Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

October 17, 2005
NOC-AE-05001913
File No.: G25
10CFR50.90

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Response to Request for Additional Information:
Proposed Amendment to Technical Specification 3/4.8.2 to Modify Requirements
Related to Batteries and DC Systems (TAC Nos. MC5720 and MC5721)

Reference: License Amendment Request, T. J. Jordan to NRC Document Control Desk, "Proposed Amendment to Technical Specification 3/4.8.2 to Modify Requirements Related to Batteries and DC Systems," dated January 20, 2005 (NOC-AE-05001837)

Pursuant to 10CFR50.90, the STP Nuclear Operating Company requested an amendment to Technical Specification 3/4.8.2 to modify requirements related to batteries and DC systems at the South Texas Project. The proposed changes and the supporting safety analysis are described in the referenced correspondence. Attached are responses to questions raised by the Nuclear Regulatory Commission staff reviewers. Revisions made to the changes proposed by the referenced correspondence are identified and annotated. A formal update to the amendment request will be provided at a later date.

A list of commitments is attached.

If there are any further questions, please contact either Mr. Philip L. Walker at 361-972-8392 or me at 361-972-7902.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 17, 2005

T. J. Jordan
Vice President, Engineering

PLW

Attachments:
1) Response to NRC Request for Additional Information Regarding Batteries and DC Systems
2) Battery Load Profiles and Battery Sizing Calculations
3) Proposed Technical Specification Changes
4) Proposed Technical Specification Basis Changes
5) List of Commitments

STI: 31906375

A001

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ATTACHMENT 1

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
REGARDING BATTERIES AND DC SYSTEMS

SOUTH TEXAS PROJECT
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING BATTERIES AND DC SYSTEMS

1) The proposed wording in SRs 4.8.2.1(c) and 4.8.2.2(b) is not consistent with the STP final safety analysis report (FSAR). The STP FSAR states the following:

> The battery charger configurations, as stated above, are sized to recharge the battery to where charging current has stabilized at the charging voltage within 12 hours after the battery being discharged for the batteries' 2-hour duty cycle.

Describe how the proposed 24-hour alternate battery charger testing criteria would verify the design capabilities of the STP battery chargers.

Response: Surveillance requirements 4.8.2.1(c) and 4.8.2.2(b) will comply with the 12-hour criterion for recharging consistent with the STP UFSAR. The Technical Specification amendment request will be revised accordingly.

2) Define the minimum float voltage used with the battery charging acceptance criteria of 2 Amps.

Response: Technical Specification actions 3.8.2.1.b.2, 3.8.2.2.b.2, and 3.8.2.3.b refer to the float current requirement for battery charging. The minimum float voltage allowed per cell is 2.17 vdc. This gives a minimum battery float voltage of 128 vdc for a 59-cell string. STP has sufficient battery capacity to operate with one or more cells, depending on the battery's specific design margin, jumpered out of the string. In these alternate configurations, the minimum float voltage would be the number of cells multiplied by 2.17 vdc. The minimum float voltage per cell will be included in the Bases as background information for 3/4.8.2, "DC Sources."

3) STP has elected to maintain the capability to perform a Performance Discharge test in lieu of a Service Discharge test (SR 4.8.2.3 Action f part 1). However, using the results of a Performance Discharge Test in lieu of Service Discharge test data does not provide assurance that the battery will be capable of meeting the STP duty cycle requirements. Because of this, the staff believes that STP should replace the allowance to perform a Performance Discharge test with the Modified Performance Discharge test provided that the Modified Performance Discharge test envelopes both the Performance Discharge test and the Service Discharge test.

Response: The modified performance discharge test envelopes both the performance discharge test and the service discharge test. Although STP terminology refers to it as a "performance discharge test", STP uses the modified performance discharge test in place of performance discharge tests and service discharge tests. References to the performance discharge test as a substitute for the service discharge test will be revised to specify it as the modified performance discharge test. The sequence has been reordered.

4) As stated in IEEE-450, it is permissible to perform a modified performance test if the test's discharge rate envelopes the duty cycle of the service test. Provide the calculation that shows that the modified performance test envelopes South Texas Project's duty cycle of the service test.

Response: The load profile for the station is shown in UFSAR table 8.3-6. The margins are determined from the battery load profiles and battery sizing calculations shown in attachment 2.

The battery manufacturer's data table gives a one-minute rate of 127.5 amps per positive plate for an NCN-17 battery (1020 amps/8 positive plates) to 1.78 vdc and a one-minute rate of 117 amps for an NCN-27 battery (1521 amps/13 positive plates) to 1.78 vdc. The calculation assumes parameters of 116.5 and 98.75 amps per cell, respectively, which are more conservative than those given in the data table. Therefore, the differences do not invalidate the calculation.

The E1B11 calculation used a final cell voltage of 1.81 vdc which reduced the one-minute rate to 98.75 amps. This voltage value used should have been 1.78 vdc, consistent with the other battery calculations. The calculations are to be updated accordingly.

5) Item 2 of new SR 4.8.2.3 Action f allows an 18-month testing frequency if a battery shows signs of degradation or reaches 85% of the service life expected for the application. This frequency is not consistent with the Institute of Electrical and Electronic Engineers (IEEE) Standard 450 testing frequency of every 12 months. The 18-month battery performance testing interval leaves a 6-month uncertainty regarding the battery operability. A degraded battery, if utilized beyond one year, is believed to have a high probability of DC system failure. The increased Performance Discharge testing frequency of every 12 months is based on an accelerated rate of capacity loss with a battery that shows degradation or has reached 85% of the expected life with capacity less than 100% of manufacturer's rating. Failure of the DC system during or following operational occurrences or accidents has significant safety and risk implications. Provide a technical justification as to how the aforementioned testing frequency satisfies the testing frequency detailed in IEEE Standard 450.

In addition to the above, IEEE Standard 450 recommends performing a performance discharge test at least once per 24 months for any battery that has reached 85% of the expected life with capacity greater than or equal to 100% of manufacturer's rating. Provide the technical justification for not performing performance discharge testing on a battery that meets the aforementioned criteria.

Response: Until sufficient justification for an 18-month interval is available, surveillance requirement 4.8.2.3.f.2 will be revised to require performance tests every 12 months of batteries that show degradation or that reach 85% of the service life for the application. Surveillance requirement 4.8.2.3.f.2 also required tests when 85% of the service life had been reached regardless of the capacity relative to the manufacturer's rating. A surveillance requirement will be added to require performance discharge tests at least once per 24 months for any battery reaching 85% of the service life expected for the application and capacity is equal to or greater than 100% of the manufacturer's rating.

The sequence of the surveillance requirements under 4.8.2.3.f has been reordered.

6) With regards to the proposed addition of TS 6.8.3(o):

a) Is the phrase "below the top of the plates" equivalent or conservative with respect to "minimum established design limits"? Describe.

Response: The phrase "below the top of the plates" refers to a level below the manufacturer's minimum established design limits. The electrolyte level is maintained between the manufacturer's established minimum and maximum fluid levels.

STP uses the minimum established design limit for minimum acceptable electrolyte level. This level is above the top of the plates and therefore does not challenge plate or cell integrity. The proposed Technical Specification amendment will require equalization of charge and battery cell testing should the electrolyte level drop below the top of the plates.

b) Identify the IEEE Standard 450 revision that the Battery Monitoring and Maintenance Program will be modeled after.

Response: IEEE 450-1995 is the model for the Battery Monitoring and Maintenance Program.

7) With regards to TS 3.8.2.1, ACTION b, define the actions that will be taken upon loss of the battery charger to limit battery capacity loss during the two hours allowed to establish the minimum float voltage.

Response: The South Texas Project design includes standby chargers to support continued battery capability. Loss of both chargers would be a rare event, and would most likely be caused by loss of the associated 4.16 kV bus. In this event, the sequencer could be turned off, and the TMI inverters unloaded. Loads required for support of plant shutdown would be left on the bus. These actions are covered by procedure for responding to annunciator lampbox indications of battery function parameters.

8) Given a loss of battery charger supply event, identify any additional loads beyond the steady-state DC loads the battery may experience during the 2-hour discharge period, such as the addition of inverters or uninterruptible power supplies. Identify the anticipated loss in battery capacity and the expected time to recharge the battery upon re-application of a battery charger.

Response: The most likely cause of a loss of all battery charging at the South Texas Project is a 4.16 kV bus failure. Under these conditions, the DC electric loading is the same as that experienced from a design-basis loss of offsite power with the exception of diesel generator field flash and control power.

Emergency procedures require that the battery breaker be opened before the battery reaches the minimum voltage required to start the associated diesel generator (107.5 vdc). Once the battery has reached this point, restoration to the fully charged state of 130 vdc will take less than 12 hours.

In the event a battery is fully discharged, the battery chargers are sized to recharge the battery to a charging current that is stabilized at the charging voltage within 12 hours to accommodate the battery's 2-hour duty cycle. The batteries are floated at 2.22 VPC (131 +1/-2 vdc), and equalized at 2.31 ±1% VPC (137.5 vdc maximum).

9) With regards to SRs 4.8.2.1(a) and 4.8.2.1(c), define the minimum established float voltage. The staff expects minimum established float voltage to be no less than the battery manufacturer's minimum recommended float voltage multiplied by the number of connected cells.

Response: The minimum cell float voltage allowed is 2.17 vdc/cell which results in an overall minimum float voltage of 128 vdc for a 59-cell string. STP has sufficient capacity in the existing batteries to operate with one or more cells jumpered out of the string. In these alternate configurations, the minimum float voltage would be the number of cells multiplied by 2.17 vdc. This value will be included in the Bases as background information for 3/4.8.2, "DC Sources."

10) Provide the battery load profile and the battery sizing calculation that demonstrate the amount of total margin above the IEEE-485 sizing requirements.

Response: The load profile for the station is shown in UFSAR table 8.3-6. The margins are determined from the battery load profiles and battery sizing calculations shown in attachment 2.

Design margin shown in the STP Class 1E battery table is set at 0% when designing for the required battery capacity. Available design margin is the true indication of the amount of excess battery power available. These margins are addressed in the sizing calculations as is the method used to calculate the available design margin.

11) Identify the alarm and monitoring, including setpoints or acceptance criteria, available to the control room to identify a degrading battery charger including, but not limited to:

a) Low DC voltage alarms on the battery charger,

b) Low DC voltage alarms on the DC bus, and

c) Operator shift rounds of the DC battery charger.

Response: The alarms and monitoring available in the control room are described in section 8.3.2.1.1 of the UFSAR.

Each DC System is provided with an annunciator window having inputs from each of the two chargers and the switchboard. The Emergency Response Facilities (ERF) computer may be used to identify which of the three inputs is being alarmed. ERF computer calculations are used to inhibit nuisance and/or duplicate alarms.

Each battery charger is provided with the following alarm circuits connected in common to the control room annunciator/ERF computer to indicate battery charger trouble:

1. Output under- and over-voltage (DC)
2. DC ground

Each 125 vdc switchboard has the following alarm circuits which are connected in common to the control room annunciator/ERF computer:

1. Input breaker position from battery charger (alarm when tripped)
2. Input breaker position from battery (alarm when tripped)
3. Output breaker positions of selected loads (alarm when tripped)
4. DC bus ground and over/under-voltage (combined)

In addition to these annunciator alarms, the ESF Status Monitoring System is used to indicate bypassed or inoperable status of the battery or battery chargers. Component level windows provided for the DC system indicate the following conditions:

1. Input under-voltage, charger output breaker open position, or charger input to switchboard breaker open position for each battery charger. (ERF computer is used to indicate which condition caused the window to light.) Since only one charger is required, a single window for both chargers is provided. This window is lit when both output breakers are open or when an inservice charger (indicated by closed output breakers) has an input under-voltage condition.
2. Battery output breaker open position.

Indicating instrumentation for each DC system is provided in the control room:

- Switchboard bus voltage
- Battery current
- Battery charger current from each charger

Setpoints for alarm activation are as follows:

- Charger Over Voltage 140 $\pm$ 1%
- Charger Under Voltage 117 $\pm$ 1%
- Switchboard Under Voltage 124 $\pm$ 2%
- Switchboard Over Voltage 140 $\pm$ 1%

Actuation of any component-level window also actuates the system level window for that system and affected systems.

Breaker alignments, voltages, and currents are monitored once per week in accordance with the surveillance test procedure for ESF Power Availability. Operator rounds are performed once per shift with two shifts per day. There is no collection of data. The acceptance criterion for battery voltage is 129.2 to 131.8 vdc. The chargers use potentiometers that are adjusted by the operators to maintain voltage within the desired range. These values are also used in the weekly battery surveillance and the weekly verification of electrical system alignment surveillance.

These alarms provide indication in the control room that the charger has failed. They are not intended to inform the operator when charger voltage drifts below the 128 vdc design limit. Use of different setpoints ensures the operators are notified when a charger failure occurs. The charger alarm at 117 vdc notifies the operator when the charger has failed. The bus voltage alarm provides a backup to this alarm.

STP does not use a conventional charger failure alarm based on low charger output current. Notification of charger failure is provided by the low-voltage alarms.

12) Regarding your request to extend the battery charger AOT (LCO 3.8.2.2 ACTION b) to 7-days. The proposed TS Bases for this ACTION states the following:

> ACTION b.1 requires that the terminal voltage of the affected batteries be restored to greater than or equal to the minimum established float voltage within 2 hours. The 2-hour limit provides for returning the required charger(s) to OPERABLE status or providing an alternate means of restoring the associated battery terminal voltage to greater than or equal to the minimum established float voltage.

Please describe 'alternate means' (e.g., spare non-Class 1E battery charger). Additionally, the staff needs to be assured that this 'alternate means' for restoring the associated battery terminal voltage to greater than or equal to the minimum established float voltage is supported by a diesel generator. Furthermore, the 'alternate means' will need to be addressed in the STP UFSAR since it would be credited for the 7-day AOT allowance.

The staff's concern relates to a loss of offsite power event. Without an 'alternate means' that is diesel backed, the affected train's battery capacity could drain to the point where the battery may not have sufficient remaining capacity to operate the supply breakers to restore power to the 4160 V safety related buses.

Response: A spare non-Class 1E battery charger may be provided in the future to serve as an alternate means of restoring the associated battery terminal voltage if the affected batteries have less than the minimum established float voltage and they are to be considered operable after two hours. The spare non-Class 1E battery charger will be diesel-backed. This provision will be included in the STP Technical Specification Bases. If this modification is made, it will be included in the STP UFSAR.

ATTACHMENT 2

BATTERY LOAD PROFILES AND BATTERY SIZING CALCULATIONS

(RESPONSE TO RAI #10)

SUMMARY OF THE MARGINS USED IN SIZING THE STP CLASS 1E BATTERIES

Unit	Battery	Temperature Margin	Aging Margin	Design Margin	Available Design Margin
Unit 1	E1A11	8% for 65° F	25%	0%	29.61%
	E1B11	8% for 65° F	25%	0%	45.19%
	E1C11	8% for 65° F	25%	0%	36.70%
	E1D11	8% for 65° F	25%	0%	102.02%
Unit 2	E2A11	8% for 65° F	25%	0%	39.94%
	E2B11	8% for 65° F	25%	0%	66.32%
	E2C11	8% for 65° F	25%	0%	48.40%
	E2D11	8% for 65° F	25%	0%	145.4%

Notes:

1. The sizing shown is for a 2-hour design basis event.
2. The differences between the Unit 1 and Unit 2 Available Design Margins result from installation of 10KVA inverters in Unit 1. The sizing assumes each inverter is fully loaded.
3. The Available Design Margin is based on using a design margin multiplier of 1.0 in the sizing calculation.

UNIT 1 BATTERY SIZING (EC05008 REVISION 13)

Battery Sizing Results

Generation Date: 01/31/2005 07:36 am

Battery: E1A1

Scenario ID	Description	Required Plates	Actual Plates	Margin	Comments
DBA1	DESIGN BASIS ACIDENT FOR STP WHICH IS A 2 HOUR EVENT	10.03	13	29.61%	

Battery Data:

Minimum Electrolyte Temperature (degF):	65
Cell Manufacturer:	GNB
Cell Type:	NCN-27
Battery Float Voltage:	131.5
Battery Nominal Voltage:	125
Battery Minimum Volts per Cell:	1.779661016949153
Number of Cells:	59
1 minute Rating (ADC):	68.43
Design Margin:	1
Aging Factor:	1.25

Cell Sizing Worksheet

Generation Date: 01/31/2005 07:36 am

Battery: E1A1

Lowest Expected Electrolyte Temp: 65 F | Minimum Cell Voltage: 1.78 VPC | Cell Mfg: GNB | Cell Type: NCN-27 | Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity At T Min Rate Amps/Pos (RT)	(7) Required Section Size Positive Plates (3)/(6)
Section 1 - First 1 Periods Only - If A2 is greater than A1, go to Section A2.						
1	A1 = 431.35	A1 - A0 = 431.35	M1 = 1	T = M1 +...+ M1 = 1	116.15	3.71
					Sec 1 Total:	3.71
Section 3 - First 3 Periods Only - If A4 is greater than A3, go to Section A4.						
1	A1 = 431.35	A1 - A0 = 431.35	M1 = 1	T = M1 +...+ M3 = 120	48.63	8.87
2	A2 = 329.59	A2 - A1 = -101.76	M2 = 118	T = M2 +...+ M3 = 119	48.84	-2.08
3	A3 = 404.48	A3 - A2 = 74.89	M3 = 1	T = M3 +...+ M3 = 1	116.15	0.64
					Sec 3 Total:	7.43

Maximum Section Size (8) 7.44 + Random Section Size (9) 0.00 = Uncorrected Size - (US) (10) 7.44
US (11) 7.44 x Temp. Corr. (12) 1.080 x Design Margin (13) 1.00 x Aging Factor (14) 1.25 = (15) 10.04
When the cell size (15) is greater than the standard cell size, the next larger cell is required.
Required cell size (16) 11 Positive Plates. Therefore cell (17) ____________ is required.

Battery Sizing Results

Generation Date: 01/31/2005 07:37 am

Battery: E1D11

Scenario ID	Description	Required Plates	Actual Plates	Margin	Comments
DBA1	DESIGN BASIS ACIDENT FOR STP WHICH IS A 2 HOUR EVENT	3.96	8	102.02%	

Battery Data:

Minimum Electrolyte Temperature (degF):	65
Cell Manufacturer:	GNB
Cell Type:	NCN-17
Battery Float Voltage:	131.5
Battery Nominal Voltage:	125
Battery Minimum Volts per Cell:	1.779661016949153
Number of Cells:	59
1 minute Rating (ADC):	68.43
Design Margin:	1
Aging Factor:	1.25

Cell Sizing Worksheet

Generation Date: 01/31/2005 07:37 am

Battery: E1D11

Lowest Expected Electrolyte Temp: 65 F | Minimum Cell Voltage: 1.78 VPC | Cell Mfg: GNB | Cell Type: NCN-17 | Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity At T Min Rate Amps/Pos (RT)	(7) Required Section Size Positive Plates (3)/(6)
Section 1 - First 1 Periods Only - If A2 is greater than A1, go to Section A2.						
1	A1 = 249.86	A1 - A0 = 249.86	M1 = 1	T = M1 +...+ M1 = 1	116.15	2.15
					Sec 1 Total:	2.15
Section 2 - First 2 Periods Only - If A3 is greater than A2, go to Section A3.						
1	A1 = 249.86	A1 - A0 = 249.86	M1 = 1	T = M1 +...+ M2 = 119	48.84	5.12
2	A2 = 142.79	A2 - A1 = -107.07	M2 = 118	T = M2 +...+ M2 = 118	49.06	-2.18
					Sec 2 Total:	2.94
Section 3 - First 3 Periods Only - If A4 is greater than A3, go to Section A4.						
1	A1 = 249.86	A1 - A0 = 249.86	M1 = 1	T = M1 +...+ M3 = 120	48.63	5.14
2	A2 = 142.79	A2 - A1 = -107.07	M2 = 118	T = M2 +...+ M3 = 119	48.84	-2.19
3	A3 = 111.79	A3 - A2 = -31	M3 = 1	T = M3 +...+ M3 = 1	116.15	-0.27
					Sec 3 Total:	2.68

Maximum Section Size (8) 2.94 + Random Section Size (9) 0.00 = Uncorrected Size - (US) (10) 2.94
US (11) 2.94 x Temp. Corr. (12) 1.080 x Design Margin (13) 1.00 x Aging Factor (14) 1.25 = (15) 3.96
When the cell size (15) is greater than the standard cell size, the next larger cell is required.
Required cell size (16) 4 Positive Plates. Therefore cell (17) ____________ is required.

Battery Sizing Results

Generation Date: 01/31/2005 07:36 am

Battery: E1B11

Scenario ID	Description	Required Plates	Actual Plates	Margin	Comments
DBA1	DESIGN BASIS ACIDENT FOR STP WHICH IS A 2 HOUR EVENT	5.51	8	45.19%	

Battery Data:

Minimum Electrolyte Temperature (degF):	65
Cell Manufacturer:	GNB
Cell Type:	NCN-17
Battery Float Voltage:	131.5
Battery Nominal Voltage:	125
Battery Minimum Volts per Cell:	1.779661016949153
Number of Cells:	59
1 minute Rating (ADC):	68.43
Design Margin:	1
Aging Factor:	1.25

Cell Sizing Worksheet

Generation Date: 01/31/2005 07:36 am

Battery: E1B11

Lowest Expected Electrolyte Temp: 65 F | Minimum Cell Voltage: 1.78 VPC | Cell Mfg: GNB | Cell Type: NCN-17 | Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity At T Min Rate Amps/Pos (RT)	(7) Required Section Size Positive Plates (3)/(6)
Section 1 - First 1 Periods Only - If A2 is greater than A1, go to Section A2.						
1	A1 = 265.98	A1 - A0 = 265.98	M1 = 1	T = M1 +...+ M1 = 1	116.15	2.29
					Sec 1 Total:	2.29
Section 3 - First 3 Periods Only - If A4 is greater than A3, go to Section A4.						
1	A1 = 265.98	A1 - A0 = 265.98	M1 = 1	T = M1 +...+ M3 = 120	48.63	5.47
2	A2 = 167.02	A2 - A1 = -98.96	M2 = 118	T = M2 +...+ M3 = 119	48.84	-2.03
3	A3 = 241.25	A3 - A2 = 74.24	M3 = 1	T = M3 +...+ M3 = 1	116.15	0.64
					Sec 3 Total:	4.08

Maximum Section Size (8) 4.09 + Random Section Size (9) 0.00 = Uncorrected Size - (US) (10) 4.09
US (11) 4.09 x Temp. Corr. (12) 1.080 x Design Margin (13) 1.00 x Aging Factor (14) 1.25 = (15) 5.52
When the cell size (16) is greater than the standard cell size, the next larger cell is required.
Required cell size (16) 6 Positive Plates. Therefore cell (17) __________ is required.

Battery Sizing Results

Generation Date: 01/31/2005 07:37 am

Battery: E1C11

Scenario ID	Description	Required Plates	Actual Plates	Margin	Comments
DBA1	DESIGN BASIS ACIDENT FOR STP WHICH IS A 2 HOUR EVENT	9.51	13	36.70%	

Battery Data:

Minimum Electrolyte Temperature (degF):	65
Cell Manufacturer:	GNB
Cell Type:	NCN-27
Battery Float Voltage:	131.5
Battery Nominal Voltage:	125
Battery Minimum Volts per Cell:	1.779661016949153
Number of Cells:	59
1 minute Rating (ADC):	68.43
Design Margin:	1
Aging Factor:	1.25

Cell Sizing Worksheet

Generation Date: 01/30/2005 07:34 pm

Battery: E1B11

Lowest Expected Electrolyte Temp: 65 F | Minimum Cell Voltage: 1.81 VPC | Cell Mfg: GNB | Cell Type: NCN-17 | Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity At T Min Rate Amps/Pos (RT)	(7) Required Section Size Positive Plates (3)/(6)
Section 1 - First 1 Periods Only - If A2 is greater than A1, go to Section A2.						
1	A1 = 265.38	A1 - A0 = 265.38	M1 = 1	T = M1 +...+ M1 = 1	98.75	2.69
					Sec 1 Total:	2.69
Section 3 - First 3 Periods Only - If A4 is greater than A3, go to Section A4.						
1	A1 = 265.38	A1 - A0 = 265.38	M1 = 1	T = M1 +...+ M3 = 120	46.16	5.75
2	A2 = 168.09	A2 - A1 = -97.29	M2 = 118	T = M2 +...+ M3 = 119	46.35	-2.10
3	A3 = 241.11	A3 - A2 = 73.03	M3 = 1	T = M3 +...+ M3 = 1	98.75	0.74
					Sec 3 Total:	4.39

Maximum Section Size (8) 4.39 + Random Section Size (9) 0.00 = Uncorrected Size - (US) (10) 4.39
US (11) 4.39 x Temp. Corr. (12) 1.080 x Design Margin (13) 1.00 x Aging Factor (14) 1.25 = (15) 5.93
When the cell size (15) is greater than the standard cell size, the next larger cell is required.
Required cell size (16) 6 Positive Plates. Therefore cell (17) ____________ is required.

UNIT 2 BATTERY SIZING (ECO5008 REVISION 12)

Battery Sizing Results

Generation Date: 01/28/2005 06:22 pm

Battery: E1A1

Scenario ID	Description	Required Plates	Actual Plates	Margin	Comments
DBA1	DESIGN BASIS ACIDENT FOR STP WHICH IS A 2 HOUR EVENT	9.29	13	39.94%	

Battery Data:

Minimum Electrolyte Temperature (degF):	65
Cell Manufacturer:	GNB
Cell Type:	NCN-27
Battery Float Voltage:	131.5
Battery Nominal Voltage:	125
Battery Minimum Volts per Cell:	1.779661016949153
Number of Cells:	59
1 minute Rating (ADC):	68.43
Design Margin:	1
Aging Factor:	1.25

Cell Sizing Worksheet

Generation Date. 01/28/2005 06 22 pm

Battery: E1A1

Lowest Expected Electrolyte Temp: 65 F   Minimum Cell Voltage: 1.75 VPC   Cell Mfg: GNB   Cell Type: NCN-27   Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity At T Min Rate Amps/Pos (RT)	(7) Required Section Size Positive Plates (3)/(6)
Section 1 - First 1 Periods Only - If A2 is greater than A1, go to Section A2.						
1	A1 = 405.92	A1 - A0 = 405.92	M1 = 1	T = M1 + ... + M1 = 1	116.15	3.49
					Sec 1 Total	3.49
Section 3 - First 3 Periods Only - If A4 is greater than A3 go to Section A4.						
1	A1 = 405.92	A1 - A0 = 405.92	M1 = 1	T = M1 + ... + M3 = 120	48.63	8.35
2	A2 = 302.81	A2 - A1 = -103.11	M2 = 118	T = M2 + ... + M3 = 119	48.84	-2.11
3	A3 = 378.06	A3 - A2 = 75.25	M3 = 1	T = M3 + ... + M3 = 1	116.15	0.65
					Sec 3 Total	6.89

Maximum Section Size (8) 6.89 + Random Section Size (9) 0.00 = Uncorrected Size - (US) (10) 6.89
US (11) 6.89 x Temp. Corr. (12) 1.080 x Design Margin (13) 1.00 x Aging Factor (14) 1.25 = (15) 9.30
When the cell size (15) is greater than the standard cell size, the next larger cell is required.
Required cell size (16) 10 Positive Plates. Therefore cell (17) NCN-21 is required

Battery Sizing Results

Generation Date: 01/28/2005 06:23 pm

Battery: E1D11

Scenario ID	Description	Required Plates	Actual Plates	Margin	C
DBA1	DESIGN BASIS ACIDENT FOR STP WHICH IS A 2 HOUR EVENT	3.26	8	145.40%	

Battery Data:

Minimum Electrolyte Temperature (degF)	65
Cell Manufacturer	GNB
Cell Type:	NCN-17
Battery Float Voltage:	131.5
Battery Nominal Voltage:	125
Battery Minimum Volts per Cell:	1.779661016949153
Number of Cells:	59
1 minute Rating (ADC)	68.43
Design Margin.	1
Aging Factor:	1.25

Cell Sizing Worksheet

Generation Date. 01/28/2005 06:23 pm

Battery. E1D11

Lowest Expected Electrolyte Temp: 65 F Minimum Cell Voltage: 1.78 VPC Cell Mfg. GNB Cell Type: NCN-17 Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity At T Min Rate Amps/Pos (RT)	(7) Required Section Size Positive Plates (3)/(6)
Section 1 - First 1 Periods Only - If A2 is greater than A1, go to Section A2.						
1	A1 = 224.99	A1 - A0 = 224.99	M1 = 1	T = M1 + ... + M1 = 1	116.15	1.94
					Sec 1 Total	1.94
Section 2 - First 2 Periods Only - If A3 is greater than A2, go to Section A3.						
1	A1 = 224.99	A1 - A0 = 224.99	M1 = 1	T = M1 + ... + M2 = 119	48.84	4.61
2	A2 = 117.64	A2 - A1 = -107.35	M2 = 118	T = M2 + ... + M2 = 118	49.06	-2.19
					Sec 2 Total	2.42
Section 3 - First 3 Periods Only - If A4 is greater than A3, go to Section A4						
1	A1 = 224.99	A1 - A0 = 224.99	M1 = 1	T = M1 + ... + M3 = 120	48.63	4.63
2	A2 = 117.64	A2 - A1 = -107.35	M2 = 118	T = M2 + ... + M3 = 119	48.84	-2.20
3	A3 = 86.71	A3 - A2 = -30.93	M3 = 1	T = M3 + ... + M3 = 1	116.15	-0.27
					Sec 3 Total	2.16

Maximum Section Size (8) 2.42 + Random Section Size (9) 0.00 = Uncorrected Size - (US) (10) 2.42
US (11) 2.42 x Temp. Corr. (12) 1.080 x Design Margin (13) 1.00 x Aging Factor (14) 1.25 = (15) 3.27
When the cell size (15) is greater than the standard cell size, the next larger cell is required
Required cell size (16) 4 Positive Plates. Therefore cell (17) ___NCN-9___ is required

Battery Sizing Results

Generation Date: 01/28/2005 05:22 pm

Battery: E1B11

Scenario ID	Description	Required Plates	Actual Plates	Margin	Comments
DBA1	DESIGN BASIS ACIDENT FOR STP WHICH IS A 2 HOUR EVENT	4.81	8	66.32%	

Battery Data:

Minimum Electrolyte Temperature (degF):	65
Cell Manufacturer:	GNB
Cell Type:	NCN-17
Battery Float Voltage:	131.5
Battery Nominal Voltage:	125
Battery Minimum Volts per Cell	1.779661016949153
Number of Cells:	59
1 minute Rating (ADC):	68.43
Design Margin	1
Aging Factor:	1.25

Cell Sizing Worksheet

Generation Date: 01/28/2005 05:22 pm

Battery: E1B11

Lowest Expected Electrolyte Temp: 65 F **Minimum Cell Voltage:** 1.78 VPC **Cell Mfg.** GNB **Cell Type** NCN-17 **Sized By:**

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity At T Min Rate Amps/Pos (RT)	(7) Required Section Size Positive Plates (3)/(6)
Section 1 - First 1 Periods Only - If A2 is greater than A1, go to Section A2.						
1	A1 = 241.13	A1 - A0 = 241.13	M1 = 1	T = M1 +...+ M1 = 1	116.15	2.08
					Sec 1 Total:	2.08
Section 3 - First 3 Periods Only - If A4 is greater than A3, go to Section A4.						
1	A1 = 241.13	A1 - A0 = 241.13	M1 = 1	T = M1 +...+ M3 = 120	45.63	4.56
2	A2 = 141.71	A2 - A1 = -99.42	M2 = 118	T = M2 +...+ M3 = 119	45.84	-2.04
3	A3 = 215.16	A3 - A2 = 74.45	M3 = 1	T = M3 +...+ M3 = 1	116.15	0.64
					Sec 3 Total:	3.56

Maximum Section Size (8) 3.57 + Random Section Size (9) 0.00 = Uncorrected Size - (US) (10) 3.57
US (11) 3.57 x Temp. Corr. (12) 1.080 x Design Margin (13) 1.00 x Aging Factor (14) 1.25 = (15) 4.82
When the cell size (15) is greater than the standard cell size, the next larger cell is required
Required cell size (16) 5 Positive Plates. Therefore cell (17) NCN-11 is required.

NOTE: The difference of 0.01 positive plate between the Section 3 total (13.56) and the maximum section size (13.57) is due to rounding of the incorporated values.

Battery Sizing Results

Generation Date: 01/28/2005 06:23 pm

Battery: E1C11

Scenario ID	Description	Required Plates	Actual Plates	Margin	Comments
DBA1	DESIGN BASIS ACIDENT FOR STP WHICH IS A 2 HOUR EVENT	8.76	13	48.40%	

Battery Data:

Minimum Electrolyte Temperature (degF)	65
Cell Manufacturer:	GNB
Cell Type:	NCN-27
Battery Float Voltage:	131.5
Battery Nominal Voltage:	125
Battery Minimum Volts per Cell.	1.779661016949153
Number of Cells:	59
1 minute Rating (ADC):	28.43
Design Margin:	1
Aging Factor	1.25

Cell Sizing Worksheet

Generation Date: 01/28/2005 06 23 pm

Battery: E1C11

Lowest Expected Electrolyte Temp: 66 F — Minimum Cell Voltage: 1.78 VPC — Cell Mfg: GNB — Cell Type: NCN-27 — Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity At T Min Rate Amps/Pos (RT)	(7) Required Section Size Positive Plates (3)/(6)
Section 1 - First 1 Periods Only - If A2 is greater than A1, go to Section A2						
1	A1 = 377.56	A1 - A0 = 377.56	M1 = 1	T = M1 +...+ M1 = 1	116.15	3.25
					Sec 1 Total	3.25
Section 3 - First 3 Periods Only - If A4 is greater than A3, go to Section A4						
1	A1 = 377.56	A1 - A0 = 377.56	M1 = 1	T = M1 +...+ M3 = 120	45.93	7.76
2	A2 = 293.52	A2 - A1 = -84.03	M2 = 118	T = M2 +...+ M3 = 119	45.84	-1.93
3	A3 = 369.42	A3 - A2 = 75.9	M3 = 1	T = M3 +...+ M3 = 1	116.15	0.85
					Sec 3 Total	6.48

Maximum Section Size (8) 6.50 + Random Section Size (9) 0.00 = Uncorrected Size - (US) (10) 6.50
US (11) 6.50 x Temp. Corr. (12) 1.080 x Design Margin (13) 1.00 x Aging Factor (14) 1.25 = (15) 8.77
When the cell size (15) is greater than the standard cell size, the next larger cell is required.
Required cell size (16) 9 Positive Plates. Therefore cell (17) NCN-19 is required.

NOTE: The difference of 0.02 positive plate between the Section 3 total (6.48) and the maximum section size (6.50) is due to rounding of the incorporated values.

ATTACHMENT 3

PROPOSED TECHNICAL SPECIFICATION CHANGES

3/4.8.2 DC SOURCES

OPERATING

LIMITING CONDITION FOR OPERATION

3.8.2.1 As a minimum, the following DC electrical sources shall be OPERABLE:

a. Channel I 125-volt Battery Bank E1A11 (Unit 1), E2A11 (Unit 2) and one of its two associated chargers,

b. Channel II 125-volt Battery Bank E1D11 (Unit 1), E2D11 (Unit 2) and one of its two associated full capacity chargers,

c. Channel III 125-volt Battery Bank E1B11 (Unit 1), E2B11 (Unit 2) and one of its two associated full capacity chargers, and

d. Channel IV 125-volt Battery Bank E1C11 (Unit 1), E2C11 (Unit 2) and one of its two associated chargers.

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

ACTION:

a. With one of the required battery banks inoperable, restore the inoperable battery bank to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. With no battery chargers for a channel OPERABLE, ~~restore at least one battery charger to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.~~

1. Restore battery terminal voltage to greater than or equal to the minimum established float voltage within 2 hours, AND

2. Verify float current for the affected battery does not exceed 2 amps once per 12 hours, AND

3. Restore one battery charger to OPERABLE status within 7 days.

If the battery terminal voltage cannot be restored in the allowed time, or a battery charger is not restored to operability in the time allowed, the affected reactor unit is to be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

c. With one of the required channels inoperable for reasons other than (a) or (b) above, restore the channel to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

~~SURVEILLANCE REQUIREMENTS~~

4.8.2.1 Each 125-volt battery bank and charger shall be demonstrated OPERABLE:

a. At least once per 7 days by verifying that:

~~1) The parameters in Table 4.8-2 meet the Category A limits, and~~

~~2)~~ The total battery terminal voltage is greater than or equal to ~~129 volts on float charge~~ the minimum established float voltage.

~~b.~~ Not used. ~~At least once per 92 days and within 7 days after a battery discharge with battery terminal voltage below 110 volts, or battery overcharge with battery terminal voltage above 135 volts, by verifying that:~~

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~~1) The parameters in Table 4.8-2 meet the Category B limits,~~

~~2) There is no visible corrosion at either cell-to-cell or terminal connections, or the connection resistance of these items is less than or equal to 150 X 10^{-6} ohm, and~~

~~3) The average electrolyte temperature of six connected cells is above 65° F.~~

~~c.~~ b. At least once per 18 months by verifying that:

Updated listing

~~1) The cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration,~~

~~2) The cell-to-cell and terminal connections are clean, tight, and coated with anticorrosion material,~~

~~3) The resistance of each cell-to-cell and terminal connection is less than or equal to 150 x 10^{-6} ohm, and~~

~~4)~~ The battery charger ~~will~~ can supply at least 300 amperes at greater than or equal to the minimum established float voltage ~~125 volts~~ for at least 8 hours.

OR

Each battery charger can recharge the battery to the fully charged state within 12 hours while supplying the largest combined demands of the various continuous steady-state loads following a battery discharge to the bounding design-basis event discharge state.

Revised per RAI #1.

Item deleted for format change

~~d.~~ Not used. ~~At least once per 18 months, during shutdown, by verifying that the battery capacity is adequate to supply and maintain in OPERABLE status all of the actual or simulated ESF loads for the design duty cycle when the battery is subjected to a battery service test;~~

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~~e.~~ Not used. ~~At least once per 60 months, during shutdown, by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test. Once per 60-month interval this performance discharge test may be performed in lieu of the battery service test required by Specification 4.8.2.1d.; and~~

~~f.~~ Not used. ~~At least once per 18 months, during shutdown, by giving performance discharge tests of battery capacity to any battery that shows signs of degradation or has reached 85% of the service life expected for the application. Degradation is indicated when the battery capacity drops more than 10% of rated capacity from its average on previous performance tests, or is below 90% of the manufacturer's rating.~~

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TABLE 4.8-2

BATTERY SURVEILLANCE REQUIREMENTS

	CATEGORY A[1]	CATEGORY B[2]	
PARAMETER	LIMITS FOR EACH DESIGNATED PILOT CELL	LIMITS FOR EACH CONNECTED CELL	ALLOWABLE[3] VALUE FOR EACH CONNECTED CELL
Electrolyte Level	>Minimum level indication mark, and <1/4" above maximum level indication mark	>Minimum level indication mark, and <1.4" above maximum level indication mark	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 volts	≥ 2.13 volts [6]	≥ 2.07 volts
Specific Gravity [4]	≥ 1.200 [5]	≥ 1.195	Not more than 0.020 below the average of all connected cells
		Average of all connected cells > 1.205	Average of all connected cells ≥ 1.195[5])

TABLE NOTATIONS

(1) For any Category A parameter(s) outside the limit(s) shown, the battery may be considered OPERABLE provided that within 24 hours all Category B measurements are taken and found to be within their allowable values, and provided all Category A and B parameter(s) are restored to within limits within the next 6 days.

(2) For any Category B parameters outside the limit(s) shown, the battery may be considered OPERABLE provided that the Category B parameter(s) are within their allowable values and provided that Category B parameters(s) are restored to within limits within 7 days.

(3) Any Category B parameter not within its allowable value indicates an inoperable battery.

(4) Corrected for electrolyte temperature and level.

(5) Or battery charging current is less than 2 amps when on charge.

(6) Corrected for average electrolyte temperature.

ELECTRICAL POWER SYSTEMS

DC SOURCES

SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.8.2.2 DC electrical power subsystem shall be OPERABLE to support the DC electrical power distribution subsystem(s) required by LCO 3.8.3.2, "Onsite Power Distribution – Shutdown."

APPLICABILITY: MODES 5 and 6

ACTION:

a. With one or more required DC electrical power subsystems inoperable:

1. Immediately declare affected required feature(s) inoperable OR

2. Immediately:

- Initiate action to suspend operation with a potential for draining the reactor vessel, AND

- Suspend all operations involving CORE ALTERATIONS, operations involving positive reactivity additions that could result in loss of required SHUTDOWN MARGIN or required boron concentration, or movement of irradiated fuel, AND

- Initiate corrective action to restore the required DC electrical power subsystems to OPERABLE status as soon as possible.

b. With no battery chargers for a required channel OPERABLE:

1. Restore battery terminal voltage to greater than or equal to the minimum established float voltage within 2 hours, AND

2. Verify float current for the affected battery does not exceed 2 amps once per 12 hours, AND

3. Restore one battery charger to OPERABLE status within 7 days.

If the battery terminal voltage cannot be restored within the allowed time, or a battery charger is not restored to operability in the time allowed:

- Initiate action to suspend operation with a potential for draining the reactor vessel, AND

LIMITING CONDITION FOR OPERATION (Continued)

- Suspend all operations involving CORE ALTERATIONS, operations involving positive reactivity additions that could result in loss of required SHUTDOWN MARGIN or required boron concentration, or movement of irradiated fuel, AND

- Initiate corrective action to restore the required DC electrical power subsystems to OPERABLE status as soon as possible.

SURVEILLANCE REQUIREMENTS

~~4.8.2.2 The required DC sources shall be demonstrated OPERABLE in accordance with Specification 4.8.2.1.~~

4.8.2.2 Each 125-volt battery bank shall be demonstrated OPERABLE:

a. At least once per 7 days by verifying that the total battery terminal voltage is greater than or equal to the minimum established float voltage.

b. At least once per 18 months by verifying that the battery charger can supply at least 300 amperes at greater than or equal to the minimum established float voltage for at least 8 hours.

Revised per RAI #1.

OR

Verify each battery charger can recharge the battery to the fully charged state within 12 hours while supplying the largest combined demands of the various continuous steady-state loads following a battery discharge to the bounding design-basis event discharge state.

c. NOTE: 1. The modified performance discharge test in SR 4.8.2.3.f may be performed in lieu of Surveillance Requirement 4.8.2.2.c.

2. This surveillance shall only be performed during shutdown. Credit may be taken for unplanned events that satisfy this surveillance requirement.

At least once per 18 months by verifying that the battery capacity is adequate to supply and maintain in OPERABLE status all of the actual or simulated ESF loads for the design duty cycle when the battery is subjected to a battery service test.

ELECTRICAL POWER SYSTEMS

BATTERY PARAMETERS

LIMITING CONDITION FOR OPERATION

3.8.2.3 Parameters for the Class 1E batteries shall be within the specified limits.

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

ACTION:

a. If a battery has one or more cells with float voltage <2.07 V:

1. Perform surveillance requirement 4.8.2.1.a within 2 hours, AND

2. Perform surveillance requirement 4.8.2.3.a within 2 hours, AND

3. Restore float voltage of the affected cell(s) to ≥2.07 volts within 24 hours.

If the required action and associated completion of the above conditions are not met, declare the associated battery INOPERABLE immediately.

b. If a battery has float current >2 amps:

1. Perform surveillance requirement 4.8.2.1.a within 2 hours, AND

2. Restore battery float current to ≤2 amps within 12 hours.

If the required action and associated completion of the above conditions are not met, declare the associated battery INOPERABLE immediately.

c. If a battery has one or more cells with electrolyte level less than minimum established design limits:

1. Restore electrolyte level in the affected cell(s) to above the top of the plates within 8 hours if electrolyte level is below the top of the plates, AND

2. Verify there is no evidence of electrolyte leakage within 12 hours if electrolyte level is below the top of the plates, AND

3. Restore electrolyte level in the affected cell(s) to greater than or equal to minimum established design limits within 31 days.

If the required action and associated completion of the above conditions are not met, declare the associated battery INOPERABLE immediately.

d. If a battery has a pilot cell electrolyte temperature less than minimum established design limits, restore battery pilot cell electrolyte temperature to greater than or equal to minimum established design limits within 12 hours.

If the required action and associated completion of the above conditions are not met, declare the associated battery INOPERABLE immediately.

e. If battery parameters are not within limits for 2 or more batteries:

1. Restore battery parameters to within design limits for at least all but one battery within 2 hours, AND

2. Restore the battery parameters of the remaining battery to within design limits within 31 days.

LIMITING CONDITION FOR OPERATION (Continued)

If the required action and associated completion of the above conditions are not met, declare the associated battery INOPERABLE immediately.

i. If a battery has one or more battery cells with float voltage < 2.07 volts and float current > 2 amps, declare the associated battery INOPERABLE immediately.

SURVEILLANCE REQUIREMENTS

4.8.2.3. Each 125-volt battery bank and charger shall be demonstrated operable:

a. [NOTE: Performance of this surveillance is not required when battery terminal voltage is less than the minimum established float voltage of surveillance requirement 4.8.2.1.a.2.]

At least once per 7 days, verify the float current for each battery is ≤2 amps.

b. At least once per 31 days, verify each battery pilot cell voltage is ≥2.07 V on float charge.

c. At least once per 92 days, verify each battery connected cell voltage is ≥2.07 V on float charge.

d. At least once per 31 days, verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.

e. At least once per 31 days, verify each battery pilot cell temperature is greater than or equal to minimum established design limits.

f. [NOTE: Battery capacity is to be verified during shutdown.]

Revised per RAI #5.

1) At least once per 12 months by giving modified performance discharge tests of battery capacity to any battery that shows degradation or reaches 85% of the service life expected for the application with capacity less than 100% of the manufacturer's rating. Degradation is indicated when battery capacity drops more than 10% from its capacity on the previous performance/modified performance discharge test, or is below 90% of the manufacturer's rating; AND

Revised per RAI #5.

2) At least once per 24 months by giving modified performance discharge tests of battery capacity to any battery reaching 85% of the service life with capacity greater than or equal to 100% if the manufacturer's rating.

Revised per RAI #3.

3) At least once per 60 months by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a modified performance discharge test. A modified performance discharge test may be performed in lieu of the battery service test required by Specification 4.8.2.2.c; AND

6.8.3.o (continued)

3. If crack indications are found in any SG tube, then the next inspection for each SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever is less). If definitive information, such as from examination of a pulled tube, diagnostic non-destructive testing, or engineering evaluation indicates that a crack-like indication is not associated with a crack(s), then the indication need not be treated as a crack.

e. Provisions for monitoring operational primary-to-secondary leakage.

p. Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance of the 125 V batteries based on the recommendations of IEEE-450, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," or of the manufacturer for the following:

1) Actions to restore battery cells with float voltage $\leq$ 2.13 V, AND

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

ATTACHMENT 4

PROPOSED TECHNICAL SPECIFICATION BASIS CHANGES

FOR INFORMATION ONLY

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

In general, when the unit is shutdown, the Technical Specification requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite power is not required. The rationale for this is based on the fact that many Design Basis Accidents (DBAs) that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6. Worst case bounding events are deemed not credible in MODES 5 and 6 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

During MODES 1, 2, 3, and 4, various deviations from the analysis assumptions and design requirements are allowed within the Required Actions. This allowance is in recognition that certain testing and maintenance activities must be conducted provided an acceptable level of risk is not exceeded. During MODES 5 and 6, performance of a significant number of required testing and maintenance activities is also required. In MODES 5 and 6, the activities are generally planned and administratively controlled. Relaxation from MODES 1, 2, 3, and 4 LCO requirements is acceptable during shutdown modes based on:

a. The fact that time in an outage is limited. This is a risk prudent goal as well as a utility economic consideration.

b. Requiring appropriate compensatory measures for certain conditions. These may include administrative controls, reliance on systems that do not necessarily meet typical design requirements applied to systems credited in operating MODE analyses, or both.

c. Prudent utility consideration of the risk associated with multiple activities that could affect multiple systems.

d. Maintaining, to the extent practical, the ability to perform required functions (even if not meeting MODE 1, 2, 3, and 4 OPERABILITY requirements) with systems assumed to function during an event.

In the event of an accident during shutdown, this LCO ensures the capability to support systems necessary to avoid immediate difficulty, assuming either a loss of all offsite power or a loss of all onsite diesel generator (DG) power.

3/4.8.2 DC SOURCES

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 conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The 125 vdc electrical power system consists of four independent and redundant safety-related Class 1E DC electrical power subsystems Trains A, B, C, and D. Each subsystem consists of one 125 vdc battery, the associated battery chargers, and the associated control equipment and interconnecting cabling.

There are two 100% capacity battery chargers per battery. One charger is kept in operation and the other is a backup. If the backup battery charger is applied, the requirements of independence and redundancy between subsystems are maintained.

During normal operation, the 125 vdc load is powered from the battery charger with the battery floating on the system. Following loss of normal power to the battery charger, the DC load is automatically powered from the station battery.

The Train A, B, C, and D electrical power subsystems provide the control power for the 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. The DC power distribution system is described in more detail in the Bases for LCO 3.8.3.1, "Onsite Power Distribution - Operating," and LCO 3.8.3.2, "Onsite Power Distribution - Shutdown."

Added per RAI #2

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 121.8 V for a 59-cell battery (i.e., cell voltage of 2.065 volts per cell). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 volts per cell, the battery cell will maintain its capacity for 30 days without further charging. The minimum float voltage required by the battery manufacturer is 2.17 volts per cell, which corresponds to 128 V for 59 cells at the battery terminals. Optimal long-term performance, however, is obtained by maintaining the float voltage between 2.17 and 2.25 volts per cell. This provides adequate over-potential which limits the formation of lead sulfate and self-discharge. The nominal float voltage of 2.23 volts per cell corresponds to a total float voltage output of 131.5 V for a 59-cell battery as discussed in UFSAR 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 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 IE subsystems, such as batteries, battery chargers, or distribution panels.

DC SOURCES (continued)

Each battery has adequate storage capacity to meet the assumed duty cycle for the bounding design basis event. Additional margin is available to support the ability of the battery to carry the DC loads continuously for approximately 4 hours as discussed in UFSAR Chapter 8 (Ref. 4) for station blackout.

The batteries for Trains A, B, C, and D 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 limits are approximately 106.8 V for Trains A, B, and C, and 108.6 V for Train D.

Each Train A, B, C, and D DC electrical power subsystem battery charger has sufficient power output capacity for the steady-state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 12 hours while supplying normal steady-state loads discussed in UFSAR Chapter 8 (Ref. 4).

This charging capacity exceeds the minimum requirements for the charger to support the required DC loads in analyzed accidents and 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 supplies the connected loads and the battery cells receive adequate current to maintain the battery in a fully charged condition. 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 after 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.

Industry test data also show that when charging at equalized voltage, and the charging current reduces to approximately 13% of the charger current limit setting (42.9 amps), 95% of the original battery capacity has been restored. With the designed margins in battery 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.

DC SOURCES (continued)

APPLICABLE SAFETY ANALYSES

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

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 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.

The DC sources satisfy Criterion 3 of 10CFR50.36(c)(2)(ii).

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308
4. UFSAR, Chapter 8
5. UFSAR, Chapter 6
6. UFSAR, Chapter 15
7. Regulatory Guide 1.93, December 1974
8. IEEE 450-2002
9. IEEE 485-1983
10. Regulatory Guide 1.32, February 1997

3/4.8.2.1 DC SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION

Each DC electrical power subsystem is required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (A00) or a postulated DBA. Each DC electrical power subsystem consists of one battery, two battery chargers, and the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the train. Loss of the DC electrical power subsystem of any train does not prevent the minimum safety function from being performed (Ref. 4).

An OPERABLE DC electrical power subsystem requires the battery and one associated charger to be operating and connected to the associated DC bus.

APPLICABILITY

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

DC SOURCES (Continued)

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

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

The DC electrical power requirements for MODES 5 and 6 are addressed in the BASES for LCO 3.8.2.2, "DC Sources—Shutdown."

ACTIONS

a. This action represents one Train with its associated battery inoperable. With the battery inoperable, the OPERABLE battery charger supplies the DC bus. Any event that results in loss of the AC bus supporting the battery charger will also result in loss of DC to that Train. Therefore, it is imperative that the operator focus attention 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, assumption of additional single failures is not required.

b. This action represents one Train with both battery chargers inoperable (e.g., the voltage limit of SR 4.8.2.1.a. is not maintained).

   Action b.1 requires that the terminal voltage of the affected batteries be restored to greater than or equal to the minimum established float voltage within 2 hours. The 2-hour limit provides for returning the required charger(s) to OPERABLE status or providing an alternate means of restoring the associated battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the terminal voltage of the affected batteries to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the affected battery will be restored to its fully charged condition from any discharge that might have occurred due to the charger inoperability.

   Added per RAI #12

   A spare non-Class 1E battery charger may be provided in the future to serve as an alternate means of restoring the associated battery terminal voltage if the affected batteries have less than the minimum established float voltage and they are to be considered operable after two hours. The spare non-Class 1E battery charger will be diesel-backed.

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

DC SOURCES (continued)

Required Action b.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 b.3 to restore a 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 Action a entered. A test (e.g., battery service test) to confirm the battery capacity is not required. 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 determined by previous testing may also be utilized in this evaluation.

Added for clarification

The charger operating in the current limit mode after 2 hours is an indication that the battery is partially discharged and its capacity margins have been reduced. The time to return the battery to its fully charged condition <u>in this case</u> is a function of the battery charger capacity, the amount of load on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is insufficient assurance that it can be recharged within 12 hours.

During the 12-hour Completion Time of Required Action b.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 hours), the expectation that at least some recharge is occurring (Required Action b.1 assures no further discharge is occurring), and that confirmation will be available within 12 hours of discovery of the inoperable battery charger.

Without adequate assurance that the battery can be recharged within 12 hours, the affected battery must also be declared inoperable and Action a initiated. This is consistent with the battery parameter requirements and actions of LCO 3.8.2.3.

Required Action b.3 limits the restoration time for the inoperable required battery charger to 7 days. This action is applicable if battery terminal voltage is restored to meet or exceed the minimum established float voltage by using an alternative method. The 7-day completion time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

c. This condition represents a train with a loss of ability to respond to an event, and a loss of ability to remain energized during normal operation. <u>An example would be failure of a battery breaker.</u> The operator must minimize 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.

Adds example of a condition

DC SOURCES (continued)

If one of the required DC electrical power subsystems is inoperable, the other DC electrical power subsystems have the capability to support a safe shutdown and to mitigate an accident condition. However, continued power operation should not exceed 2 hours. The 2-hour completion time is based on Regulatory Guide 1.93 and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem. If the DC electrical power subsystem is not restored to OPERABLE status, the time allowed is sufficient to prepare to effect an orderly and safe unit shutdown.

SURVEILLANCE REQUIREMENTS

SR 4.8.2.1.a

Verification of battery terminal voltage while on float charge helps to ensure the effectiveness of the battery chargers supporting the ability of the batteries to perform their intended function. Float charge is the condition in which the charger supplies the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state, while supplying the continuous steady-state loads of the associated DC subsystem. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum ~~float~~ voltage on float charge established by the battery manufacturer (2.17 volts per cell or 128 V at the battery ~~terminals~~ for a 59-cell battery). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). The 7-day cycle is conservative with respect to manufacturer recommendations and IEEE-450 (Ref. 8).

Added per RAI #9.

Corrected Value

Corrected Terminology

SR 4.8.2.1.b

This charging capacity exceeds the minimum requirements for the charger to support the required DC loads in analyzed accidents. The 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 300 amps at 128 volts (the minimum established float voltage) for 8 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time allowed is sufficient for the charger temperature to stabilize and be maintained for at least 2 hours.

Revised per RAI #2.

The second option requires that each battery charger be capable of recharging the battery within 12 hours following a service test coincident with supplying the largest combined demands of the various continuous steady-state loads (regardless of the status of the plant during which these demands occur). This load level may not normally be available following the service test and will need to be supplemented with additional loads. The duration of this test may be longer than the charger sizing criterion 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 less than or equal to 2 amps.

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

3/4.8.2.2 DC SOURCES – SHUTDOWN

LIMITING CONDITION FOR OPERATION

One DC electrical power subsystem consisting of one battery, at least one charger, and the corresponding control equipment and interconnecting cabling within the train are required to be OPERABLE to support one train of the distribution systems required to be OPERABLE by LCO 3.8.3.2, "Distribution Systems-Shutdown." This ensures 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.

APPLICABILITY

The DC electrical power sources required to be OPERABLE in MODES 5 and 6 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 needed to mitigate the effects of events that can lead to core damage during shutdown are available; and

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

ACTIONS

By allowing the option to declare required features inoperable with the associated DC power source inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCO ACTIONS. Allowance is made for sufficiently conservative actions. The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required shutdown margin is maintained.

Suspension of these activities does not preclude completion of actions to establish a safe, conservative condition. The actions minimize the probability of occurrence of postulated events.

Use of "immediately" for Completion Time is consistent with the required times for actions requiring prompt attention.

DC SOURCES (continued)

SURVEILLANCE REQUIREMENT

SR 4.8.2.2.a

Verification of battery terminal voltage while on float charge helps to ensure the effectiveness of the battery chargers supporting the ability of the batteries to perform their intended function. Float charge is the condition in which the charger supplies the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state, while supplying the continuous steady-state loads of the associated DC subsystem. 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 (2.17 volts per cell or 128 V at the battery terminals for a 59-cell battery). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). The 7 day cycle is conservative with respect to manufacturer recommendations and IEEE-450 (Ref. 8).

Added per RAI #9.

Corrected Value

Corrected Terminology

SR 4.8.2.2.b

This charging capacity exceeds the minimum requirements for the charger to support the required DC loads in analyzed accidents. The 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 300 amps at 128 volts for 8 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time allowed is sufficient for the charger temperature to stabilize and be maintained for at least 2 hours.

The second option requires that each battery charger be capable of recharging the battery within 12 hours following a service test coincident with supplying the largest combined demands of the various continuous steady-state loads (regardless of the status of the plant during which these demands occur). This load level may not normally be available following the service test and will need to be supplemented with additional loads. The duration of this test may be longer than the charger sizing criterion 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 less than or equal to 2 amps.

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

SR 4.8.2.2.c

This SR allows a modified performance discharge test to be used in lieu of a service test. Either the battery performance discharge test or the modified performance discharge test may be used to satisfy SR 4.8.2.3.f. However, only the modified performance discharge test may be used to satisfy the requirements of SR 4.8.2.2.c.

3/4.8.2.3 BATTERY PARAMETERS

LIMITING CONDITION FOR OPERATION

In order to ensure the ability of the batteries to perform their intended function, the batteries are normally maintained in a fully charged state and the environment in which the batteries are located is maintained within the parameters used to determine battery sizing and operation. Verifying average electrolyte temperature, total battery terminal voltage on float charge, connection resistance values, and the performance of battery service and discharge tests ensures the effectiveness of the charging system and the ability to handle high discharge rates, and compares the battery capacity with the rated capacity.

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

Additional preventive maintenance, testing, and monitoring performed in accordance with the Battery Monitoring and Maintenance Program is conducted without direct impact on the requirements of this Specification. Failure to meet any Battery Monitoring and Maintenance 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.

APPLICABILITY

The battery parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery parameter limits are only required when the DC power source is required to be OPERABLE. Refer to the Applicability discussion in Bases for LCO 3.8.2.1 and LCO 3.8.2.2.

ACTIONS

a. With float voltage in 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 4.8.2.1.a.1 and of the overall battery state of charge by monitoring the battery float charge current SR 4.8.2.1.a.2. 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.

DC SOURCES (continued)

Since the Required Actions only specify "perform," failure to satisfy SR 4.8.2.1.a or SR 4.8.2.3.a acceptance criteria does not result in this Required Action not being met. However, if one of the SRs is not met, the applicable ~~Condition~~ Action in the associated specification is entered.

Terminology Correction

Update from TSTF-360 comments

b. Float current greater than 2 amps in one or more batteries 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. ~~Should the battery float current exceed 10 amps, the battery is considered inoperable.~~ However, although float current may be greater than 2 amps ~~(but $\leq$ 10 amps)~~, the battery capacity remains sufficient to perform its intended safety function during the time allowed.

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.

If the affected battery float current is less than or equal to 2 amps, and the battery has been discharged as the result of the inoperable battery charger, this indicates that the battery is fully recharged. If, at the expiration of the initial 12-hour period, the battery float current is NOT less than or equal to 2 amps, unit shutdown is initiated. There may be additional battery problems, as well.

c. With one or more batteries with electrolyte level in one or more cells below the minimum established design limits, the battery 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, not meeting the specified electrolyte level does not by itself require the affected battery to be considered inoperable. Level is required to be restored to above the top of plates within 8 hours, and within 31 days the minimum established design limits for electrolyte level must be re-established.

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. 8).

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~~ Action A is entered.

Terminology Correction

DC SOURCES (continued)

d. This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit of 65°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. 8).

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. Because the battery is sized with margin, degraded battery capacity leaves sufficient capacity to perform the intended function and the affected battery is not required to be considered inoperable solely as a result of not meeting the required pilot cell temperature.

Terminology Correction

e. Where batteries in redundant ~~divisions~~ trains ~~are~~ found with batteries not within design limits, and one of the two associated chargers in each affected train is not operable, there is insufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function. The longer completion times are therefore not appropriate, and the parameters must be restored to within limits on at least one division within 2 hours.

f. If a battery is found with one or more battery cell float voltage less than 2.07 V, and float current is greater than 2 amps, the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared INOPERABLE immediately.

SURVEILLANCE REQUIREMENTS

The surveillance requirements are based on:

- Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler TSTF-360, Revision 1, "DC Electrical Rewrite," as incorporated in NUREG-1431, Revision 2, "Standard Technical Specifications, Westinghouse Plants" (June 2001), and

- IEEE 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations."

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 seven-day cycle is conservative with respect to manufacturer recommendations and IEEE-450 (Ref. 9).

SR 4.8.2.3.a

Verification of battery float current while on float charge is used to determine the state of charge on the battery. Float charge is the condition in which the charger is supplying continuous charge required to overcome the internal losses of a battery and maintain the battery in a charged state. 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.

DC SOURCES (continued)

This surveillance requirement 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 4.8.2.1.a. When this float voltage is not maintained, LCO 3.8.2.2 Action A is applicable, and provides the necessary and appropriate verification of the battery condition. The float current limit of 2 amps is based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

SR 4.8.2.3.b and SR 4.8.2.3.c

These SRs require verification that the cell voltages are equal to or greater than the short-term absolute minimum of 2.07 V.

Optimal long-term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer. This provides adequate over-potential, which limits formation of lead sulfate. Monitoring individual cell long-term performance is accomplished by the Battery Monitoring and Maintenance Program, which implements a program for monitoring various battery parameters based on the recommendations of IEEE 450-2002 (Ref.8). Individual cell voltages < 2.13 V will result in increased monitoring and appropriate corrective action(s) in accordance with this program.

The minimum float voltage required by the battery manufacturer is 2.17 volts per cell, which corresponds to 128 V for 59 cells at the battery terminals. Individual cell float voltage less than 2.13 volts per cell, but greater than 2.07 volts per cell, is addressed in Technical Specification Administrative Control subsection 6.8.3.o. The Frequency for cell voltage verification, every 31 days for each pilot cell and 92 days for each connected cell, is consistent with IEEE-450. The primary change to incorporate this method is that the pilot cells are no longer average cells. Pilot cells are now the cells with the lowest individual cell voltages.

SR 4.8.2.3.d

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.

SR 4.8.2.3.e

This surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit. 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.

DC SOURCES (continued)

Editiorial addition

SR 4.8.2.3.f

This test is performed at 60-month intervals. The acceptance criteria for this surveillance are 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. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

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 cycle is reduced to 18 months. 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. These frequencies are consistent with the recommendations in IEEE-450 (Ref. 8).

A battery performance discharge test is a test of constant current capacity of a battery to detect any change in the capacity determined by the acceptance test. This test is intended to determine overall battery degradation due to age and usage.

Either the battery performance test or the modified performance discharge test is acceptable for satisfying SR 4.8.2.3.f; however, only the modified performance discharge test may be used to satisfy the battery service test requirements of SR 4.8.2.1.

A modified performance discharge test is a test of the battery capacity and its ability to provide the duty cycle. This confirms 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 the service test.

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

The Frequencies are consistent with IEEE-450.

ATTACHMENT 5

LIST OF COMMITMENTS

LIST OF COMMITMENTS

The following table identifies the actions in this document to which the STP Nuclear Operating Company has committed. Statements in this submittal with the exception of those in the table below are provided for information purposes and are not considered commitments. Please direct questions regarding these commitments to Philip Walker at (361) 972-8392.

Commitment	Expected Completion Date	CR Action No.
From the response to question #1: Surveillance requirements 4.8.2.1(c) and 4.8.2.2(b) will comply with the 12-hour criterion for recharging. The Technical Specification amendment request will be revised accordingly.	03/01/2006	04-12263-15
From the response to questions #2 and #9: The minimum float voltage allowed per cell is 2.17 vdc/cell. The minimum float voltage per cell will be included in the Bases as background information for Technical Specification 3/4.8.2, "DC Sources."	03/01/2006	04-12263-19
From the response to question #3: The modified performance discharge test envelopes both the performance discharge test and the service discharge test. References to the performance discharge test as a substitute for the service discharge test will be revised to specify the modified performance discharge test.	03/01/2006	04-12263-16
From the response to question #4: The E1B11 calculation used a final cell voltage of 1.81 vdc which reduced the one-minute rate to 98.75 amps. This voltage value used should have been 1.78 vdc, consistent with the other battery calculations. The calculations are to be updated accordingly.	03/01/2006	04-12263-20
From the response to question #5: Until sufficient justification is available supporting the 18-month interval, the South Texas Project will use 12-month intervals between battery performance tests of batteries that show degradation or that reach 85% of the service life for the application.	03/01/2006	04-12263-17
From the response to question #5: A surveillance requirement will be added to require performance discharge tests at least once per 24 months for any battery reaching 85% of the service life expected for the application and capacity is equal to or greater than 100% of the manufacturer's rating.	03/01/2006	04-12263-18

<u>From the response to question #12:</u> A spare non-Class 1E battery charger may be provided in the future to serve as an alternate means of restoring the associated battery terminal voltage if the affected batteries have less than the minimum established float voltage and they are to be considered operable after two hours. The spare non-Class 1E battery charger will be diesel-backed. This provision will be included in the STP Technical Specification Bases. If this modification is made, it will be included in the STP UFSAR.	03/01/2006	04-12263-21