrolyte) and excess negative plate material available for the chemical reaction in the design of the cell. Establishing a small positive polarity will retard self discharge for a significant length of time.
14) The battery is sometimes placed in equalization to mix the sulfuric acid or establish correct polarities on the plates and balance cell potentials in the string. This results in higher currents.
15) The current drawn by a charged battery is determined experimentally. It is displayed in a Tafel curve.
16) Any voltage greater than or equal to the open circuit voltage for each cell provides assurance that the cell is not discharging. Localized discharges may occur due to internal conduction paths. This is acceptable because the localized discharge does not affect a significant percentage of the material. When the cell discharges it follows the Nernst equation. The voltage drops logarithmically as the ratio of the reactants is converted to lead sulfate.
17) The qualified life of the battery is greater than 20 years.

18) The limiting component in the aged battery is the grid. The failure is due to corrosion of the grid. This increases the resistance of the grid and limits the current available from the battery.

19) Other degraded conditions may exist in a battery cell beyond the loss of the conduction path. These do not result in a performance decrease as significant as a loss of conduction.
After the battery is charged, sulfation develops due to low cell voltage.
Minor internal conduction paths develop between the positive and negative plates. This includes treeing, mossing, material deposits in the bottom of the jar, and separator failures.
The external connections of the battery cells corrode.
The electrolyte evaporates.
The spark arrestor vent path is bypassed by additional vent paths to atmosphere.

20) When the battery is discharged, the bottom of the plates provided the majority of the chemical reactants. The sulfuric acid is denser at the bottom of the plate. This effect has been seen in numerous cell teardowns. When electrolyte levels are low, slightly below the top of plates there is little change in capacity. The density of the acid increases with evaporation. This increase, more than offsets the slight decrease in surface area. The loss of electrolyte provides a small loss in long rate (20 hour) capability and provides a boost in short term high rate capability.

21) Equalization of the battery results in gas developing on the cell plates. High rate discharges are affected by about 2%. Equalization voltages increase water usage, increase grid corrosion, and age the positive plate active material. The battery should not be kept on the permanent equalize state.

22) The battery ratings are established by test and include the coup de foet effect. The coup de foet is the initial reluctance of the battery to respond to an initial application of a load. The battery is sized using IEEE 485 methodology and the manufacturer's rating curves.

23) In Technical Specifications, when equipment is inoperable, time limits are imposed which ensure the equipment is restored to an operable status or the system & plant are placed in a safe status. While in these time periods, the single failure criterion does not apply. Credit may be taken for all operable redundant equipment to safely shutdown the plant.

24) The Units that adopt the Technical Specifications with operability limits will adopt procedures and programs, which use IEEE 450 recommended practices & limits for evaluating the battery to the Maintenance Rule.

25) The Design Basis Accident bounds the radiological release to the public.

26) The 1E battery is sized to a specific load profile for the Design Base Accident. During other accidents and events with lower radiological releases, the load may vary from the Design Base Event at any specific time, specific components may require more or less voltage, the amp-hours removed from the battery may be greater or less than the Design Base Accident as a function of charger return to service time, running load, and operator actions. The conditions prior to the onset of the event may differ from those assumed for the Design Base Accident; electrolyte temperature may be more favorable, normal equipment

availability and operating conditions may be assumed, and the requirement to consider a single failure may not be applicable. The Examples of the less bounding events are Fire Safe Shutdown scenarios, Station Black Out, and high energy line breaks.

27) Although the charger may be restored quickly, the battery, alone, is designed to energize the required safety loads and other non-shed non safety loads required for the Design Basis Accident. The safety related loads will be capable of performing their design function. The design shall preclude non-shed non safety loads from operating in a manner that would prevent the safety related loads from performing their safety function.

28) The battery shall be sized for design environmental conditions, specifically low electrolyte temperature, under which the discharge battery is expected to occur.

29) Battery degradation is monitored through capacity testing. The battery is oversized a minimum of 125%. Reduction of the battery capacity below 80% indicates that a margin review should be made to determine if the battery will is capable of supplying the loads present during a Design Base Accident. Margin would indicate that the battery is capable of fulfilling it's safety function.

30) Capacity testing evaluates the battery active components. It should be performed near the highest state of charge reasonably achieved in service.

31) The level of charge is evaluated by measuring current at a specific voltage, typically float voltage in normal operation or equalize voltage while recharging. When the charger is switched from equalize to float, charging current will decrease. A typical Tafel curve would suggest that float current will be 10 to 20% of the current in equalize.

32) Battery degradation is monitored through cell parameters. When cell parameters are slightly outside of specification, it indicates a insignificant or small loss of capability.

33) When not in the Design Base Accident, the battery shall support the charger when the charger is energized. Peak loads exceeding the charger's current limit, may be provided by the battery.

34) Due to the complexity of the charging system and it's power sources, the availability of the charger to perform it's safety function is different from the battery. The battery reliability is higher than the charger. The maintenance actions required to return a charger to service are more complex than returning a battery to service. Core Damage frequency is reduced by designing the DC system to perform the Design Base Accident on the battery alone, and allowing longer out of service times for the battery charger. The performance of the charger is enhanced by allowing Out of Service times sufficient to plan, identify problems, perform maintenance activities, and verify performance of the charger under a reasonable time frame.

35) A battery charger's safety function is to maintain the battery in a state of readiness, charged sufficiently to supply the loads required during the Design Base Accident.
The capacity of each battery charger shall be based on the largest combined demands of the various continuous steady state loads.

36) A battery charger's safety function is to stabilize the discharge of Design Basis Accident at the completion of the duty cycle. The stabilization ensures that

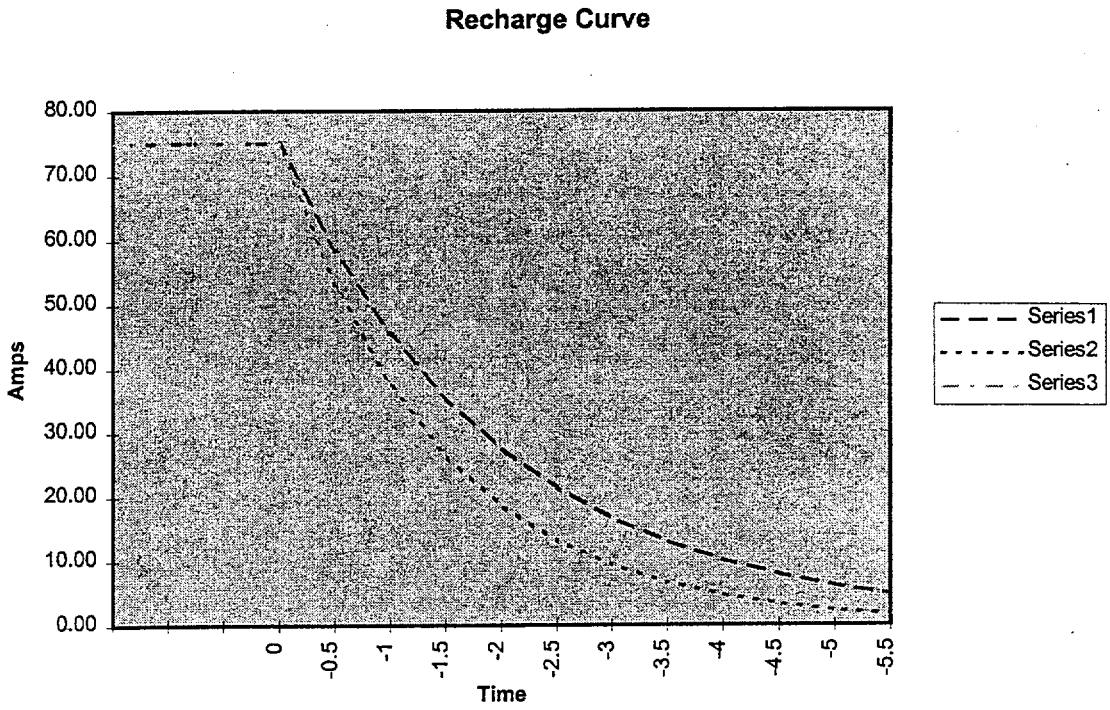
sufficient reserves are present in the battery to provide for loads in excess of the battery charger capability.

37) The battery charger shall also be capable of charging the battery at completion of the accident after normal environmental conditions (approximately 77 degrees F) have been restored. Although the charger may be capable of providing charging current at cold temperatures, a cold battery will not accept the charge. As a minimum, the charger should be capable of providing it's necessary current at low float voltage. It is acceptable to show by test that the charger will restore the battery to a state of readiness, in which the stored amp-hours are sufficient to meet the Design Base Accident current profile, maintaining the terminal voltage above that required by the DC system and components.

The level of charge required to be restored by the charger is that charge which would be sufficient to maintain bus voltages while perform the bounding design base discharge. The time period considered for sizing the charger may be established using IEEE 946 methodology. This methodology assumes that the battery accepts all of the charge at the rating or current limit of the charger. This bounds the maximum current and the charger can be expected to supply. The maximum current ensures that the charger rating is adequately sized. The time period for actually charging the battery is expected to be larger, due to the response of the battery cells. Typical cells decrease the current they will accept exponentially, between 60 and 80 percent charge. The total energy returned to the charger is equivalent to the previous method, current is lowered as time increases. The time period for restoring the battery is dependent on temperature, the charger current limit, the charger voltage, and the depth of discharge and the battery cell condition.

The capacity of each battery charger shall be based on charging capacity to restore the battery after the bounding design basis event discharge to a state that the battery can perform its design basis function regardless of the status of the plant. The time period considered for sizing the charger shall be as stated in the design basis of the plant.

38) Battery current, when charged using constant voltage, has an exponential form. Examples of constant voltage charging are provided below.



For a given depth of discharge, the recharge voltage determines the length of time in current limit. While in current limit the battery is converting the returned amps efficiently into stored energy. Some thermal losses exist. Between 60 and 80% of charge the battery cell voltage rises to the charging voltage and the current reduces exponentially. As the cell voltage approaches the charging voltage, efficiency in converting to stored energy decreases and gasses form. Maintaining the charger at high voltage returns the charge rapidly, however cells at voltages near the lower range of float voltage will also return the energy to the stored condition.
Recharge data has been analyzed for 250 VA batteries. Recharges to the point when the trickle charge was less than 1 amp with float voltage at the low end of the float voltage range, enabled batteries to be at 98 % of the charge possible. At low float voltage, 2 amps is appropriate for cells with 8 hour capacities of 1000 AH or larger.

Charging data has been provided by Yuasa for 50 Amp-Hour and 150 Amp-Hour cells. The CC-3 is charged at the high end of the float voltage range & the CC-9 is charged at the low end of the equalization range. Both indicate recharges of near 100% or greater for low float current. These are provided in an attachment to this Primer.

The IEEE SCC 29 reviewed and endorsed Kyle Floyd's Return to Service white paper. It analyzes when a battery has available 95% of its charge based on the charger's rating. Although actual current limits are slightly greater than the charger rating, the charger rating is typically used to evaluate the recharge time. The paper establishes that 95% of the charge has been replaced when the charge current reaches 13% of the charger rating when measured at equalize voltage. Most batteries, when charged after a capacity test, are charged at the equalize voltage. This ensures that, for the same depth of discharge, the charger stays in current limit longer than when charged at low float voltage. A greater percentage of the amp-hours are thus returned in the current limit phase of the charge.
Examples of the charging current at 2.33 volts per cell, which would indicate 95% charge has been returned are provided for different rating chargers.

Charger Rating (Amps)	Charging Current (Amps @ 2.33 VPC, 95% charge)
50	6
75	9
100	13
150	19
200	26
300	39
400	52
500	65
600	78

To achieve the above results, it is also acceptable to leave the charger in the float mode until it comes out of current limit, then switch to the equalize mode. The charger current will then rise to current limit again.

ENCLOSURE to Attachment 1

March 21, 1999
TO: J.K. Coyle
PECo Energy

SUBJECT: Interpretation of Standard 308-1991

The following is the response to your Request for Interpretation of Standard 308-1991. It is the result of your meeting with Nuclear Power Engineering Committee SC4.1 Working Group for IEEE 308. The response has been approved by the full committee.

The paragraphs cited have been reviewed and found to give a clear set of requirements except for Paragraph 6.3.4(3). To clarify the paragraph, it should be interpreted as follows:

"Section 6.3.4(3) Capacity: The capacity of each battery charger shall be based on the largest combined demands of the various continuous steady state loads plus charging capacity to restore the battery after the bounding design basis event discharge to a state that the battery can perform its design basis function regardless of the status of the plant. The time period considered for sizing the charger shall be as stated in the design basis of the plant."

The standard is undergoing a revision at this time. The words developed to provide the interpretation will be considered in the revision process.

Very Truly Yours,

Britton P. Grim
Chairman, PES NPEC

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(Note added by J. Coyle)
At the time this response was prepared, the working group of this response were asked to define the term "status" in the phrase "regardless of the status of the plant". The members of the working group defined this term as the plants "operational condition", e.g. OPCON 1 through 5(6), but would not permit the use of a term used in Technical Specifications within the standard.
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ATTACHMENT 2

Kyle Floyd White Paper

To Be Provided Later

This document has 4 levels of documented communication.

1) **The original numbered comments were EEIB's comments on the late September '99 draft.**
2) **The paragraph that follows, is TSB's response that also reflects their latest draft published 11/17/99.**

** 3) **What follows next is a "COMMENT" paragraph, which is EEIB's rebuttal to TSB's response (in some cases there is no "COMMENT" and it is assumed that this issue was resolved by the TSB response.**

4) **Next is a "REPLY" to address the TSTF input to EEIB's comments.**

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Comments relating to TS Branch disposition of EEIB comments on proposed battery iSTS

1. Condition A of 3.8.5 should be removed.

   A separate condition for inoperable battery chargers was the subject of extensive technical discussion and has been incorporated into TS 3.8.4. The staff proposal presented at the 9/20/99 meeting also contained a separate condition for inoperable chargers in TS 3.8.5. The consolidated draft sent for comment maintains consistency between 3.8.4 and 3.8.5 and with the earlier staff proposal and has been approved by the IEEE.

Comment: The original proposal by IEEE was to allow redundant battery chargers located in redundant trains to be inoperable at the same time. The staff disagreed with this proposal. Technical discussion led to the change to 3.8.4 which allowed one or more battery chargers in the same train (not redundant trains) to be inoperable for a specified period of time. With the change to 3.8.4, 3.8.5 should be changed to maintain consistency with 3.8.4. Operation during shutdown without an operable battery charger in either redundant train has not been technically justified.

REPLY: **This issue relates also to TSTF-204, which we anticipate will be approved. In this event LCO 3.8.5 may only addresses a single train (TSTF-204 provides an option to only require a single train to be OPERABLE). In that case we agree that TSTF-360 should not address extending Completion Times for inoperable charger(s) on that train. Since LCO 3.8.5 currently addresses multiple trains (and that option remains with or without approval of TSTF-204) the proposed Action A should allow one train's charger(s) to fall under the proposed actions, provided there is a second train with operable charger(s). As such, LCO 3.8.5 Condition A specifically limits entry to conditions where the redundant train has an operable charger. The Bases includes a Reviewer's Note to address the options.**

2. Required Action to suspend operation immediately when there is a potential for draining the vessel should be added to 3.8.5.

   As the TSTF pointed out in their comments and the IEEE agreed to, Required Action B.2.3 in the consolidated draft is PWR-specific. The BWR-specific Action will be "Initiate action to suspend operations with a potential for draining the reactor vessel," consistent with other specifications in the BWR STS with applicability in the shutdown modes. This will be noted in the cover letter transmitting the specifications to the TSTF.

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3. The 2.07 volts specified in Condition A of 3.8.6 has not been justified.

   The 2.07 V limit has been justified as it is the operability limit, carried over from the current revision of the STS (Rev 1) and, therefore, is the appropriate limit for the TS. This has been endorsed by the IEEE.

Comment: The operability limit in the current revision of the STS (Rev1) is 2.13 volts as the A or B limits with a 31 day LCO when the voltage is between 2.07 and 2.13 volts. Also, there was not an IEEE consensus agreement with respect to operability when one or more cells are below 2.13 volts. For example, See E-Mail located at the following location: http://irm25.nrc.gov:88/HyperNews/get/EELB/UNSECURE/2/2/6/1/3/3.html
The 2.07 volt limit (or what ever limit is specified) should be technically justifiable.

REPLY: In the STS, Rev 1, the "operability limit" (assuming we are discussing *battery* operability) is clearly 2.07v (Category C). The battery remains operable between 2.07v and 2.13v (or greater). In the approved TS NUREG, there is an imposed "maintenance" time limit of 31 days with a cell between 2.07v and 2.13v; but no battery inoperability. AND this applies to ANY number of cells on ANY/ALL batteries. As a maintenance issue, this latest proposal (TSTF-360) retains similar direction (relocated to the TRM) for identifying and correcting any cell voltage that is below 2.13v. {NOTE: the NRC referenced email could not be reached at the stated address.}

4. With respect to Required Action A.3 of 3.8.6, the term "limits" has not been defined.

   As is TS convention, the use of the word "limit" in Required Action A.3 refers to the limit defined in Condition A.

   (**)

5. With respect to the Reviewer's note in 3.8.6, IEEE 450-1995 does not define a program as indicated for battery parameters. The program and its basis needs to be defined and justified for all cell voltages over the design life of the battery cell.

   The reviewer's note is meant to indicate that the licensee should implement a program that is consistent with the recommended practices of IEEE 450-1995. No regulatory basis could be established to require maintenance actions such as voltage monitoring above the operability limit (2.07 volts) in technical specifications. The IEEE NTF approved the note as worded in the consolidated draft.

Comment: From my discussions/participation with the IEEE NTF, I do not find any information or documentation which indicates that the wording of the subject note was presented to IEEE NTF for their consensus vote or that they discussed the proposed wording.

REPLY: Suggest the Reviewer's Note have the words "that is based on" replace the "in accordance with" wording: "...*that is* based on IEEE-450...". The intent of the Note (and its referred-to commitment) is to elicit the explicit commitment to monitor and maintain batteries as recommended by IEEE-450-1995. The IEEE and NTF *do, most assuredly,* concur with following these recommendations for battery monitoring and maintenance. However, it is also true that IEEE/NTF do not care to review the specific wording that conveys this thought or need for commitment; but this does NOT infer any lack of consensus on the technical aspects.

6. With respect to Condition A of 3.8.6, allowing redundant batteries to be degraded (and possibly inoperable because cell voltage of one or more cells in redundant batteries is below 2.07 volts) at the same time for 24 plus 12 hours has no justification.

   The issue of allowing one or more batteries to be "degraded" was the subject of extensive technical discussion and Condition A has been approved by the IEEE as being technically acceptable. The version of 3.8.6 presented by the staff at the 9/20/99 meeting allowed 24 hours to restore float voltage of affected cells when it is below limits. Therefore, it appears that the only issue is the 12 hours allowed to restore an inoperable battery in 3.8.4, Condition B. Note that Condition B of 3.8.4 only allows one battery or two batteries in the same train to be inoperable. It does not allow redundant batteries to be inoperable. We have decided to leave the current STS Completion Time of 2 hours in brackets in the final draft and the Bases will explain that any licensee wishing to request a longer Completion Time will need to demonstrate that the longer Completion Time is appropriate for them following the guidance in Regulatory Guide (RG) 1.177, "An Approach for Plant- Specific, Risk-Informed Decisionmaking: Technical Specifications,". RG 1.177 provides guidance for using a risk-informed method for determining Completion Times.

Comment: When one cell is found below 2.07 volts, current battery STS allows 2 hours to correct the condition. The proposed new STS allows 24 hours (without other restrictions) when one or more cells in redundant batteries are below 2.07 volts. The proposed change represents a significant departure from currently approved NRC STS guidelines and practices.

REPLY: The issue of "without other restrictions" is misleading. There was extensive discussion on the remaining restrictions that continue to be imposed by LCO 3.8.4 to assure overall battery float voltage is monitored to maintain the battery operable (and monitoring this parameter within 2 hours *is* an added restriction being proposed). It was acknowledged that at some unknown number of individual cells below 2.07v, the overall battery voltage would no longer be maintainable above values that would justify its continued operability, and Actions of 3.8.4 would dictate appropriate measures. Given LCO 3.8.4 is bounding the possible extreme degradations that 3.8.6 appears to allow, there did not appear to be a specific safety concern with the presentation. The extension of the action time for individual cell voltages from 2 hours to 24 hours is justified based on continuing to monitor the overall condition of the battery (overall volt voltage and float current).

7. Completion Time for Required Action C.2 of 3.8.6 should be 2 hours and once per 12 hours thereafter for 7 days. There is no justification for having a possible inoperable battery cell for 12 hours before it is tested.

   With electrolyte level below the limit the first action should be to restore electrolyte level. The Completion Time for this action (Required Action C.1) is 8 hours. The next action is the verify battery connected cell voltage and 12 hours is a reasonable time to perform this action as it is only allowing 4 additional hours after restoring electrolyte level.

   (**)

8. Following restoration of electrolyte level should be added to Required Action C.2 of 8.3.6.

   The TSTF commented that the Required Action C.2 should have read, "Perform SR 3.8.6.5 for affected cells." Requiring performance of SR 3.8.6.3 would be meaningless when already in the Actions for low electrolyte level. The IEEE agreed with the TSTF and the correction has been made in the latest consolidated draft.

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9. With respect to Condition D of 3.8.6, allowing redundant batteries to be inoperable for 12 hours plus an additional 12 hours (or 24 hours) due to temperature of electrolyte cannot be technically justified.

   The version of 3.8.6 presented by the staff at the 9/20/99 meeting allowed 12 hours to restore one or more battery cell temperatures when below limits. Therefore, it appears that the only issue is the 12 hours allowed to restore an inoperable battery in 3.8.4, Condition B. Note that Condition B of 3.8.4 only allows one battery or two batteries in the same train to be inoperable. It does not allow redundant batteries to be inoperable. We have decided to leave the current STS Completion Time of 2 hours in brackets in the final draft and the Bases will explain that any licensee wishing to request a longer Completion Time will need to demonstrate that the longer Completion Time is appropriate for them following the guidance in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications,". RG 1.177 provides guidance for using a risk-informed method for determining Completion Times.

Comment: When pilot cell in one battery is found below temperature limit for operability, current battery STS allows 2 hours to correct the condition. The proposed new STS allows 12 hours when pilot cells in redundant batteries are found below the temperature limit for operability. The proposed change represents a significant departure from currently approved NRC STS guidelines and practices.

REPLY: Given the limited level of degradation that a temperature excursion represents, the probability of restoring that temperature in a timely fashion, the minimal potential for an event during this period that would require 100% of the battery design capability, and the risk that is minimized by avoiding an unnecessary plant transient invoked by a required plant shutdown, this change was deemed acceptable.

10. With respect to Condition E of 3.8.6, allowing redundant batteries to be inoperable for 12 hours with battery float current grater than10 amps cannot be technically justified.

    Again, this is an issue with the 12 hours allowed to restore an inoperable battery in 3.8.4, Condition B. Note that Condition B of 3.8.4 only allows one battery or two batteries in the same train to be inoperable. It does not allow redundant batteries to be inoperable. We have decided to leave the current STS Completion Time of 2 hours in brackets in the final draft and the Bases will explain that any licensee wishing to request a longer Completion Time will need to demonstrate that the longer Completion Time is appropriate for them following the guidance in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications,". RG 1.177 provides guidance for using a risk-informed method for determining Completion Times.

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11. SR3.8.6.1 requires float current to be verified between 0 and 2 amps. A Required Action is needed when current is less than or equal to 0 amps that states the battery is inoperable. Allowing any one battery to operate without charge for 24 hours plus 12 hours cannot be technically justified.

    Condition B of 3.8.6 would be entered when float current was < 0 amps. Required ACTION B.1 requires restoration of float current to within the limits of SR 3.8.6.1 in 24 hours, otherwise the battery must be declared inoperable. The IEEE NTF approved these requirements.

Comment: IEEE NTF were asked to vote on a 2 hour completion time when float current is less than 0 amps. There was a consensus agreement for the 2 hour completion time. Also, the 24 hour completion time is not consistent with the 2 hour completion time associated with Required Action A.1 of 3.8.4.

REPLY: This issue was agreed to require a fix. A condition where true "float" current is < 0 amps reflects a condition where the overall battery voltage must necessarily be well below the value required by SR 3.8.4.1. Failing this overall voltage value required entry into 3.8.4 Action A and application of Required Action A.1, which requires that any battery discharge be terminated within 2 hours. A battery discharge is synonymous with float current < 0 amps. So, the comment is accurate in that the condition of a battery discharging is to be terminated within 2 hours (as required by 3.8.4 Required Action A.1).

Since the situation is identified and addressed, and since the condition of < 0 amps will be accompanied by a low float voltage also, there would be no need to explicitly address the condition with the < 0 amps criteria in 3.8.6 (Note that the Frequency for surveilling overall battery float voltage (SR 3.8.4.1) is the same as currently proposed for surveilling float current (SR 3.8.6.1; both at 7 days).

12. In SR 3.8.6 float current greater than 0 amps should be changed to float current is at a measurable value greater than 0 amps.

    This was discussed at the 9/20/99 and the consensus was that the term "measurable value" was beyond the level of detail typically found in TS. Even the staff's surveillance requirement for float current presented at the 9/20/99 meeting (SR 3.8.4.2) did not contain the phrase "measurable value greater than 0 amps."

Comment: Measurable value was added based on comments from IEEE NTF. The specific E-mail comment is located at:
http://irm25.nrc.gov:88/HyperNews/get/EELB/UNSECURE/2/2/6/1/3/6.html

REPLY: <<Refer to Item #11 above for elimination of an explicit "0 amp" limit.>> In general, all TS values recognize the non-stated need for the value to be measured or measurable. I believe the consensus IEEE-NTF input was that not adopting "measurable value" was acceptable.

13. The 2.07 volts specified in SR 3.8.6.2 has not been justified

The 2.07 V limit has been justified as it is the operability limit, carried over from the current revision of the STS (Rev 1), and, therefore, is the appropriate limit for the TS. This has been endorsed by the IEEE.

Comment: See comment included with item 3 above

REPLY: In the STS, Rev 1, the "operability limit" (assuming we are discussing *battery* operability) is clearly 2.07v (Category C). The battery remains operable between 2.07v and 2.13v (or greater). In the approved TS NUREG, there is an imposed "maintenance" time limit of 31 days with a cell between 2.07v and 2.13v; but no battery inoperability. AND this applies to ANY number of cells on ANY/ALL batteries. As a maintenance issue, this latest proposal (TSTF-360) retains similar direction (relocated to the TRM) for identifying and correcting any cell voltage that is below 2.13v. {NOTE: the referenced email could not be reached at the stated address.}

14. SR3.8.6.2 should use the same limit as stated in SR 3.8.6.5

We agree. The TSTF also made this comment and it has been incorporated.

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15. With respect to Condition C of 3.8.6, allowing redundant batteries to be degraded at the same time (and possibly inoperable because electrolyte level was below the top of the plates of one or more cells) for 8 plus 12 hours cannot be technically justified.

The issue of allowing one or more batteries to be "degraded" was the subject of extensive technical discussion and Condition C has been approved by the IEEE as being technically acceptable. The version of 3.8.6 presented by the staff at the 9/20/99 meeting allowed 8 hours to restore electrolyte level of affected cells when it is below limits. Therefore, it appears that the only issue is the 12 hours allowed to restore an inoperable battery in 3.8.4, Condition B. Note that Condition B of 3.8.4 only allows one battery or two batteries in the same train to be inoperable. It does not allow redundant batteries to be inoperable. We have decided to leave the current STS Completion Time of 2 hours in brackets in the final draft and the Bases will explain that any licensee wishing to request a longer Completion Time will need to demonstrate that the longer Completion Time is appropriate for them following the guidance in Regulatory Guide (RG) 1.177, "An Approach for Plant- Specific, Risk-Informed Decisionmaking: Technical Specifications,". RG 1.177 provides guidance for using a risk-informed method for determining Completion Times.

Comment: When electrolyte level is found below allowable limit, current battery STS allows 2 hours to correct the condition. The proposed new STS allows 8 hours when level in one or more cells of redundant batteries are found below the top of the plates. The proposed change represents a significant departure from currently approved NRC STS guidelines and practices.

REPLY: Given the limited level of degradation that a level excursion represents, the probability of restoring that level in a timely fashion, the minimal potential for an event during this period that would require 100% of the battery design capability, and the risk that is minimized by avoiding an unnecessary plant transient invoked by a required plant shutdown, this change was deemed acceptable.

16. With respect to Condition B of 3.8.6, allowing redundant batteries to be degraded at the same time (and possibly inoperable because float current is greater than or equal to 2 amps) for 24 plus 12 hours cannot be technically justified.

    The issue of allowing one or more batteries to be "degraded" was the subject of extensive technical discussion and Condition B has been approved by the IEEE as being technically acceptable. The consensus was that the battery was not necessarily inoperable if it's float current was greater than 2 amps for a short period of time (< 24 hours). Again, Condition B of 3.8.4 only allows one battery or two batteries in the same train to be inoperable. It does not allow redundant batteries to be inoperable. We have decided to leave the current STS Completion Time of 2 hours in brackets in the final draft and the Bases will explain that any licensee wishing to request a longer Completion Time will need to demonstrate that the longer Completion Time is appropriate for them following the guidance in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications,". RG 1.177 provides guidance for using a risk-informed method for determining Completion Times.

Comment: Currently approved NRC STS only allows the use of current of less than 1 amp to establish operability for seven days following a battery recharge. If current is found above the 1 amp limit on one battery, the current STS allows 2 hours to correct the condition. The proposed new STS allows 24 hours when float current of redundant batteries are found above 2 amps at any time. The proposed change represents a significant departure from currently approved NRC STS guidelines and practices.

REPLY: {Note that the STS, Rev 1, uses the same "[2]" amps that is being proposed - not the stated "1 amp."} Given the limited level of degradation that a minor (i.e., < 10 amps) re-charging current excursion represents, the probability of restoring that float current in a timely fashion, the minimal potential for an event during this period that would require 100% of the battery design capability, and the risk that is minimized by avoiding an unnecessary plant transient invoked by a required plant shutdown, this change was deemed acceptable.

17. With respect to Condition B of 3.8.6, allowing redundant batteries to be inoperable at the same time because float current is less than 0 amps for 24 plus 12 hours cannot be technically justified.

    The issue of allowing one or more batteries to be "degraded" was the subject of extensive technical discussion and Condition B has been approved by the IEEE as being technically acceptable. The consensus was that the battery was not necessarily inoperable if it's float current was less than 0 amps for a short period of time (< 24 hours). Again, Condition B of 3.8.4 only allows one battery or two batteries in the same train to be inoperable. It does not allow redundant batteries to be inoperable. We have decided to leave the current STS Completion Time of 2 hours in brackets in the final draft and the Bases will explain that any licensee wishing to request a longer Completion Time will need to demonstrate that the longer Completion Time is appropriate for them following the guidance in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications,". RG 1.177 provides guidance for using a risk-informed method for determining Completion Times.

Comment: The proposed new STS allows 24 hours when float current of redundant batteries are found to be less than 0 amps. The proposed change represents a significant departure from currently approved NRC STS guidelines and practices. Also, see comment include with item 11 above.

REPLY: This issue was agreed to require a fix. A condition where true "float" current is < 0 amps reflects a condition where the overall battery voltage must necessarily be well below the value required by SR 3.8.4.1. Failing this overall voltage value required entry into 3.8.4 Action A and application of Required Action A.1, which requires that any battery discharge be terminated within 2 hours. A battery discharge is synonymous with float current < 0 amps. So, the comment is accurate in that the condition of a battery discharging is to be terminated within 2 hours (as required by 3.8.4 Required Action A.1).

Since the situation is identified and addressed, and since the condition of < 0 amps will be accompanied by a low float voltage also, there would be no need to explicitly address the condition with the < 0 amps criteria in 3.8.6 (Note that the Frequency for surveilling overall battery float voltage (SR 3.8.4.1) is the same as currently proposed for surveilling float current (SR 3.8.6.1; both at 7 days).

18. With respect to Condition E of 3.8.6 and Condition B or C of 3.8.4, an additional 12 hours beyond that which is specified as a completion time in Condition A, B, C, and D of 3.8.6 cannot be technically justified.

    This comment is a repeat of comments 6, 9, 15, 16, & 17.

    (**)

19. Required Action A.1 [or (a)] of 3.8.4 allows a battery to be inoperable while the battery charger is being repaired. The Require Action should be modified to assure the battery is not discharging and still has sufficient capacity to perform its design function within 2 hours. Allowing an inoperable battery for 24 hours (or 36 hours as proposed) cannot be technically justified.

    Required Action A.1 and revised Required Action A.2 accomplish this. See response to comment #20.

    (**)

20. Required Action A.2 [or (b)] of 3.8.4 serves no purpose. The Required Action should include a written requirement to restore battery float voltage to minimum float voltage recommended by the manufacturer within 12 hours.

    Required Action A.2 of 3.8.4 has been revised based on comments from the TSTF that were approved by the IEEE. Revised Required Action A.2 requires verification that the battery terminal voltage is greater than or equal to the minimum required voltage to support operability of associated required loads within 2 hours and once per 12 hours thereafter.

Comment: We do not have an IEEE consensus recommendation relating to the new requirements presented by required action A.1, A.2, and A.3 of 3.8.4

REPLY: Regarding the original comment above, is was agreed that Required Action A.2 served no purpose and is now deleted. Required Action A.1 will assure the battery voltage is sufficient to preclude continued discharge, which is also sufficient to support the immediate operability of required DC loads. The issue of restoring (or maintaining) manufacturer's recommended float voltage is an issue of long term battery life and not an immediate safety concern. 7 days of operation below the recommended minimum voltage will have an insignificant impact on long term battery life.

21. Required Actions for Condition A of 3.8.4 should limit the time to reestablish a fully charged battery to 24 hours. The 24 plus 12 hours that appears to be permitted is not needed and is not justifiable.

    In the revised Actions for 3.8.4, the licensee would have 12 hours to verify the battery's state of charge was sufficient to perform the design duty cycle. If the licensee could not complete that verification within 12 hours, Condition D would be entered, requiring a unit shutdown. If the licensee could verify the battery's state of charge was sufficient to perform the design duty cycle within 12 hours, then they would have 7 days to restore the battery charger.

    (**)

22. Required Action A.3 of 3.8.4 serves no purpose. The Note with SR 3.8.6.1 states the SR is not applicable when battery float voltage is less than minimum design levels. The Required Action should include a written requirement to restore battery float current to less than 2 amps within 24 hours.

    We agree that Required Action A.3 as originally proposed served no purpose. Required Action A.3 has been revised based on comments from the TSTF that were approved by the IEEE. Revised Required Action A.3 requires verification that the associated battery's state of charge is sufficient to perform the design duty cycle once per 12 hours.

Comment: See comment for item 20 above

REPLY: Regarding the original comment above (1st Note that the latest draft the previous Required Action A.2 is eliminated and the above referenced Required Action A.3 is now A.2), it is true that upon restoring minimum manufacturers float voltage, float current could be discovered > 2 amps, and would only then result in starting a 24 hour clock per 3.8.6 Action B. However, given the limited level of degradation that this scenario represents (limited due to assuring via 3.8.4 Required Action A.2 (old A.3) that the battery remains "operable"), the probability of restoring that float current in a timely fashion, the minimal potential for an event during this period that would require 100% of the battery design capability, and the risk that is minimized by avoiding an unnecessary plant transient invoked by a required plant shutdown, this change was deemed acceptable.

23. Required Actions for Condition A of 3.8.4 should include a written requirement to restore battery float current to less than 10 amps withing 12 hours.

Required Action A.3 has been revised based on comments from the TSTF that were approved by the IEEE. Revised Required Action A.3 requires verification that the associated battery's state of charge is sufficient to perform the design duty cycle once per 12 hours.

Comment: See comment for item 20 above

REPLY: Regarding the original comment above, since the battery float voltage is presumably below manufacturer's minimum, the 10 amp limit is not necessarily appropriate. However, 3.8.4 Require Action A.3 is essentially verifying this very same thing. The "10 amp" limit is presented as reflecting a battery whose state of charge is sufficient to perform the design duty cycle.

24. Required Action A.1 of 3.8.6 serves no purpose. The Required Action should include a written requirement to verify battery float voltage to minimum float voltage recommended by the manufacturer within 2 hours.

Required Action A.1 requires performance of SR 3.8.4.1 within 2 hours. SR 3.8.4.1 requires verification that battery terminal voltage is greater than or equal to the minimum established float voltage. The phrase "recommended by the battery manufacturer" will be moved to the Bases based on a comment from the TSTF and approved by the IEEE that the phrase is excessive detail of how limits are established and is not reflective of the detail typically found in the STS. Also, the revised wording is consistent with that found in the 3.8.6 SRs. If terminal voltage were not within the limit of SR 3.8.4.1 then the licensee would enter Condition B of 3.8.6.

Comment: It is not clear why one would enter Condition B of 3.8.6 when not meeting SR 3.8.4.1

REPLY: True, the last statement of the original reply above appears to be in error. There is a Required Action A.2 that required SR 3.8.6.1 and its failure would lead to Condition B entry (as possibly copied from the next comment's reply). But, the remainder of the above reply addresses the original comment.

25. Required Action A.2 of 3.8.6 serves no purpose. The Required Action should include a written requirement to verify battery float is less than 2 amps within 2 hours.

Required Action A.2 requires performance of SR 3.8.6.1 within 2 hours. SR 3.8.6.1 requires verification that float current is between 0 amps and 2 amps. If float current were not in this range then the licensee would enter Condition B of 3.8.6.

Comment: The completion time for Condition B of 3.8.6 is 24 hours which is the same as A.3. Thus, the purpose of A.2 is not clear.

REPLY: The purpose of Required Action A.2 is to identify whether float current is also out of limits (a reasonable possibility), so as to concurrently enter (and start the clock for) the appropriate Action for that condition. The appropriate action for float current already exists; all that is needed here is a 'quick-look' at the actual parameter value (i.e., perform the SR).

26. Required Action C.2 of 3.8.6 serves no purpose. The Required Action should include a written requirement to verify voltage for affected cells is within the established design voltage limits within 2 hour and once per 12 hours thereafter for 7 days.

The TSTF commented that the Required Action C.2 should have read, "Perform SR 3.8.6.5 for affected cells." Requiring performance of SR 3.8.6.3 would be meaningless when already in the Actions for low electrolyte level. The IEEE agreed with the TSTF and the correction has been made in the latest consolidated draft. The Completion Time is addressed in comment #7.

Comment: After electrolyte level is restored to above the top of the plates, verification that cell voltage is greater than 2.07 volts does not provide an acceptable test for assuring battery cell operability. The proposed 2.07 volt limit should be 2.13 volts.

REPLY: The battery remains operable between 2.07v and 2.13v (or greater). There is an imposed "maintenance" action, which is addressed in the TRM (i.e., the IEEE-450 based Program) with a cell between 2.07v and 2.13v. So verification and restoration to > 2.13v will be made. For the purposes of continued plant operation in the mean time, 2.07v should suffice. Given the limited level of degradation that this scenario represents, the probability of restoring cell voltage in a timely fashion, the minimal potential for an event during this period that would require 100% of the battery design capability, and the risk that is minimized by avoiding an unnecessary plant transient invoked by a required plant shutdown, this change was deemed acceptable.

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] battery charger[s on one {train}] inoperable.	A.1	Verify associated batter[y][ies] not discharging.	2 hours
		AND		
		A.2	Determine the associated batter[y][ies] state of charge is sufficient to perform the design duty cycle.	Once per 12 hours
		AND		
		A.3	Restore battery charger[s] to OPERABLE status.	7 days
[B.	One [or two] batter[y][ies on one train] inoperable.	B.1	Restore batter[y][ies] to OPERABLE status.	[2] hours]
C.	One DC electrical power subsystem inoperable for reasons other than Condition A [or B].	C.1	Restore DC electrical power subsystem to OPERABLE status.	[2] hours
D.	Required Action and associated Completion Time not met.	D.1	Be in MODE 3.	{6} hours
		AND		
		D.2	Be in MODE {5}.	36 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.2	Verify each battery charger supplies ≥ [400] amps at the minimum established float voltage for ≥ [4] 8 hours. 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.	[18 months]
SR 3.8.4.3	----------NOTES---------- 1. The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3. 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, 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.	[18 months]

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources - Shutdown

LCO 3.8.5 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."

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
[A. One [or two] battery charger[s on one {train}] inoperable. AND The redundant {train} battery and charger[s] OPERABLE.	A.1 Verify associated batter[y][ies] not discharging. AND A.2 Determine the associated batter[y][ies] state of charge is sufficient to perform the design duty cycle. AND A.3 Restore battery charger[s] to OPERABLE status.	[2] hours Once per 12 hours 7 days]
B. One DC electrical power subsystem inoperable[for reasons other than Condition A. OR Required Action and associated Completion Time of Condition A not met].	B.1 Declare affected required feature(s) inoperable. OR B.2.1 Suspend CORE ALTERATIONS. AND B.2.2 Suspend movement of irradiated fuel assemblies. AND B.2.3 {PWR: Initiate action to suspend operations involving	Immediately Immediately Immediately

CONDITION	REQUIRED ACTION	COMPLETION TIME
	positive reactivity additions.} {BWR: Initiate action to suspend operations with a potential for draining the reactor vessel.}	
	AND	Immediately
	B.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.5.1	----------NOTES---------- 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

----------REVIEWER'S NOTE----------

Licensee's must also implement a program to monitor battery parameters that is based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications."

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 more batteries with one or more battery cells 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 more batteries float current > [2] amps.	B.1 Restore battery float current to ≤ [2] amps.	24 hours
----------NOTE---------- Required Action C.2 shall be completed if electrolyte level was below the top of plates. ---------- C. One or more batteries with one or more cells electrolyte level less than minimum established design limits.	C.1 Restore electrolyte level to above top of plates. AND C.2 ----------NOTE---------- Only applicable if electrolyte level was below the top of plates. ---------- Perform SR 3.8.6.5 for affected	8 hours Once per 12 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
	cell(s). AND C.3 Restore electrolyte level to greater than or equal to minimum established design limits.	for 7 days 31 days
D. One or more batteries 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. Required Actions and associated Completion Time of Condition A, B, C, or D not met. OR One or more batteries float current > [10] amps.	E.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

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

	SURVEILLANCE	FREQUENCY
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ [2.07] V.	92 days
SR 3.8.6.6	----------NOTE---------- This Surveillance shall not be performed in MODE 1, 2, {3, or 4}. However, 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 or a modified performance discharge test.	60 months AND 12 months when battery shows degradation or has reached [85]% of the expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached [85]% of the expected life with capacity ≥ 100% of manufacturer's rating

INSERT: 3.8.4 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One [or two] battery charger[s on one {train}] inoperable.	A.1 Verify associated batter[y][ies] not discharging. AND A.2 Determine the associated batter[y][ies] state of charge is sufficient to perform the design duty cycle. AND A.3 Restore battery charger[s] to OPERABLE status.	2 hours Once per 12 hours 7 days
[B. One [or two] batter[y][ies on one train] inoperable.	B.1 Restore batter[y][ies] to OPERABLE status.	[2] hours]

INSERT: Charger SR

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.2	... 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.	...

INSERT: 3.8.5 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
[A. One [or two] battery charger[s on one {train}] inoperable. AND The redundant {train} battery and charger[s] OPERABLE.	A.1 Verify associated batter[y][ies] not discharging. AND A.2 Determine the associated batter[y][ies] state of charge is sufficient to perform the design duty cycle. AND A.3 Restore battery charger[s] to OPERABLE status.	[2] hours Once per 12 hours 7 days]

INSERT: IEEE-450 Reviewers Note

----------REVIEWER'S NOTE----------

Licensee's must also implement a program to monitor battery parameters that is based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications."

INSERT: 3.8.6 ACTIONS

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 cells 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 more batteries float current > [2] amps.	B.1 Restore battery float current to ≤ [2] amps.	24 hours
----------NOTE---------- Required Action C.2 shall be completed if electrolyte level was below the top of plates. --- C. One or more batteries with one or more cells electrolyte level less than minimum established design limits.	C.1 Restore electrolyte level to above top of plates. AND C.2 ----------NOTE---------- Only applicable if electrolyte level was below the top of plates. ---------- Perform SR 3.8.6.5 for affected cell(s). AND C.3 Restore electrolyte level to greater than or equal to minimum established design limits.	8 hours Once per 12 hours for 7 days 31 days
D. One or more batteries 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

INSERT: 3.8.6 SRs

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
SR 3.8.6.2	Verify each battery pilot cell voltage is $\geq$ [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 $\geq$ [2.07] V.	92 days

INSERT: Battery Capacity

... meet the assumed duty cycle for the bounding design basis event. Additional margin is designed and supports the ability of the battery to carry the DC loads continuously for approximately [2] hours as discussed in the FSAR, Chapter [8] (Ref. 4).

INSERT: Vpc Bases

... The minimum design voltage limit is 105/210 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 when there is no charging or discharging. Once fully charged with its open circuit voltage $\geq$ [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 [2.22 to 2.28] Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of [2.25] Vpc corresponds to a total float voltage output of [130.5] V for a [58] cell battery as discussed in the FSAR, Chapter [8] (Ref. 4).

INSERT: Charger

This charging capacity exceeds the minimum requirements for the charger to support the required DC loads in analyzed accidents. This excess capability supports minimizing the operational limitations imposed on battery testing and associated recharging.

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.

INSERT: 3.8.4 ACTION Bases

ACTIONS

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

Condition A represents one {**PWR:** train}{**BWR:** division} with one [or two] battery chargers inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on establishing and maintaining the battery capable of supporting its required post-accident function. Required Action A.1 requires that any associated battery discharge be terminated within 2 hours. Provided a means (either via the inoperable charger or an alternate means) of maintaining battery terminal voltage $\geq$ [2.07] Vpc is provided, the battery capacity will be maintained without further discharge. This also reflect s a DC bus voltage that assures sufficient voltage to continue to support OPERABILITY of the associated required DC loads. The Completion Time of 2 hours assures that any battery discharge that was experienced prior to establishing alternate charging is limited to a 2 hour discharge.

Required Action A.2 allows 12 hours to establish that the battery capacity remains (or is restored) sufficient to perform its required safety function (duty cycle) and further requires that this determination be periodically re-verified. This provides assurance that in the event of a DBA during the 7 days allowed by Required Action A.3 to restore the battery charger to OPERABLE status, the battery will be available to perform its assumed function. If at the expiration of the initial 12 hour period the battery capacity can not be determined to be sufficient to perform the design duty cycle, the battery must be declared inoperable and Condition [B] entered. It is not required to perform a test (e.g., battery service test) to confirm the batter capacity; rather the intent of this Required Action is to evaluate the capacity based on available operational data. The ability of the battery to satisfy this Required Action can be evaluated by indirect means, such as observation of the charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery. Consideration of excess capacity that was determined by previous testing may also be utilized in this evaluation.

During the 12 hour Completion Time of Required Action A.2, provided the battery is otherwise not known to be inoperable (including charging currents not in excess of [10] amps), the battery may be considered OPERABLE and operation continued in accordance with Action A. This is an acceptable presumption based on the limited discharge of the battery (< 2 hour), the expectation that at least some recharge is occurring (Required Action A.1 assures no further discharging is occurring), and that confirmation will be available within 12 hours of discovery of the inoperable battery charger.

Required Action A.3 limits the restoration time for the inoperable battery charger to 7 days. During the 7 day period the battery terminal voltage may have been maintained below the minimum established float voltage. However, given the limited time at a reduced float voltage, the assurance of not continually discharging the battery, and assurance that sufficient battery capacity remains to perform its intended function, the 7 day Completion Time reflects a reasonable time to effect restoration of the battery charger to OPERABLE status.

INSERT: 3.8.4 ACTION Bases (continued)

B.1

----------REVIEWERS NOTE----------
Delete ACTION B if Required Action B.1 Completion Time is the same as Required Action C.1 Completion Time. A [12] hour Completion Time may be considered for Required Action B.1 (as outlined in the optional Bases provided at the end of the Required Action B.1 Bases below) based on compensatory factors acceptable to the NRC Staff.

Condition B represents one {**PWR:** train}{**BWR:** division} with one [or two] batter[y][ies] inoperable. With one [or two] batter[y][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[s] will also result in loss of DC to that {train}. Therefore, it is imperative that the operator's attention focus on stabilizing the unit, thereby minimizing the potential for complete loss of DC power to the affected {train}. The [2] hour limit allows sufficient time to effect restoration of an inoperable battery while minimizing the risk of a loss of AC power to the associated battery charger as a result of imposing a required unit shutdown. During this time, 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 DBA), the battery charger will be expected to restore power to the DC subsystem after the associated diesel generator is connected. [As such, 12 hours is an acceptable extension to the period allowed for: 1) loss of both the battery and the charger (LCO 3.8.4, Condition C), or 2) for the complete deenergization of the DC bus (LCO 3.8.9, ACTIONS).]

INSERT: SR 3.8.4.1 Bases

..., 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 ([2.25] Vpc or [130.5] 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).

INSERT: SR 3.8.4.2 Bases

This charging capacity exceeds the minimum requirements for the charger to support the required DC loads in analyzed accidents. This excess capability supports minimizing the operational limitations imposed on battery testing and associated recharging.

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

The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the expected normal operating loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is $\leq$ [2] amps.

INSERT: Bases SR 3.8.6.6

... Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this [80]% limit.

INSERT: 3.8.5 ACTIONS Bases

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

---REVIEWER'S NOTE---

ACTION A is included only when plant-specific implementation of LCO 3.8.5 includes the potential to require both {trains} of the DC System to be OPERABLE. If plant-specific implementation results in LCO 3.8.5 requiring only one {trains} of the DC System to be OPERABLE, then ACTION A is omitted and ACTION B is renumbered as ACTION A.

Condition A represents one {**PWR:** train}{**BWR:** division} with one [or two] battery chargers inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained) and the redundant {**PWR:** train}{**BWR:** division} battery and charger[s] OPERABLE. The ACTIONS provide a tiered response that focuses on establishing and maintaining the battery capable of supporting its required post-accident function. Required Action A.1 requires that any associated battery discharge be terminated within 2 hours. Provided a means (either via the inoperable charger or an alternate means) of maintaining battery terminal voltage $\geq$ [2.07] Vpc is provided, the battery capacity will be maintained without further discharge. This also reflect s a DC bus voltage that assures sufficient voltage to continue to support OPERABILITY of the associated required DC loads. The Completion Time of 2 hours assures that any battery discharge that was experienced prior to establishing alternate charging is limited to a 2 hour discharge.

Required Action A.2 allows 12 hours to establish that the battery capacity remains (or is restored) sufficient to perform its required safety function (duty cycle) and further requires that this determination be periodically re-verified. This provides assurance that in the event of a DBA during the 7 days allowed by Required Action A.3 to restore the battery charger to OPERABLE status, the battery will be available to perform its assumed function. If at the expiration of the initial 12 hour period the battery capacity can not be determined to be sufficient to perform the design duty cycle, the battery must be declared inoperable and Condition [B] entered. It is not required to perform a test (e.g., battery service test) to confirm the batter capacity; rather the intent of this Required Action is to evaluate the capacity based on available operational data. The ability of the battery to satisfy this Required Action can be evaluated by indirect means, such as observation of the charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery. Consideration of excess capacity that was determined by previous testing may also be utilized in this evaluation.

During the 12 hour Completion Time of Required Action A.2, provided the battery is otherwise not known to be inoperable (including charging currents not in excess of [10] amps), the battery may be considered OPERABLE and operation continued in accordance with Action A. This is an acceptable presumption based on the limited discharge of the battery (< 2 hour), the expectation that at least some recharge is occurring (Required Action A.1 assures no further discharging is occurring), and that confirmation will be available within 12 hours of discovery of the inoperable battery charger.

Required Action A.3 limits the restoration time for the inoperable battery charger to 7 days. During the 7 day period the battery terminal voltage may have been maintained below the minimum established float voltage. However, given the limited time at a reduced float voltage, the assurance of not continually discharging the battery, and assurance that sufficient battery capacity remains to perform its intended function, the 7 day Completion Time reflects a reasonable time to effect restoration of the battery charger to OPERABLE status.

INSERT: 3.8.6 Background Bases

... In addition to the limitations of this Specification, the [licensee controlled program] also implements a program for monitoring various battery parameters that is based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications" (Ref.1).

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 $\geq$ [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 [2.22 to 2.28] Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of [2.25] Vpc corresponds to a total float voltage output of [130.5] V for a [58] cell battery as discussed in the FSAR, Chapter [8] (Ref. 2).

The current flow into the battery is also a primary parameter used to monitor the capacity of the battery. During a service test or performance test discharge, the fully charged battery voltage (nominal open circuit voltage at [2.065] Vpc) will decrease to approximately [1.8] Vpc (or for a [58] cell battery [105] V battery terminal voltage). The battery recharges at the current limit of the battery charger ([400] amps) until the battery terminal voltage approaches the voltage setpoint for the charger (on equalize the battery terminal voltage will be approximately 135 V or 2.33 Vpc). Charging current reduces exponentially during the remainder of the recharge cycle. Industry test data has shown that when charging at float voltage or greater, and the charging current reduces to approximately [2] amps, 98% of the original battery capacity is restored. Industry test data has also shown that when charging at equalize voltage, and the charging current reduces to approximately 13% of the chargers current limit setting ([52] amps), 95% of the original battery capacity has been restored. With the designed margins in batter sizing and the excess capacity available above the maximum assumed load, battery OPERABILITY (including post maintenance return to service) is assured at charging currents well above [10] amps.

INSERT: 3.8.6 LCO Bases

... Additional preventative maintenance, testing, and monitoring performed in accordance with the [licensee controlled program] is conducted without direct impact on the requirements of this Specification. Failure of any [licensee controlled program] requirement is evaluated against the Technical Specification limits, OPERABILITY determinations, and [Maintenance Rule Program], but does not necessarily result in failure to meet this LCO.

INSERT: 3.8.6 ACTION Bases

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

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

Since the Required Actions only specify "perform," a failure of SR 3.8.4.1 or SR 3.8.6.1 acceptance criteria does not result in this Required Action not met. However, if one of the SRs is failed, the applicable Condition in the associated Specification is entered.

B.1

With one or more batteries float current > [2] amps indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possible due to one or more battery cells in a low voltage condition reflecting some loss of capacity. It is noted that should the battery float current reach > [10] amps, the battery is considered inoperable. However, while > [2] amps (but $\leq$ [10] amps) the battery capacity remains sufficient to perform its intended safety function. Taking into consideration that, while battery capacity is degraded, sufficient capacity exists to perform the intended function and to allow time to fully restore the battery parameters to normal limits, this time is acceptable for operation prior to declaring the DC batteries inoperable.

C.1, C.2, C.3

With one or more batteries with one or more cells electrolyte level below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function. Even in the event level drops slightly below the top of the plates, the plates are porous and acid will wick from the immersed plate. Therefore, the affected battery is not required to be considered inoperable solely as a result of electrolyte level not met. Within 8 hours level is required to be restored to above the top of plates and within 31 days the minimum established design limits for electrolyte level must be re-established.

Required Action C.2 is modified by a Note that requires that the affected cell voltage be monitored (SR 3.8.6.5) only if electrolyte level was below the top of the plates. Furthermore, Condition C is modified by a Note that requires Required Action C.2 be completed whenever electrolyte is discovered below the top of the plates. Since this Condition may be exited well before the end of the 7 day period, this Note is required to complete the necessary monitoring period. With electrolyte level below the top of plates there is a potential for dryout and plate degradation. Therefore, this monitoring will ensure continued plate integrity. Since the Required Action only specifies "perform," a failure of SR 3.8.6.5 acceptance criteria does not result in this Required Action not met. However, if one or more cell voltages fail to meet SR 3.8.6.5, Condition A is entered.

D.1

With one or more batteries with pilot cell temperature less than the minimum established design limits, 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.

INSERT: 3.8.6 E.1 Bases

... discovering battery float charging current > [10] amps reflects sufficient loss of margin in battery capacity that immediately declaring the associated battery inoperable is required. This results in entering the ACTIONS of LCO 3.8.4.

INSERT: 3.8.6 SR Bases

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. 1). The 7 day Frequency is consistent with IEEE-450 (Ref. 1).

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 LCO 3.8.4 ACTION A are being taken, which provides 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

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. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. 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. 1).

SR 3.8.6.3

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintains adequate electron transfer capability. The Frequency is consistent with IEEE-450 (Ref. 1).

SR 3.8.6.4

This Surveillance verification that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e., [40]°F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The Frequency is consistent with IEEE-450 (Ref. 1).

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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
INSERT 3.8.4 ACTIONS →		
~~A.~~ One DC electrical power subsystem inoperable for reasons other than Condition A or B. (C)	~~A.1~~ C Restore DC electrical power subsystem to OPERABLE status.	2 hours
~~B.~~ Required Action and Associated Completion Time not met. (D)	D ~~B.1~~ Be in MODE 3. AND D ~~B.2~~ Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ~~≥ [129/258] V on float charge~~ greater than or equal to the minimum established float voltage.	7 days

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance [is ≤ [1E-5 ohm] for inter-cell connections, ≤ [1E-5 ohm] for inter-rack connections, ≤ [1E-5 ohm] for inter-tier connections, and ≤ [1E-5 ohm] for terminal connections].	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration.	[12] months
SR 3.8.4.4	Remove visible terminal corrosion and verify battery cell to cell and terminal connections are [clean and tight, and are] coated with anti-corrosion material.	[12] months
SR 3.8.4.5	Verify battery connection resistance [is ≤ [1E-5 ohm] for inter-cell connections, ≤ [1E-5 ohm] for inter-rack connections, ≤ [1E-5 ohm] for inter-tier connections, and ≤ [1E-5 ohm] for terminal connections].	[12] months

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.4.~~6~~ 2 ----------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. ----------	
Verify each battery charger supplies ≥ [400] amps at ~~≥ [125/250] V~~ the minimum established float voltage for ≥ [8] hours.	[18 months]
SR 3.8.4.~~7~~ 3 ----------NOTES 6.6---------- 1. The modified performance discharge test in SR 3.8.~~4~~ 8 may be performed in lieu of ~~the service test in~~ SR 3.8.4.~~7~~ 3 ~~once per 60 months~~. 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. ----------	
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.	[18 months]

INSERT CHARGER SR

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
MOVE to Spec 3.8.6 (SR 3.8.6.6) SR 3.8.~~4.8~~ 6.6 ----------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. ---------- 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 battery shows degradation, or has reached [85]% of the expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached [85]% of the expected life with capacity ≥ 100% of manufacturer's rating

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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
INSERT 3.8.5 ACTIONS ~~A~~. One or more required B DC electrical power subsystems inoperable [for reasons other than Condition A OR Required Actions and associated Completion Time of Condition A not met.]	~~A~~.1 B Declare affected required feature(s) inoperable. OR ~~A~~.2.1 B Suspend CORE ALTERATIONS. AND ~~A~~.2.2 B Suspend movement of irradiated fuel assemblies. AND ~~A~~.2.3 B Initiate action to suspend operations involving positive reactivity additions. AND	Immediately Immediately Immediately Immediately (continued)

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ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A.~~ B (continued)	~~A.~~ B.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	----------NOTE---------- The following SRs are not required to be performed: SR 3.8.4.6 (2) and SR 3.8.4.7 (3) ~~and SR 3.8.4.8.~~ ----------	
	For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1, SR 3.8.4.2, SR 3.8.4.3, ~~SR 3.8.4.4, SR 3.8.4.5, SR 3.8.4.6, SR 3.8.4.7, SR 3.8.4.8~~	In accordance with applicable SRs

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3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Cell Parameters

INSERT IEEE-450 REVIEWERS NOTE

LCO 3.8.6 Battery cell parameters for the Train A and Train B batteries shall be within the limits of Table 3.8.6-1.

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

ACTIONS

NOTE
Separate Condition entry is allowed for each battery.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more batteries with one or more battery cell parameters not within Category A or B limits.	A.1 Verify pilot cell[s] 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 Once per 7 days thereafter
	AND	
	A.3 Restore battery cell parameters to Category A and B limits of Table 3.8.6-1.	31 days

INSERT 3.8.6 ACTIONS

(continued)

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E ~~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.	E ~~B.1~~ Declare associated battery inoperable.	Immediately

(A, B, C, or D)

Float current >[10] amps

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)

INSERT 3.8.6 SRs

MOVE SR 3.8.6.6 (from SR 3.8.4.8)

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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 24 hours after a battery discharge < [110] V AND Once within 24 hours after a battery overcharge > [150] V
SR 3.8.6.3	Verify average electrolyte temperature of representative cells is ≥ [60]°F.	92 days

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

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark(a)	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark(a)	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity(b)(c)	≥ [1.200]	≥ [1.195] AND Average of all connected cells > [1.205]	Not more than 0.020 below average 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) A battery charging current of < [2] amps when on float charge is acceptable for meeting specific gravity limits following a battery recharge, for a maximum of [7] days. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to expiration of the [7] day allowance.

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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 [125/250] VDC electrical power system consists of two independent and redundant safety related Class 1E DC electrical power subsystems ([Train A and Train B]). Each subsystem consists of [two] 125 VDC batteries [(each battery [50]% capacity)], the associated battery charger[s] for each battery, and all the associated control equipment and interconnecting cabling.

[The 250 VDC source is obtained by use of the two 125 VDC batteries connected in series. Additionally, there is [one] spare battery charger per subsystem, which provides backup service in the event that the preferred battery charger is out of service. If the spare battery charger is substituted for one of the preferred battery chargers, then the requirements of independence and redundancy between subsystems are maintained.]

During normal operation, the [125/250] VDC load is powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC load is automatically powered from the station batteries.

The [Train A and Train B] DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, [4.16] kV switchgear, and [480] V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC vital buses.

(continued)

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BASES

BACKGROUND (continued)

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

INSERT BATTERY CAPACITY

Each battery has adequate storage capacity to carry the required load continuously for at least 2 hours and to perform three complete cycles of intermittent loads discussed in the FSAR, Chapter [8] (Ref. 4).

Each 125/250 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystem to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems, such as batteries, battery chargers, or distribution panels.

INSERT Vpc Bases

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. Battery size is based on 125% of required capacity and, after selection of an available commercial battery, results in a battery capacity in excess of 150% of required capacity. The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 128 V per battery discussed in the FSAR, Chapter [8] (Ref. 4). The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5)

battery charger

Each Train A and Train B DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads discussed in the FSAR, Chapter [8] (Ref. 4).

excess

INSERT CHARGER

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) (6) (5) and transient analyses in the FSAR, Chapter [6] (Ref. 6) and Chapter [15] (Ref. 7), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system

(continued)

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BASES

APPLICABLE SAFETY ANALYSES (continued)

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 subsystems, each subsystem consisting of [two] batteries, 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 to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any train DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4).

An OPERABLE DC electrical power subsystem requires all required batteries and respective chargers to be operating and connected to the associated DC bus(es).

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

(continued)

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BASES

APPLICABILITY (continued)

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

INSERT 3.8.4 ACTION BASES

C

A.1

Condition A 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 train. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution system train.

For reasons other than Condition A or B

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger(s), or 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 would, however, result in the complete loss of the remaining 250/125 VDC electrical power subsystems with attendant loss of ESF functions, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 8) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

could

Minimum necessary DC electrical subsystems to mitigate a worst case accident,

T

D D

B.1 and B.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

(continued)

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BASES

ACTIONS

B.1 and B.2 (continued)

within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

battery chargers, which support the ability of the batteries to perform their intended function.

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 8).

INSERT B SR 3.8.4.1

SR 3.8.4.2

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

The limits established for this SR must be no more than 20% above the resistance as measured during installation or not above the ceiling value established by the manufacturer.

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

(continued)

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

[The 12 month Frequency for this SR is consistent with IEEE-450 (Ref. 9), which recommends detailed visual inspection of cell condition and rack integrity on a yearly basis.]

SR 3.8.4.4 and SR 3.8.4.5

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

[Reviewer's Note: The requirement to verify that terminal connections are clean and tight applies only to nickel cadmium batteries as per IEEE Standard P1106, "IEEE Recommended Practice for Installation, Maintenance, Testing and Replacement of Vented Nickel - Cadmium Batteries for Stationary Applications." This requirement may be removed for lead acid batteries.]

The connection resistance limits for SR 3.8.4.5 shall be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.

[The Surveillance Frequencies of [12] months is consistent with IEEE-450 (Ref. 9), which recommends cell to cell and terminal connection resistance measurement on a yearly basis.]

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.6

This SR requires that each battery charger be capable of supplying [400] amps and [250/125] V for > [8] hours. These requirements are based on the design capacity of the chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 10), the battery charger supply is required to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensure that these requirements can be satisfied.

INSERT B SR 3.8.4.2

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these [18 month] intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

SR 3.8.4.7

A battery service test is a special test of the 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 Reference 4.

The Surveillance Frequency of [18 months] is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 10) and Regulatory Guide 1.129 (Ref. 11), which state that the battery service test should be performed during refueling operations, or at some other outage, with intervals between 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 once per 60 months.

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

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

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

The reason for Note 2 is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

SR 3.8.4.8

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

~~A battery modified performance discharge test is described in the Bases for SR 3.8.4.7.~~ Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.8 (6.6) (continued) battery service test

SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 (3) at the same time.

MOVE 2 ¶s from previous page

The acceptance criteria (3) for this Surveillance are consistent with IEEE-450 (Ref. 9) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. (4)

INSERT B SR 3.8.6.6

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's ratings. (3) Degradation is indicated, according to IEEE-450 (Ref. 9), 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. 9). (3)

MOVE TO SR 3.8.6.6 BASES

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

REFERENCES

1. 10 CFR.50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-[1978].
4. FSAR, Chapter [8].
5. IEEE-485-[1983], June 1983.

MOVE TO 3.8.6

(continued)

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BASES

REFERENCES (continued)

5 ~~6~~. FSAR, Chapter [6].

6 ~~7~~. FSAR, Chapter [15].

7 ~~8~~. Regulatory Guide 1.93, December 1974.

8 ~~9~~. IEEE-450-[~~1987~~]. 1995

9 ~~10~~. Regulatory Guide 1.32, February 1977.

10 ~~11~~. Regulatory Guide 1.129, December 1974.

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources—Shutdown

BASES

BACKGROUND

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

APPLICABLE SAFETY ANALYSES

The initial (5) conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, 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

The DC electrical power subsystems, each subsystem consisting of two batteries, one battery charger per battery, and the corresponding control equipment and interconnecting cabling within the train, are required to be

(continued)

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BASES

LCO (continued)

OPERABLE to support required trains of the distribution systems required OPERABLE by LCO 3.8.10, "Distribution Systems—Shutdown." This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

APPLICABILITY

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

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

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

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

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

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

ACTIONS

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

INSERT 3.8.5 ACTION BASES

If two trains are required by 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

(continued)

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BASES

ACTIONS

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

allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions). The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained.

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

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all (3) Surveillances required by SR 3.8.4.1 through SR 3.8.4.(8) Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

(continued)

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BASES (continued)

REFERENCES

1. FSAR, Chapter [6]. (5)
2. FSAR, Chapter [14].

+110

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery cell Parameters

BASES

BACKGROUND

This LCO delineates the limits on electrolyte temperature, level, float voltage, and specific gravity for the DC power subsystem sources 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."

INSERT 3.8.6 Background BASES

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter [6] (Ref. 1) and Chapter [15] (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the 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 cell parameters satisfy Criterion 3 of the NRC Policy Statement.

LCO

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

INSERT 3.8.6 LCO BASES

(continued)

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BASES (continued)

APPLICABILITY

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

ACTIONS

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

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

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

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

INSERT 3.8.6 ACTION BASES

(continued)

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BASES

ACTIONS

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

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

E

B.1

allowances of the Required Actions for Condition A, B, C, or D,

battery

INSERT 3.8.6 E.1 BASES

is

any

With one or more batteries with one or more battery cell parameters outside the Category C limit for any connected cell sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F, are also cause for immediately declaring the associated DC electrical power subsystem inoperable.

SURVEILLANCE REQUIREMENTS

INSERT 3.8.6 SR BASES

SR 3.8.6.1

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

SR 3.8.6.2

The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 3). In addition, within 24 hours of a battery discharge < [110] V or a battery overcharge > [150] V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to ≤ [110] V, do not constitute a battery discharge

MOVE SR 3.8.6.6 FROM SR 3.8.4.8

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.6.2 (continued)

provided battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.

SR 3.8.6.3

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

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

Table 3.8.6-1

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

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

The Category A limits specified for electrolyte level are based on manufacturer recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra ¼ inch allowance above the high water level indication for operating margin to account for temperatures and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates

(continued)

TSTF-360

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

suffer no physical damage and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 3) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

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

The Category A limit specified for specific gravity for each pilot cell is ≥ [1.200] (0.015 below the manufacturer fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation.

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

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ [1.195] (0.020 below the manufacturer fully charged, nominal specific gravity) with the average of all connected cells > [1.205] (0.010 below the manufacturer fully charged, nominal specific gravity). These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell will not mask overall degradation of the battery.

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

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

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

The Category C limits of average specific gravity $\geq$ [1.195] is based on manufacturer recommendations (0.020 below the manufacturer recommended fully charged, nominal specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell does not mask overall degradation of the battery.

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

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote (c) to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

up to [7] days following a battery recharge. Within [7] days each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements may be made in less that [7] days.

Reviewer's Note: The value of [2] amps used in footnote (b) and (c) is the nominal value for float current established by the battery vendor as representing a fully charged battery with an allowance for overall battery condition.

REFERENCES

1. FSAR, Chapter [6].
2. FSAR, Chapter [15].
3. IEEE-450-[~~1980~~ 1995].
4. IEEE-485-[1983], June 1983.

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.

INSERT 3.8.4 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One DC electrical power subsystem inoperable for reasons other than Condition A or B.	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. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.4.1 Verify battery terminal voltage is ≥ [129] V on float charge.	7 days

greater than or equal to the minimum established float voltage

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance [is ≤ [1E-5 ohm] for inter-cell connections, ≤ [1E-5 ohm] for inter-rack connections, ≤ [1E-5 ohm] for inter-tier connections, and ≤ [1E-5 ohm] for terminal connections].	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration.	[12] months
SR 3.8.4.4	Remove visible terminal corrosion, verify battery cell to cell and terminal connections are clean and tight, and are coated with anti-corrosion material.	[12] months
SR 3.8.4.5	Verify battery connection resistance [is ≤ [1E-5 ohm] for inter-cell connections, ≤ [1E-5 ohm] for inter-rack connections, ≤ [1E-5 ohm] for inter-tier connections, and ≤ [1E-5 ohm] for terminal connections].	[12] months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.4.~~5~~ (2) ----------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. ---------- INSERT CHARGER SR Verify each battery charger supplies ≥ [400] amps at ~~≥ [125] V~~ the minimum established float voltage for ≥ [8] hours.	[18 months]
SR 3.8.4.~~X~~ (3) ----------NOTES---------- 1. The modified performance discharge test in SR 3.8.4.~~6~~ (6) may be performed in lieu of ~~the service test in~~ SR 3.8.4 (1) (3) ~~once per 60 months~~. 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. ---------- 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.	[18 months]

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.~~4.8~~ (6.6) 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.	
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 battery shows degradation or has reached [85]% of expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached [85]% of the expected life with capacity ≥ 100% of manufacturer's rating

MOVE TO Spec 3.8.6 (SR 3.8.6.6)

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.

INSERT 3.8.5 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required DC electrical power subsystems inoperable. [For reasons other than Condition A. OR Required Actions and associated Completion Time of Condition A not met.] B	A.1.1 Declare affected required feature(s) inoperable. B OR A.2.1 Suspend CORE ALTERATIONS. B AND A.2.2 Suspend movement of irradiated fuel assemblies. B AND A.2.3 Initiate action to suspend operations involving positive reactivity additions. B AND	Immediately Immediately Immediately (continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A.~~ (continued) B	~~A~~.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status. B	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 3.8.4.7x and ~~SR 3.8.4.8.~~ 2 and 3 ----------	
	For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.2 SR 3.8.4.3 ~~SR 3.8.4.4~~ ~~SR 3.8.4.7~~ ~~SR 3.8.4.5~~ ~~SR 3.8.4.8~~ ~~SR 3.8.4.6~~	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Cell Parameters

INSERT IEEE-450 REVIEWERS NOTE

LCO 3.8.6 Battery cell parameters for Train A and Train B batteries shall be within the limits of Table 3.8.6-1.

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

ACTIONS

NOTE
Separate Condition entry is allowed for each battery.

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

INSERT 3.8.6 ACTIONS

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B.~~ E 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~~ E Declare associated battery inoperable.	Immediately

, B, C, or D

float current > [10] amps

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)

INSERT 3.8.6 SRs

« MOVE SR 3.8.6.6 (from SR 3.8.4.8) »

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 24 hours after a battery discharge < [110] V AND Once within 24 hours after a 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 Cell Parameters Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark(a)	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark(a)	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity(b)(c)	≥ [1.200]	≥ [1.195] AND Average of all connected cells > [1.205]	Not more than 0.020 below 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) A battery charging current of < [2] amps when on float charge is acceptable for meeting specific gravity limits following a battery recharge, for a maximum of [7] days. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to expiration of the [7] day allowance.

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 [125/250] VDC electrical power system consists of two independent and redundant safety related Class 1E DC electrical power subsystems ([Train A and Train B]). Each subsystem consists of [two] 125 VDC batteries [(each battery [50]% capacity)], the associated battery charger(s) for each battery, and all the associated control equipment and interconnecting cabling.

[The 250 VDC source is obtained by use of the two 125 VDC batteries connected in series. Additionally there is [one] spare battery charger per subsystem, which provides backup service in the event that the preferred battery charger is out of service. If the spare battery charger is substituted for one of the preferred battery chargers, then the requirements of independence and redundancy between subsystems are maintained.]

During normal operation, the [125/250] VDC load is powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC load is automatically powered from the station batteries.

The [Train A and Train B] DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, [4.16] kV switchgear, and [480] V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC vital buses.

(continued)

BASES

BACKGROUND (continued)

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

INSERT BATTERY CAPACITY

Each battery has adequate storage capacity to carry the required load continuously for at least 2 hours and to perform three complete cycles of intermittent loads discussed in the FSAR, Chapter [8] (Ref. 4).

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystem to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems, such as batteries, battery chargers, or distribution panels.

INSERT Vpc Bases

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. Battery size is based on 125% of required capacity and, after selection of an available commercial battery, results in a battery capacity in excess of 150% of required capacity. The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 128 V per battery discussed in the FSAR, Chapter [8] (Ref. 4). The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5).

INSERT CHARGER

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 excess at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads discussed in the FSAR, Chapter [8] (Ref. 4).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (6) (DBA) and transient analyses in the FSAR, Chapter [6] (Ref. 6), and in the FSAR, Chapter [15] (Ref. 7), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC (5)

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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 subsystems, each subsystem consisting of [two] batteries, 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 to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any train DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4).

An OPERABLE DC electrical power subsystem requires all required batteries and respective chargers to be operating and connected to the associated DC bus(es).

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

(continued)

BASES

APPLICABILITY (continued)

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

INSERT 3.8.4 ACTION BASES

C
~~A.1~~

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

for reasons other than Condition A or B

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger(s), or 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 would, however, result in the complete loss of the remaining 125 VDC electrical power subsystems with attendant loss of ESF functions, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 8) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

could

minimum necessary DC electrical subsystems to mitigate a worst case accident,

7

D D
~~B.1 and B.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

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

SURVEILLANCE REQUIREMENTS

battery chargers, which support the ability of the batteries to perform their intended function.

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 8).

INSERT B SR 3.8.4.1

SR 3.8.4.2

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

The limits established for this SR must be no more than 20% above the resistance as measured during installation or not above the ceiling value established by the manufacturer.

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

[The 12 month Frequency for this SR is consistent with IEEE-450 (Ref. 9), which recommends detailed visual inspection of cell condition and rack integrity on a yearly basis.]

SR 3.8.4.4 and SR 3.8.4.5

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

Reviewer's Note: The requirement to verify that terminal connections are clean and tight applies only to nickel cadmium batteries as per IEEE Standard P1106, "IEEE Recommended Practice for Installation, Maintenance, Testing and Replacement of Vented Nickel - Cadmium Batteries for Stationary Applications." This requirement may be removed for lead acid batteries.

The connection resistance limits for SR 3.8.4.5 shall be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.

[The Surveillance Frequencies of 12 months is consistent with IEEE-450 (Ref. 9), which recommends cell to cell and terminal connection resistance measurement on a yearly basis.]

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.6 (2)

This SR requires that each battery charger be capable of supplying [400] amps and [125] V for ≥ [8] hours. These requirements are based on the design capacity of the chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 10), the battery charger supply is required to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

INSERT B SR 3.8.4.2

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these [18 month] intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This Surveillance is required to be performed during MODES 5 and 6 since it would require the DC electrical power subsystem to be inoperable during performance of the test.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

SR 3.8.4.7 (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 Reference 4.

The Surveillance Frequency of [18 months] is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 10) and Regulatory Guide 1.129 (Ref. 11), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests, not to exceed [18 months].

(continued)

BASES

SURVEILLANCE REQUIREMENTS

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

This SR is modified by two Notes. Note 1 allows the performance of a modified performance discharge test in lieu of a service test ~~once per 60 months~~.

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

must

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SWAP ORDER

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

The reason for Note 2 is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

MOVE TO SR 3.8.6.6 BASES

SR 3.8.~~4.8~~ 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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.8 (6.6) (continued)

~~A battery modified performance discharge test is described in the Bases for SR 3.8.4.7.~~ Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy ~~SR 3.8.4.8 while satisfying~~ the requirements of SR 3.8.4.7 ~~at the same time~~. (6.6) (3)

MOVE 24's from previous page

battery service test

The acceptance criteria (3) for this Surveillance are consistent with IEEE-450 (Ref. 9) and IEEE-485 (Ref. 8). These (4) references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

INSERT B SR3.8.6.6

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 9), 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. 9).

MOVE to SR3.8.6.6 BASES

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-[1978].

(continued)

BASES

REFERENCES (continued)

4. FSAR, Chapter [8].
5. ~~IEEE-485-[1983]~~, June 1983.
5 ~~6~~. FSAR, Chapter [6].
6 ~~7~~. FSAR, Chapter [15].
7 ~~8~~. Regulatory Guide 1.93, December 1974.
8 ~~9~~. IEEE-450-[1987].
9 ~~10~~. Regulatory Guide 1.32, February 1977.
10 ~~11~~. Regulatory Guide 1.129, December 1974.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources—Shutdown

BASES

BACKGROUND

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

APPLICABLE SAFETY ANALYSES

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

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

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

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

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

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

The DC sources satisfy Criterion 3 of the NRC Policy Statement.

LCO

The DC electrical power subsystems, each subsystem consisting of two batteries, one battery charger per battery, and the corresponding control equipment and

(continued)

BASES

LCO (continued)

interconnecting cabling within the train, are required to be OPERABLE to support required trains of the distribution systems required OPERABLE by LCO 3.8.10, "Distribution Systems—Shutdown." This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

APPLICABILITY

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

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

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

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

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

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

ACTIONS

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

INSERT 3.8.5 ACTION BASES

If two trains are required by 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

(continued)

BASES

ACTIONS

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

allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions). The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained.

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

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all (3) Surveillances required by SR 3.8.4.1 through SR 3.8.4.(8). Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

(continued)

BASES (continued)

REFERENCES

1. FSAR, Chapter [6].

2. FSAR, Chapter [15].

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

BACKGROUND

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

battery float current as well as

subsystem

INSERT 3.8.6 BACKGROUND BASES

APPLICABLE SAFETY ANALYSES

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

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining 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 cell parameters satisfy the Criterion 3 of the NRC Policy Statement.

LCO

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

Battery parameter

INSERT 3.8.6 LCO BASES

(continued)

BASES (continued)

APPLICABILITY

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

ACTIONS

INSERT 3.8.6 ACTION BASES

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

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

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

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

(continued)

BASES

ACTIONS

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

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

E

B.1

With one or more batteries with one or more battery cell parameters outside the Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F, are also cause for immediately declaring the associated DC electrical power subsystem inoperable.

allowances of the Required Actions for Condition A, B, C, or D

battery

INSERT 3.8.6 E.1 BASES

SURVEILLANCE REQUIREMENTS

INSERT 3.8.6 SR BASES

SR 3.8.6.1

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

SR 3.8.6.2

The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 3). In addition, within 24 hours of a battery discharge < [110] V or a battery overcharge > [150] V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to ≤ [110] V, do not constitute a battery discharge

MOVE SR 3.8.6.6 from SR 3.8.4.8

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.2 (continued)

provided the battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.

SR 3.8.6.3

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

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

Table 3.8.6-1

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

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

The Category A limits specified for electrolyte level are based on manufacturer recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra ¼ inch allowance above the high water level indication for operating margin to account for temperatures and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 3) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

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

The Category A limit specified for specific gravity for each pilot cell is ≥ [1.200] (0.015 below the manufacturer fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation.

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

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ [1.195] (0.020 below the manufacturer fully charged, nominal specific gravity) with the average of all connected cells > [1.205] (0.010 below the manufacturer fully charged, nominal specific gravity). These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell will not mask overall degradation of the battery.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

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

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

The Category C limit of average specific gravity $\geq$ 1.195 is based on manufacturer recommendations (0.020 below the manufacturer recommended fully charged, nominal specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell does not mask overall degradation of the battery.

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

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote (c) to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

up to [7] days following a battery recharge. Within [7] days, each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements may be made in less than [7] days.

[Reviewer's Note: The value of [2] amps used in footnote (b) and (c) is the nominal value for float current established by the battery vendor as representing a fully charged battery with an allowance for overall battery condition.]

REFERENCES

1. FSAR, Chapter [6].
2. FSAR, Chapter [15].
3. IEEE-450-[~~1980~~] 1995
4. IEEE-485-[1983], June 1983

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
INSERT 3.8.4 ACTIONS ~~A.~~ One DC electrical power subsystem inoperable for reasons other than Condition A or B C	~~A.1~~ C Restore DC electrical power subsystem to OPERABLE status.	2 hours
~~B.~~ Required Action and associated Completion Time not met. D	~~B.1~~ D Be in MODE 3. AND ~~B.2~~ O Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.4.1 Verify battery terminal voltage is ≥ [129/258] V on float charge, greater than or equal to the minimum established float voltage	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance [is ≤ [1E-5 ohm] for inter-cell connections, ≤ [1E-5 ohm] for inter-rack connections, ≤ [1E-5 ohm] for inter-tier connections, and ≤ [1E-5 ohm] for terminal connections].	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration.	[12] months
SR 3.8.4.4	Remove visible terminal corrosion and verify battery cell to cell and terminal connections are [clean and tight, and are] coated with anti-corrosion material.	[12] months
SR 3.8.4.5	Verify battery connection resistance [is ≤ [1E-5 ohm] for inter-cell connections, ≤ [1E-5 ohm] for inter-rack connections, ≤ [1E-5 ohm] for inter-tier connections, and ≤ [1E-5 ohm] for terminal connections].	[12] months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.4.6 (2) ~~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.~~ Verify each battery charger supplies ≥ [400] amps at ~~≥ [125/250] V~~ the minimum established float voltage for ≥ [8] hours.	[18 months]
SR 3.8.4.7 (3) NOTES 1. The modified performance discharge test in SR 3.8.~~4.6~~ 6.6 may be performed in lieu of ~~the service test in~~ SR 3.8.4.7 (3) ~~once per 60 months~~. 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. 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.	[18 months]

INSERT CHARGER SR

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.~~4.8~~ 6.6 MOVE TO Spec 3.8.6 (SR 3.8.6.6)	
----------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. ----------	
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 battery shows degradation or has reached [85]% of the expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached [85]% of the expected life with capacity ≥ 100% of manufacturer's rating

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
INSERT 3.8.5 ACTIONS →		
~~A.~~ B. ~~One or more required DC electrical power subsystems inoperable~~ [for reasons other than Condition A. OR Required Actions and associated Completion Time of Condition A not met.]	~~A.~~ B.1 Declare affected required feature(s) inoperable.	Immediately
	OR	
	~~A.~~ B.2.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	~~A.~~ B.2.2 Suspend movement of irradiated fuel assemblies.	Immediately
	AND	
	~~A.~~ B.2.3 Initiate action to suspend operations involving positive reactivity additions.	Immediately
	AND	

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A.~~ (continued) B	~~A~~.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status. B	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~~ 2 and 3 ----------	
	For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.2 SR 3.8.4.3 ~~SR 3.8.4.4~~ ~~SR 3.8.4.5~~ ~~SR 3.8.4.6~~ ~~SR 3.8.4.7~~ ~~SR 3.8.4.8~~.	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Cell Parameters

INSERT IEEE-450 REVIEWERS NOTE

LCO 3.8.6 Battery cell parameters for the Train A and Train B batteries shall be within the limits of Table 3.8.6-1.

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

ACTIONS

NOTE
Separate Condition entry is allowed for each battery.

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

INSERT 3.8.6 ACTIONS

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B.~~ E 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~~ E Declare associated battery inoperable.	Immediately

, B, C, or D

float current >[10] amps

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)

INSERT 3.8.6 SRs

MOVE SR 3.8.6.6 (from SR 3.8.4.8)

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 24 hours after battery discharge < [110] V AND Once within 24 hours 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 LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark(a)	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark(a)	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity(b)(c)	≥ [1.200]	≥ [1.195]	Not more than 0.020 below average 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) A battery charging current of < [2] amps when on float charge is acceptable for meeting specific gravity limits following a battery recharge, for a maximum of [7] days. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to expiration of the [7] day allowance.

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 [125/250] VDC electrical power system consists of two independent and redundant safety related Class 1E DC electrical power subsystems ([Train A and Train B]). Each subsystem consists of [two] 125 VDC batteries [(each battery [50]% capacity)], the associated battery charger(s) for each battery, and all the associated control equipment and interconnecting cabling.

[The 250 VDC source is obtained by use of the two 125 VDC batteries connected in series. Additionally there is [one] spare battery charger per subsystem, which provides backup service in the event that the preferred battery charger is out of service. If the spare battery charger is substituted for one of the preferred battery chargers, then the requirements of independence and redundancy between subsystems are maintained.]

During normal operation, the [125/250] VDC load is powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC load is automatically powered from the station batteries.

The [Train A and Train B] DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, [4.16] kV switchgear, and [480] V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC vital buses.

(continued)

BASES

BACKGROUND (continued)

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

INSERT BATTERY CAPACITY

Each battery has adequate storage capacity to carry the required load continuously for at least 2 hours and to perform three complete cycles of intermittent loads discussed in the FSAR, Chapter [8] (Ref. 4).

Each 125/250 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystem to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems, such as batteries, battery chargers, or distribution panels.

INSERT Vpc Bases

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. Battery size is based on 125% of required capacity and, after selection of an available commercial battery, results in a battery capacity in excess of 150% of required capacity. The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 128 V per battery discussed in the FSAR, Chapter [8] (Ref. 4). The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5).

battery charger

Each Train A and Train B DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads discussed in the FSAR, Chapter [8] (Ref. 4).

excess

INSERT CHARGER

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) (6) and transient analyses in the FSAR, Chapter [6] (Ref. 6) (5) and Chapter [15] (Ref. 7), assume that Engineered Safety Feature

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

(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 subsystems, each subsystem consisting of [two] batteries, 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 to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any train DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4).

An OPERABLE DC electrical power subsystem requires all required batteries and respective chargers to be operating and connected to the associated DC bus(es).

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

(continued)

BASES

APPLICABILITY (continued)

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

INSERT 3.8.4 ACTION BASES

C A.1

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

for reasons other than Condition A or B

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger(s), or 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 would, however, result in the complete loss of the remaining 250/125 VDC electrical power subsystems with attendant loss of ESF functions, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 8) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

Could

minimum necessary DC electrical subsystems to mitigate a worst case accident,

7

D D

B.1 and B.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

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

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. 7).

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 8).

battery charges, which support the ability of the batteries to perform their intended function.

INSERT B SR 3.8.4.1

SR 3.8.4.2

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

The limits established for this SR must be no more than 20% above the resistance as measured during installation or not above the ceiling value established by the manufacturer.

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

The 12 month Frequency for this SR is consistent with IEEE-450 (Ref. 9), which recommends detailed visual inspection of cell condition and rack integrity on a yearly basis.

SR 3.8.4.4 and SR 3.8.4.5

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

Reviewer's Note: The requirement to verify that terminal connections are clean and tight applies only to nickel cadmium batteries as per IEEE Standard P1106, "IEEE Recommended Practice for Installation, Maintenance, Testing and Replacement of Vented Nickel - Cadmium Batteries for Stationary Applications." This requirement may be removed for lead acid batteries.

The connection resistance limits for SR 3.8.4.5 shall be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.

The Surveillance Frequencies of 12 months is consistent with IEEE-450 (Ref. 9), which recommends cell to cell and terminal connection resistance measurement on a yearly basis.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.6 (2)

This SR requires that each battery charger be capable of supplying [400] amps and [250/125] V for ≥ [8] hours. These requirements are based on the design capacity of the chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 10), the battery charger supply is required to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these [18 month] intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

SR 3.8.4.7 (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 Reference 4.

The Surveillance Frequency of [18 months] (10) is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 10) and Regulatory Guide 1.129 (Ref. 11), which state that the battery service test should be performed during refueling operations, or at some other outage, with intervals between 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 once per 60 months

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

It may 3 for instance

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

MOVE & INSERT on next page

SWAP ORDER

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

MOVE TO SR 3.8.6.6 BASES

The reason for Note 2 is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

SR 3.8.~~4.8~~ 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.

~~A battery modified performance discharge test is described in the Bases for SR 3.8.4.7.~~ Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.~~4.8~~ 6.6; however, only the modified performance discharge test may be used to satisfy

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.8 (6.6) (continued)

SR 3.8.4.8 while satisfying the battery service test requirements of SR 3.8.4.7 (3) at the same time.

MOVE 2nd from previous page

The acceptance criteria (3) for this Surveillance (4) are consistent with IEEE-450 (Ref. 3) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer 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.

INSERT B SR 3.8.6.6

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. (3) 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). (3)

MOVE TO SR 3.8.6.6 BASES

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

REFERENCES

1. 10 CFR.50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-[1978].
4. FSAR, Chapter [8].
5. IEEE-485-[1983], June 1983.

(continued)

BASES

REFERENCES (continued)

5 ~~6~~. FSAR, Chapter [6].

6 ~~7~~. FSAR, Chapter [15].

7 ~~8~~. Regulatory Guide 1.93, December 1974.

8 ~~9~~. IEEE-450-~~[1987]~~ 1995.

9 ~~10~~. Regulatory Guide 1.32, February 1977.

10 ~~11~~. Regulatory Guide 1.129, December 1974.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources—Shutdown

BASES

BACKGROUND

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

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, 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

The DC electrical power subsystems, each subsystem consisting of two batteries, one battery charger per battery, and the corresponding control equipment and interconnecting cabling within the train, are required to be

(continued)

BASES

LCO (continued)

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 operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

APPLICABILITY

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

a. Required features 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

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

INSERT 3.8.5 ACTION BASES

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

(continued)

BASES

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

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.

REFERENCES

1. FSAR, Chapter [6].
2. FSAR, Chapter [15].

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

BACKGROUND

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

"battery float current as well as"

subsystem

INSERT 3.8.6 Background BASES

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter [6] (Ref. 1) and Chapter [15] (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the 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 cell parameters satisfy Criterion 3 of the NRC Policy Statement.

LCO

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

Battery parameter

INSERT 3.8.6 LCO BASES

(continued)

BASES (continued)

APPLICABILITY

parameter limits are

The battery cell parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery electrolyte is 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

INSERT 3.8.6 ACTION BASES

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

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

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

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

(continued)

BASES

ACTIONS

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

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

E

B.1

allowances of the Required Actions for Condition A, B, C, or D

is

any

With one or more batteries with one or more battery cell parameters outside the Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F, are also cause for immediately declaring the associated DC electrical power subsystem inoperable.

battery

INSERT 3.8.6 E.1 BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

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

INSERT 3.8.6 SR BASES

SR 3.8.6.2

The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 3). In addition, within 24 hours of a battery discharge < [110] V or a battery overcharge > [150] V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to ≤ [110] V, do not constitute a battery discharge

MOVE SR 3.8.6.6 from SR 3.8.4.8

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.2 (continued)

provided the battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.

SR 3.8.6.3

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

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

Table 3.8.6-1

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

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

The Category A limits specified for electrolyte level are based on manufacturer recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra ¼ inch allowance above the high water level indication for operating margin to account for temperatures and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 3) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

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

The Category A limit specified for specific gravity for each pilot cell is ≥ [1.200] (0.015 below the manufacturer fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation.

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

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ [1.195] (0.020 below the manufacturer fully charged, nominal specific gravity) with the average of all connected cells > [1.205] (0.010 below the manufacturer fully charged, nominal specific gravity). These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell will not mask overall degradation of the battery.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

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

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

The Category C limit of average specific gravity $\geq$ [1.195] is based on manufacturer recommendations (0.020 below the manufacturer recommended fully charged, nominal specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell does not mask overall degradation of the battery.

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

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote (c) to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

up to [7] days following a battery equalizing recharge. Within [7] days, each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements may be made in less than [7] days.

Reviewer's Note: The value of [2] amps used in footnote (b) and (c) is the nominal value for float current established by the battery vendor as representing a fully charged battery with an allowance for overall battery condition.

REFERENCES

1. FSAR, Chapter [6].
2. FSAR, Chapter [15].
3. IEEE-450-[1980]. 1995
4. IEEE-485-[1983], June 1983.

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3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources—Operating

LCO 3.8.4 The [Division 1 and Division 2 station service, and DG 1B, 2A, and 2C] DC electrical power subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS — INSERT 3.8.4 ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One DC electrical power subsystem inoperable for reasons other than Condition A or B.	C.1 Restore DC electrical power subsystem to OPERABLE status.	2 hours
D. Required Action and Associated Completion Time of Condition A, B, or C not met for station service DC subsystem.	D.1 Be in MODE 3. AND D.2 Be in MODE 4.	12 hours 36 hours
E. Required Action and associated Completion Time of Condition A not met for DG DC subsystem.	E.1 Declare associated DG inoperable.	Immediately

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ~~≥ [120] V on float charge.~~ greater than or equal to the minimum established float voltage	7 days
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance [is ≤ [1.5E-4 ohm] for inter-cell connections, ≤ [1.5E-4 ohm] for inter-rack connections, ≤ [1.5E-4 ohm] for inter-tier connections, and ≤ [1.5E-4 ohm] for terminal connections].	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration.	[12] months
SR 3.8.4.4	Remove visible corrosion and verify battery cell to cell and terminal connections are [clean and tight, and] coated with anti-corrosion material.	[12] months
SR 3.8.4.5	Verify battery connection resistance [is ≤ [1.5E-4 ohm] for inter-cell connections, ≤ [1.5E-4 ohm] for inter-rack connections, ≤ [1.5E-4 ohm] for inter-tier connections, and ≤ [1.5E-4 ohm] for terminal connections].	[12] months

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.4.~~6~~ (2) ----------NOTE---------- This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. ----------	
INSERT CHARGER SR → Verify each required battery charger supplies ≥ [400 amps for station service subsystems, and ≥ 100 amps for DG subsystems] at ~~[≥ [129] V]~~ the minimum established float voltage for ≥ [4] hours.	[18 months]
SR 3.8.4.~~7~~ (3) ----------NOTES---------- 1. The modified performance discharge test in SR 3.8.~~4.0~~ 6.6 may be performed in lieu of ~~the service test in~~ SR 3.8.4.~~7~~ 3 once per 60 months. 2. This Surveillance shall not be performed in MODE 1, 2, or 3. However, 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.	[18 months]

(continued)

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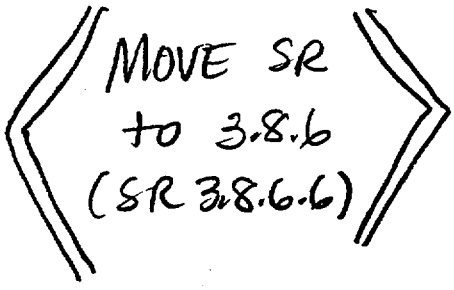
SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.~~4.8~~ 6.6 NOTE This Surveillance shall not be performed in MODE 1, 2, or 3. However, 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 or a modified performance discharge test.	60 months AND 12 months when battery shows degradation or has reached [85]% of expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached [85]% of the expected life with capacity ≥ 100% of manufacturer's rating



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3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources—Shutdown

LCO 3.8.5 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."

APPLICABILITY: MODES 4 and 5,
During movement of irradiated fuel assemblies in the [secondary] containment.

INSERT 3.8.5 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A.~~ B One or more required DC electrical power subsystems inoperable [for reasons other than Condition A, OR Required Actions and associated Completion Time of Condition A not met.]	B ~~A~~.1 Declare affected required feature(s) inoperable.	Immediately
	OR	
	~~A~~.2.1 B Suspend CORE ALTERATIONS.	Immediately
	AND	
	~~A~~.2.2 B Suspend movement of irradiated fuel assemblies in the [secondary] containment.	Immediately
	AND	

(continued)

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ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A.~~ B (continued)	B ~~A~~.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel. AND B ~~A~~.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately 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~~ 2, SR 3.8.4.~~7~~ and 3, and ~~SR 3.8.4.8~~. ---------- For DC sources required to be OPERABLE the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.2 SR 3.8.4.3 ~~SR 3.8.4.4~~ ~~SR 3.8.4.5~~ ~~SR 3.8.4.6~~ ~~SR 3.8.4.7~~ ~~SR 3.8.4.8~~.	In accordance with applicable SRs

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3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Cell Parameters

INSERT IEEE-450 REVIEWERS NOTE

LCO 3.8.6 Battery cell parameters for the [station service and DG] batteries shall be within the limits of Table 3.8.6-1.

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

ACTIONS

NOTE
Separate Condition entry is allowed for each battery.

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

INSERT 3.8.6 ACTIONS

(continued)

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B~~. E Required Action and associated Completion Time of Condition A not met. OR One or more batteries with average electrolyte temperature of the representative cells not within limits. OR One or more batteries with one or more battery cell parameters not within Category C values.	~~B~~.1 E Declare associated battery inoperable.	Immediately

B, C, or D

float current >[10] amps

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)

INSERT 3-8.6 SRs

MOVE SR 3.8.6.6 (from SR 3.8.4.8)

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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 24 hours after battery discharge < [110] V AND Once within 24 hours after battery overcharge > [150] V
SR 3.8.6.3	Verify average electrolyte temperature of representative cells is ≥ [65°F for each station service battery, and ≥ 55°F for each DG battery].	92 days

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Table 3.8.6-1 (page 1 of 1)
Battery Cell Parameter Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark(a)	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark(a)	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity(b)(c)	≥ [1.195]	≥ [1.195] AND Average of all connected cells > [1.205]	Not more than 0.020 below 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 level during equalizing charges provided it is not overflowing.

(b) Corrected for electrolyte temperature and level. Level correction is not required, however, when on float charge battery charging current is < [1 amp for station service batteries and < 0.5 amp for DG batteries].

(c) A battery charging current of < [1 amp for station service batteries and < 0.5 amp for DG batteries] when on float charge is acceptable for meeting specific gravity limits following a battery recharge, for a maximum of [7] days. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to expiration of the [7] day allowance.

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources—Operating

BASES

BACKGROUND

The 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. Also, these DC subsystems provide DC electrical power to inverters, which in turn power the AC vital buses. 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 station service DC power sources provide both motive and control power to selected safety related equipment, as well as circuit breaker control power for the nonsafety related 4160 V, and all 600 V and lower, AC distribution systems. Each DC subsystem is energized by one 125/250 V station service battery and three 125 V battery chargers (two normally inservice chargers and one spare charger). Each battery is exclusively associated with a single 125/250 VDC bus. Each set of battery chargers exclusively associated with a 125/250 VDC subsystem cannot be interconnected with any other 125/250 VDC subsystem. The normal and backup chargers are supplied from the same AC load groups for which the associated DC subsystem supplies the control power. The loads between the redundant 125/250 VDC subsystem are not transferable except for the Automatic Depressurization System, the logic circuits and valves of which are normally fed from the Division 1 DC system.

The diesel generator (DG) DC power sources provide control and instrumentation power for their respective DG. In addition, DG 2A and 2C DC power sources provide circuit breaker control power for the loads on the 4160 V 2E, 2F, and 2G emergency buses. Each DG DC subsystem is energized by one 125 V battery and one 125 V battery charger. Provisions exist for connecting a portable alternate battery charger.

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system.

(continued)

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BASES

BACKGROUND (continued)

In case of loss of normal power to the battery charger, the DC loads are automatically powered from the station batteries.

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

INSERT BATTERY CAPACITY

Each battery has adequate storage capacity to carry the required load continuously for approximately 2 hours (Ref. 3).

Each DC battery subsystem is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, battery chargers, or distribution panels.

INSERT Vdc BASES

The batteries for DC electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 105/210 V.

Each battery charger of DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each station service battery charger has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads (Ref. 3).

INSERT CHARGER

4

APPLICABLE SAFETY ANALYSES

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

(continued)

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BASES

APPLICABLE SAFETY ANALYSES (continued)

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

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

b. A worst case single failure.

The DC sources satisfy Criterion 3 of the NRC Policy Statement.

LCO

The DC electrical power subsystems—with: 1) each station service DC subsystem consisting of two 125 V batteries in series two battery chargers and the corresponding control equipment and interconnecting cabling supplying power to the associated bus, and 2) each DG DC subsystem consisting of one battery bank, one battery charger, and the corresponding control equipment and interconnecting cabling are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 3).

APPLICABILITY

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

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

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

The DC electrical power requirements for MODES 4 and 5 are addressed in the Bases for LCO 3.8.5, "DC Sources—Shutdown."

(continued)

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BASES (continued)

ACTIONS

C A.1

INSERT 3.8.4 ACTION BASES

Condition A represents one division with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected division. The 2 hour limit is consistent with the allowed time for an inoperable DC Distribution System division.

for reasons other than Condition A or B

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger(s), or inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, 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. 6) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

7

D

D B.1 and B.2

inoperable

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

7

(continued)

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BASES

ACTIONS (continued)

E.1

If the DG DC electrical power subsystem cannot be restored to OPERABLE status in the associated Completion Time, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable. This declaration also requires entry into applicable Conditions and Required Actions for an inoperable DG, LCO 3.8.1, "AC Sources—Operating."

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

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

battery chargers, which support the ability of the batteries to perform their intended function

INSERT B SR 3.8.4.1

SR 3.8.4.2

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

The connection resistance limits established for this SR must be no more than 20% above the resistance as measured during installation or not above the ceiling value established by the manufacturer.

The Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is considered

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.2 (continued)

acceptable based on operating experience related to detecting corrosion trends.

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

[The 12 month Frequency for this SR is consistent with IEEE-450 (Ref. 7), which recommends detailed visual inspection of cell condition and rack integrity on a yearly basis.]

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of inter-cell, inter-rack, inter-tier, and terminal connections provides an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anti-corrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection.

The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR, provided visible corrosion is removed during performance of this Surveillance.

Reviewer's Note: The requirement to verify that terminal connections are clean and tight applies only to nickel cadmium batteries as per IEEE Standard P1106, "IEEE Recommended Practice for Installation, Maintenance, Testing and Replacement of Vented Nickel - Cadmium Batteries for Stationary Applications." This requirement may be removed for lead acid batteries.

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.4 and SR 3.8.4.5 (continued)

The connection resistance limits for this SR must be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.

[The 12 month Frequency of these SRs is consistent with IEEE-450 (Ref. 7), which recommends detailed visual inspection of cell condition and inspection of cell to cell and terminal connection resistance on a yearly basis.]

SR 3.8.4.6 2 This SR verifies

battery

Battery charger capability requirements are based on the design capacity of the chargers (Ref. 3). According to Regulatory Guide 1.32 (Ref. 8), the battery charger supply is required to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

9 recommended

INSERT B SR 3.8.4.2

The Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these [18 month] intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This SR is modified by two Notes. The reason for Note 1 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy the Surveillance.

(continued)

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.X (3)

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

The Frequency of [18 months] (10) is consistent with (9) the recommendations of Regulatory Guide 1.32 (Ref. ~~8~~) and Regulatory Guide 1.129 (Ref. ~~9~~), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between 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 ~~once per 60 months~~.

It may

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

for instance

must

MOVE & INSERT on next page

SWAP ORDER

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

The reason for Note 2 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.X (continued)

challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance.

SR 3.8.4.8

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

~~A battery modified performance discharge test is described in the Bases for SR 3.8.4.7.~~ Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.3 at the same time.

MOVE from previous page

The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. X) and IEEE-485 (Ref. ~~10~~). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

INSERT B SR 3.8.6.6

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

MOVE TO SR 3.8.6.6 BASES

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.8 (6.6) (continued)

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance.

MOVE TO SR 3.8.6.6

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6.
3. IEEE Standard 308, 1978.
4. FSAR, Chapter [8].
5. ~~4.~~ FSAR, Chapter [6].
6. ~~5.~~ FSAR, Chapter [15].
7. ~~6.~~ Regulatory Guide 1.93.
8. ~~7.~~ IEEE Standard 450-1995
9. ~~8.~~ Regulatory Guide 1.32, February 1977.
10. ~~9.~~ Regulatory Guide 1.129, December 1974.

~~10. IEEE Standard 485, 1983.~~ MOVE TO 3.8.6

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources—Shutdown

BASES

BACKGROUND

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

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident and transient analyses in the FSAR, Chapter [6] (Ref. 1) and Chapter [15] (Ref. 2), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators (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 4 and 5 and during movement of irradiated fuel assemblies ensures that:

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

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

c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel handling accident.

The DC sources satisfy Criterion 3 of the NRC Policy Statement.

LCO

The DC electrical power subsystems—with: 1) each station service DC subsystem consisting of two 125 V batteries in series, two battery chargers, and the corresponding control

(continued)

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BASES

LCO (continued)

equipment and interconnecting cabling; and 2) each DG DC subsystem consisting of one battery bank, one battery charger, and the corresponding control equipment and interconnecting cabling—are required to be OPERABLE to support required DC distribution subsystems required OPERABLE by LCO 3.8.10, "Distribution Systems—Shutdown." This requirement ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents and inadvertent reactor vessel draindown).

APPLICABILITY

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

a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core in case of an inadvertent draindown of the reactor vessel;

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

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

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

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

ACTIONS

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

INSERT 3.8.5 ACTION BASES

If more than one DC distribution subsystem is required according to LCO 3.8.10, the DC subsystems remaining OPERABLE with one or more DC power sources inoperable may be

(continued)

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BASES

ACTIONS

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

capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. By allowance of the option to declare required features inoperable with associated DC power sources inoperable, appropriate restrictions are implemented in accordance with the affected system LCOs' 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 any activities that could result in inadvertent draining of the reactor vessel).

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

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all (3) Surveillances required by SR 3.8.4.1 through SR 3.8.4.(3). Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged below their capability to provide the required power supply or otherwise rendered inoperable during the performance of SRs. It is the intent that these SRs must

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1 (continued)

still be capable of being met, but actual performance is not required.

REFERENCES

1. FSAR, Chapter [6].
2. FSAR, Chapter [15].

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

BACKGROUND

INSERT 3.8.6 BACKGROUND BASES

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

battery float current as well as

APPLICABLE SAFETY ANALYSES

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

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

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

b. A worst case single failure.

Since battery cell parameters support the operation of the DC electrical power subsystems, they satisfy Criterion 3 of the NRC Policy Statement.

LCO

Battery parameter

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

INSERT 3.8.6 LCO BASES

(continued)

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BASES (continued)

APPLICABILITY

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

Parameter limits are

ACTIONS

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

INSERT 3.8.6 ACTION BASES

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

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

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

(continued)

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BASES

ACTIONS

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

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

E.1

allowances of the Required Actions for Condition A, B, C, or D

When any battery parameter is outside the Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not ensured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, ~~such as not completing~~ the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F, also are cause for immediately declaring the associated DC electrical power subsystem inoperable.

battery

INSERT 3.8.6 E.1 BASES

SURVEILLANCE REQUIREMENTS

INSERT 3.8.6 SR BASES

SR 3.8.6.1

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

SR 3.8.6.2

MOVE SR 3.8.6.6 from SR 3.8.4.8

The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 3). In addition, within 24 hours of a battery discharge < [110] V or a battery overcharge > [150] V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to ≤ [110] V, do not constitute a battery discharge provided the battery terminal voltage and float current

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.2 (continued)

return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.

SR 3.8.6.3

This Surveillance verification that the average temperature of representative cells is within limits is consistent with a recommendation of IEEE-450 (Ref. 3) that states that the temperature of electrolytes in representative cells should be determined on a quarterly basis.

Lower than normal temperatures act to inhibit or reduce battery capacity. This SR ensures that the operating temperatures remain within an acceptable operating range. This limit is based on manufacturer's recommendations.

Table 3.8.6-1

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

Category A defines the normal parameter limit for each designed pilot cell in each battery. The cells selected as pilot cells are those whose temperature, voltage, and electrolyte specific gravity approximate the state of charge of the entire battery.

The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra ¼ inch allowance above the high water level indication for operating margin to account for temperature and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 3) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

The Category A limit specified for float voltage is ≥ 2.13 V per cell. This value is based on the recommendation of IEEE-450 (Ref. 3), which states that prolonged operation of cells below 2.13 V can reduce the life expectancy of cells. The Category A limit specified for specific gravity for each pilot cell is ≥ [1.200] (0.015 below the manufacturer's fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation. Level correction will be in accordance with manufacturer's recommendations.

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

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ 1.195 (0.020 below the manufacturer's fully charged, nominal specific gravity) with the average of all connected cells [1.205] (0.010 below the manufacturer's fully charged, nominal specific gravity). These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell do not mask overall degradation of the battery.

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

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

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

The Category C limit on average specific gravity [$\geq$ 1.195], is based on manufacturer's recommendations (0.020 below the manufacturer's recommended fully charged, nominal specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell does not mask overall degradation of the battery.

The footnotes to Table 3.8.6-1 that apply to specific gravity are applicable to Category A, B, and C specific gravity. Footnote (b) of Table 3.8.6-1 requires the above mentioned correction for electrolyte level and temperature, with the exception that level correction is not required when battery charging current, while on float charge, is < 1 amp for station service batteries and < 0.5 amp for DG batteries. This current provides, in general, an indication of overall battery condition.

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge of the designated pilot cell. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote (c) to Table 3.8.6-1

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

allows the float charge current to be used as an alternate to specific gravity for up to 7 days following a battery recharge. Within [7] days, each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements may be made in less than [7] days.

[Reviewer's Note: The value of [2] amps used in footnote (b) and (c) is the nominal value for float current established by the battery vendor as representing a fully charged battery with an allowance for overall battery condition.]

REFERENCES

1. FSAR, Chapter [6].
2. FSAR, Chapter [15].
3. IEEE Standard 450, ~~1987.~~ 1995
4. IEEE Standard 485, 1983.

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3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources—Operating

LCO 3.8.4 The [Division 1], [Division 2], and [Division 3] DC electrical power subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

INSERT 3.8.4 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A.~~ C. [Division 1 or 2] DC electrical power subsystem inoperable for reasons other than Condition A or B	~~A.1~~ C.1 Restore [Division 1 and 2] DC electrical power subsystems to OPERABLE status.	2 hours
~~B.~~ D. [Division 3] DC electrical power subsystem inoperable for reasons other than Condition A or B	~~B.1~~ D.1 Declare High Pressure Core Spray System [and 2C Standby Service Water System] inoperable.	Immediately
~~C.~~ E. Required Action and associated Completion Time not met.	E ~~C.1~~ E.1 Be in MODE 3.	12 hours
	AND	
	~~C.2~~ E.2 Be in MODE 4.	36 hours

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ~~≥ [129] V on float charge~~ greater than or equal to the minimum established float voltage	7 days
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance [is ≤ [1.5 E-4 ohm] for inter-cell connections, ≤ [1.5 E-4 ohm] for inter-rack connections, ≤ [1.5 E-4 ohm] for inter-tier connections, and ≤ [1.5 E-4 ohm] for terminal connections].	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration.	[12] months
SR 3.8.4.4	Remove visible corrosion and verify battery cell to cell and terminal connections are [clean and tight, and] coated with anti-corrosion material.	[12] months
SR 3.8.4.5	Verify battery connection resistance [is ≤ [1.5 E-4 ohm] for inter-cell connections, ≤ [1.5 E-4 ohm] for inter-rack connections, ≤ [1.5 E-4 ohm] for inter-tier connections, and ≤ [1.5 E-4 ohm] for terminal connections].	[12] months

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.4.6 (2) ~~NOTE~~ This ~~Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR.~~	
Verify each [required] battery charger supplies ≥ [400] amps at ~~≥ [250/125] V~~ the minimum established float voltage for ≥ [8] hours.	[18 months]
SR 3.8.4.7 (3) NOTES (6.6) 1. The modified performance discharge test in SR 3.8.4.~~8~~ may be performed in lieu of ~~the service test in~~ SR 3.8.4.~~6~~ (3) ~~once per 60 months~~. 2. This Surveillance shall not be performed in MODE 1, 2, or 3. However, 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.	[18 months]

INSERT CHARGER SR

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.8.~~4.8~~ 6.6 NOTE: This Surveillance shall not be performed in MODE 1, 2, or 3. However, 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 or a modified performance discharge test.	60 months AND 12 months when battery shows degradation or has reached [85]% of expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached [85]% of the expected life with capacity ≥ 100% of manufacturer's rating

MOVE TO 3.8.6 as SR 3.8.6.6

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3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources—Shutdown

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

APPLICABILITY: MODES 4 and 5,
During movement of irradiated fuel assemblies in the [primary or secondary] containment.

INSERT 3.8.5 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A.~~ B One or more required DC electrical power subsystems inoperable [for reasons other than Condition A. OR Required Actions and associated Completion Time of Condition A not met.]	~~A~~.1 B Declare affected required feature(s) inoperable.	Immediately
	OR	
	~~A~~.2.1 B Suspend CORE ALTERATIONS.	Immediately
	AND	
	~~A~~.2.2 B Suspend movement of irradiated fuel assemblies in the [primary or secondary] containment.	Immediately
	AND	
	~~A~~.2.3 B Initiate action to suspend operations with a potential for draining the reactor vessel.	Immediately
	AND	

(continued)

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ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued) B	A.2.4 B Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	----------NOTE---------- The following SRs are not required to be performed: SR 3.8.4.6, SR 3.8.4.7, ~~and SR 3.8.4.8~~. (2) (and) (3) ----------	
	For DC sources required to be OPERABLE the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.2 SR 3.8.4.3 ~~SR 3.8.4.4~~ ~~SR 3.8.4.7~~ ~~SR 3.8.4.5~~ ~~SR 3.8.4.8~~. ~~SR 3.8.4.6~~	In accordance with applicable SRs

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3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Cell Parameters

INSERT IEEE-450 REVIEWERS NOTE

LCO 3.8.6 Battery cell parameters for the [Division 1, 2, and 3] batteries shall be within the limits of Table 3.8.6-1.

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

ACTIONS

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

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

INSERT 3.8.6 ACTIONS

(continued)

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E ~~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.	E ~~B.1~~ Declare associated battery inoperable.	Immediately

, B, C, or D

float current > [10] amps

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)

INSERT 3.8.6 SRs

MOVE SR 3.8.6.6 (from SR 3.8.4.8)

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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 24 hours after battery discharge < [110] V AND Once within 24 hours after battery overcharge > [150] V
SR 3.8.6.3	Verify average electrolyte temperature of representative cells is ≥ [60]°F.	92 days

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Table 3.8.6-1 (page 1 of 1)
Battery Cell Parameter Requirements

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

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

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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. 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 requirements of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The 125 VDC electrical power system consists of three independent Class 1E DC electrical power subsystems, Divisions 1, 2, and 3. Each subsystem consists of a battery, associated battery charger(s), and all the associated control equipment and interconnecting cabling.

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC loads are automatically powered from the Engineered Safety Feature (ESF) batteries.

Each of the Division 1 and 2 electrical power subsystems provides the control power for its associated Class 1E AC power load group, 4.16 kV switchgear, and 480 V load centers. Also, these DC subsystems provide DC electrical power to the inverters, which in turn power the AC vital buses. The Division 3 DC electrical power subsystem provides DC motive and control power as required for the High Pressure Core Spray (HPCS) System diesel generator (DG) set control and protection.

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

INSERT BATTERY CAPACITY →

Each Division 1 and 2 battery has adequate storage capacity to carry the required load continuously for at least 4 hours and to perform three complete cycles of intermittent loads as discussed in the ESAR, Section [8.3.2] (Ref. 4).

(continued)

MOVE Next page

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BASES

BACKGROUND (continued)

The Division 3 battery has adequate storage to carry the required load continuously for at least 2 hours (Ref. 4).

Each DC battery subsystem is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, battery chargers, or distribution panels.

The batteries for a DC electrical power subsystem are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The voltage design limit is 1.75 V per cell (Ref. 4).

Each battery charger of Division 1 and 2 DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger has sufficient capacity to restore the battery bank from the design minimum charge to its fully charged state within 12 hours while supplying normal steady state loads (Ref. 4).

The battery charger of Division 3 DC electrical power subsystem has sufficient capacity to restore the battery bank from the design minimum charge to its fully charged state in 8 hours while supplying normal steady state loads (Ref. 4).

APPLICABLE SAFETY ANALYSES

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

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

(continued)

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BASES

APPLICABLE SAFETY ANALYSES (continued)

maintaining DC sources OPERABLE during accident conditions in the event of:

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

APPLICABILITY

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

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

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

The DC electrical power requirements for MODES 4 and 5 are addressed in the Bases for LCO 3.8.5, "DC Sources—Shutdown."

(continued)

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BASES (continued)

ACTIONS

INSERT 3.8.4 ACTION BASES

C
~~A.1~~

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

for reasons other than Condition A or B

If one of the required [Division 1 or 2] DC electrical power subsystems is inoperable (e.g., ~~inoperable battery, inoperable battery charger, or~~ inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 7) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

D
~~B.1~~

With the Division 3 DC electrical power subsystem inoperable, the HPCS and 2C Standby Service Water System may be incapable of performing their intended functions and must be immediately declared inoperable. This declaration also requires entry into applicable Conditions and Required Actions of LCO 3.5.1, "ECCS—Operating," [and LCO 3.7.1, "Standby Service Water (SSW)] System and [Ultimate Heat Sink (UHS)"]].

E E
~~C.1 and C.2~~

If the DC electrical power subsystem cannot be restored to OPERABLE status within the associated Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to

(continued)

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BASES

ACTIONS E.1 and E.2 (continued)

at least MODE 3 within 12 hours and to MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 4 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

SURVEILLANCE REQUIREMENTS

battery chargers, which support the ability of the batteries to perform their intended function

INSERT B SR 3.8.4.1

SR 3.8.4.1

Verifying battery terminal voltage while on float charge helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or battery cell) in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer's recommendations and IEEE-450 (Ref. 8).

SR 3.8.4.2

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

The limits established for this SR must be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.

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

(continued)

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

[The 12 month Frequency of this SR is consistent with IEEE-450 (Ref. 8), which recommends detailed visual inspection of cell condition and inspection of cell to cell and terminal connection resistance on a yearly basis.]

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of inter-cell, inter-rack, inter-tier, and terminal connections provides an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anti-corrosion material is used to ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection.

The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR, provided visible corrosion is removed during performance of this Surveillance.

Reviewer's Note: The requirement to verify that terminal connections are clean and tight applies only to nickel cadmium batteries as per IEEE Standard P1106, "IEEE Recommended Practice for Installation, Maintenance, Testing and Replacement of Vented Nickel - Cadmium Batteries for Stationary Applications." This requirement may be removed for lead acid batteries.

The connection resistance limits for this SR must be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.

[The 12 month Frequency of these SRs is consistent with IEEE-450 (Ref. 8), which recommends detailed visual inspection of cell condition and inspection of cell to cell and terminal connection resistance on a yearly basis.]

(continued)

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.2

This SR verifies

Battery charger capability requirements are based on the design capacity of the chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 9), the battery charger supply is required to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensure that these requirements can be satisfied.

battery

recommended

INSERT B SR 3.8.4.2

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 18 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance.

SR 3.8.4.3

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

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 9) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between 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 once per 60 months.

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (3) (continued)

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

It may

SWAP ORDER

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

MOVE & INSERT ON NEXT PAGE

The reason for Note 2 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance.

SR 3.8.~~4.8~~ 6.6

MOVE TO SR 3.8.6.6 BASES

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

~~A battery modified performance discharge test is described in the Bases for SR 3.8.4.7.~~ Either the battery performance discharge test or the modified performance discharge test is

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.~~4.8~~ 6.6 (continued)

acceptable for satisfying SR 3.8.~~4.8~~ 6.6; however, only the modified performance discharge test may be used to satisfy ~~SR 3.8.4.8 while satisfying~~ the requirements of SR 3.8.4 ~~at the same time~~.

INSERT FROM PREVIOUS PAGE

The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. ~~8~~) and IEEE-485 (Ref. ~~9~~). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

INSERT B SR 3.8.6.6

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. ~~8~~), 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. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. ~~8~~).

MOVE TO SR 3.8.6.6

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE Standard 308, 1978.
4. FSAR, ~~Section [8.3.2]~~ Chapter [8].

(continued)

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BASES

REFERENCES (continued)

5. FSAR, Chapter [6].

6. FSAR, Chapter [15].

7. Regulatory Guide 1.93, December 1974.

8. IEEE Standard 450, 1987.

9. Regulatory Guide 1.32, February 1977.

10. Regulatory Guide 1.129, December 1974.

11. IEEE Standard 485.

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources—Shutdown

BASES

BACKGROUND

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

APPLICABLE SAFETY ANALYSES

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

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

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

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

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

c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel handling accident.

The DC sources satisfy Criterion 3 of the NRC Policy Statement.

LCO

The DC electrical power subsystems, each consisting of [two] battery banks, [one or two] battery charger[s], and

(continued)

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BASES

LCO (continued)

the corresponding control equipment and interconnecting cabling within the division, are required to be OPERABLE to support required divisions of Distribution System divisions required OPERABLE by LCO 3.8.10, "Distribution Systems—Shutdown." This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents and inadvertent reactor vessel draindown).

APPLICABILITY

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

a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core in case of an inadvertent draindown of the reactor vessel;

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

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

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

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

ACTIONS

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

If more than one DC distribution subsystem is required according to LCO 3.8.10, the DC subsystems remaining OPERABLE with one or more DC power sources inoperable may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel.

INSERT 3.8.5 ACTION BASES

(continued)

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BASES

ACTIONS

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

By allowing the option to declare required features inoperable with associated DC power source(s) inoperable, appropriate restrictions are implemented in accordance with the affected system LCOs' 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 any activities that could result in inadvertent draining of the reactor vessel).

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

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

3
SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.8. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

(continued)

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BASES (continued)

REFERENCES

1. FSAR, Chapter [6].
2. FSAR, Chapter [15].

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery cell Parameters

BASES

BACKGROUND

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

battery float current as well as

INSERT 3.8.6 BACKGROUND BASES

APPLICABLE SAFETY ANALYSES

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

Since battery cell parameters support the operation of the DC power sources, they satisfy Criterion 3 of the NRC Policy Statement.

LCO

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

Battery parameter

INSERT 3.8.6 LCO BASES

(continued)

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BASES (continued)

APPLICABILITY

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

ACTIONS

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

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

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

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

INSERT 3.8.6 ACTION BASES

(continued)

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BASES

ACTIONS

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

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

E

B.1

When any battery parameter is outside the Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F, also are cause for immediately declaring the associated DC electrical power subsystem inoperable.

battery

INSERT 3.8.6 E.1 BASES

SURVEILLANCE REQUIREMENTS

INSERT 3.8.6 SR BASES

SR 3.8.6.1

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

MOVE SR 3.8.6.6 from SR 3.8.4.8

SR 3.8.6.2

The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 3). In addition, within 24 hours of a battery discharge < [110] V or a battery overcharge > [150] V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to ≤ [110] V, do not constitute a battery discharge provided the battery terminal voltage and float current

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.2 (continued)

return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.

SR 3.8.6.3

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

Lower than normal temperatures act to inhibit or reduce battery capacity. This SR ensures that the operating temperatures remain within an acceptable operating range. This limit is based on manufacturer's recommendations.

Table 3.8.6-1

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

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

The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra ¼ inch allowance above the high water level indication for operating margin to account for temperatures and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 3) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

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

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

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation. Level correction will be in accordance with manufacturer's recommendations.

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

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

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

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

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

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

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

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote (c) to Table 3.8.6-1 allows the float charge

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

current to be used as an alternate to specific gravity for up to 7 days following a battery recharge. Within [7] days each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements may be made in less than [7] days.

[Reviewer's Note: The value of [2] amps used in footnote (b) and (c) is the nominal value for float current established by the battery vendor as representing a fully charged battery with an allowance for overall battery condition.]

REFERENCES

1. FSAR, Chapter [6].
2. FSAR, Chapter [15].
3. IEEE Standard 450, ~~1987~~ 1995
4. IEEE Standard 485, 1983