

September 29, 2017

U.S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: Application to Revise Technical Specifications to Adopt Technical Specification Task Force (TSTF)-500, Revision 2, "DC Electrical Rewrite-Update to TSTF-360."

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to the Technical Specifications (TS) for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3.

The proposed changes incorporate the NRC-approved TSTF-500, Revision 2, "DC Electrical Rewrite-Update to TSTF-360."

EGC has concluded that the proposed changes present no significant hazards consideration under the standards set forth in 10 CFR 50.92.

The proposed changes have been reviewed by the PBAPS Plant Operations Review Committee in accordance with the requirements of the EGC Quality Assurance Program.

This amendment request contains three regulatory commitments, described in Attachment 4.

Attachment 1 provides an evaluation of the proposed changes. Attachment 2 provides the existing TS pages marked up to show the proposed changes. Attachment 3 provides the existing TS Bases pages marked up to show the proposed changes (for information only). Attachment 4 provides the Summary of Regulatory Commitments. Attachment 5 provides the List of Required Updated Final Safety Analysis Report (UFSAR) Descriptions. Attachment 6 provides the PBAPS DC System Simplified Diagram. Attachment 7 provides the PBAPS 4 kV Emergency Bus System Cross Ties. Attachment 8 provides the Conceptual Alternate Battery Charger Diagram. Attachment 9 provides the newly proposed PBAPS Technical Requirements Manual Section 3.21 Markup that contains the Battery Monitoring and Maintenance Program. Enclosure 1 provides the letter from the battery manufacturer, EnerSys, verifying the acceptability of using float current monitoring.

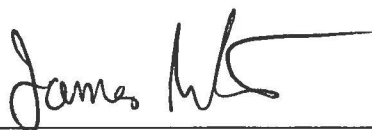
EGC requests approval of the proposed amendment by September 29, 2018. Once approved, the amendments shall be implemented on a per unit basis, prior to the first subsequent unit refueling outage to avoid repeated battery service discharge testing.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), EGC is notifying the Commonwealth of Pennsylvania of this application for license amendment by transmitting a copy of this letter and its attachments to the designated State Official.

If you have any questions or require additional information, please contact Frank J. Mascitelli at (610) 765-5512.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 29th day of September 2017.

Respectfully,



James Barstow
Director - Licensing and Regulatory Affairs
Exelon Generation Company, LLC

- Attachments:
1. Evaluation of Proposed Changes
 2. Markup of Technical Specifications Pages
 3. Markup of Technical Specifications Bases Pages (For Information Only)
 4. Summary of Regulatory Commitments
 5. List of Required Updated Final Safety Analysis Report (UFSAR) Descriptions
 6. PBAPS DC System Simplified Diagram (Unit 2 only)
 7. PBAPS 4 kV Emergency Bus System Cross Ties
 8. Conceptual Alternate Battery Charger Diagram
 9. PBAPS Technical Requirements Manual Section 3.21 Markup

Enclosure 1: Letter from Jan G. Reber, Director of Assembly Engineering, EnerSys to Dipen Patel, System Engineer, Peach Bottom Atomic Power Station, Re: "Stabilized Float Current for EnerSys GN Batteries," dated March 31, 2017.

cc:	USNRC Region I, Regional Administrator	w/ attachments
	USNRC Senior Resident Inspector, PBAPS	"
	USNRC Project Manager, PBAPS	"
	R. R. Janati, Pennsylvania Bureau of Radiation Protection	"
	S. T. Gray, State of Maryland	"

ATTACHMENT 1

Evaluation of Proposed Changes

Peach Bottom Atomic Power Station, Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278

Subject: Application to Revise Technical Specifications to Adopt Technical Specification Task Force (TSTF)-500, Revision 2, "DC Electrical Rewrite-Update to TSTF-360."

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1.0 DESCRIPTION

Exelon Generation Company, LLC (EGC), proposes changes to the Technical Specifications (TS), Appendix A of Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, respectively.

The proposed changes request new TS Actions for an inoperable battery, battery charger and alternate battery charger testing criteria for Limiting Condition for Operation (LCO) 3.8.4, "DC Sources-Operating," and LCO 3.8.5, "DC Sources-Shutdown." The proposed changes also include the relocation of a number of Surveillance Requirements (SRs) in TS 3.8.4 that perform preventive maintenance on the safety related batteries to a licensee controlled program. It is proposed that LCO 3.8.6, "Battery Parameters," be modified by relocating Table 3.8.6-1, "Battery Cell Parameter Requirements," to a licensee-controlled program, and that specific actions with associated Completion Times for out-of-limits conditions for battery cell voltage, electrolyte level, and electrolyte temperature be added to TS 3.8.6. In addition, specific SRs are being proposed for verification of these parameters.

A new program is being proposed for TS Section 5.5, Programs and Manuals, of the Administrative Controls for the maintenance and monitoring of station batteries. The items proposed to be relocated will be contained within this new program, TS 5.5.15, titled "Battery Monitoring and Maintenance Program."

The proposed changes provide new Actions for an inoperable battery, battery charger, and alternate battery charger testing criteria. The longer Completion Time for an inoperable battery charger will allow additional time for maintenance and testing. In addition, a number of Surveillance Requirements are relocated to licensee control. Monitoring of battery cell parameter requirements and performance of battery maintenance activities are relocated to a licensee-controlled program, the PBAPS Technical Requirements Manual (TRM). The TS requirements are revised from requirements on battery cells to requirements on the battery. This focuses the requirements on the assumed safety function of the battery.

These changes are consistent with the U.S. Nuclear Regulatory Commission (NRC)-approved Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2 (Reference 1). The availability of this TS improvement was announced in the Federal Register on September 1, 2011 (76 FR 54510).

In addition, a review of the existing PBAPS DC System Battery Capacity Analysis (Reference 3) and the preparation of three new Technical Evaluations (References 2, 4, 6) were completed to support station specific analyses required to adopt TSTF-500, Revision 2.

2.0 ASSESSMENT

2.1 Applicability of Published Safety Evaluation

EGC has reviewed the model safety evaluation referenced in the Federal Register Notice of Availability published on September 1, 2011 (76 FR 54510). EGC has concluded that the justifications presented in TSTF-500 Revision 2 and the safety evaluation prepared by the NRC staff are applicable to PBAPS, Units 2 and 3, and justify this amendment for the incorporation of the changes to the PBAPS TS.

The PBAPS DC System is very similar to the system described in TSTF-500 with respect to its ability to meet the duty cycle assumed in the accident analyses and with its operations in the float and equalize modes. Minor differences between the systems are noted in Section 2.3 below. The following section contains a brief description of the PBAPS DC System.

PBAPS DC System

The 125/250 VDC System provides a source of reliable, uninterruptible 125/250 VDC power and 125 VDC control and instrument power to Class 1E and non-Class 1E loads during normal plant operating conditions and for safe shutdown of the plant following the initiation of any plant design basis event or accident as identified in the PBAPS Updated Final Safety Analysis report (UFSAR).

Attachment 6, DC System Simplified Diagram (for Unit 2) is provided to facilitate the following description (Unit 3 is similar). There are two independent safety-related 125/250 V, 3-wire, DC systems (Subdivisions I and II) per unit. Each system is comprised of two 125 V batteries, each with its own battery charger panel consisting of two 100% chargers. Within the charger panel, one battery charger is in service and the other charger remains in standby and can be manually transferred, usually within a half hour, should the operating battery charger become inoperable. There are a total of four safety-related 125/250 V batteries in the station, two for Unit 2 and two for Unit 3. Each safety-related 125/250 V battery is in a separate ventilated battery room. The two batteries for each unit are redundant. Loads are diversified between these systems so that each system serves loads which are identical and redundant, which are different but redundant to plant safety, or which back up AC equipment.

Power required for the larger loads, such as DC motor driven pumps and valves, is supplied at 250 V from the two 125 V sources of each system connected in series, and distributed through 250 VDC motor control centers.

Power for all DC control functions, that is required for the control of the 13 kV and 4 kV circuit breakers, control relays, and annunciators, and power for exit lighting, is supplied at 125 V from each of the two 125 V sources of each system and distributed through 125 VDC power distribution panels.

Each safety related 125 V battery is of the lead-calcium type and consists of 58 shock absorbent, clear plastic cells, EnerSys Model GN-23. The battery is rated at 1,712 amp-hours at the 8-hour rate (terminal voltage of 1.81 Vpc). The chargers are full wave, silicon controlled rectifiers. The housings are freestanding, NEMA Type I and are ventilated. The safety-related chargers are suitable for float charging the lead-calcium battery at 2.25 V per cell, and supplying an equalizing charge at 2.33 V per cell. The safety-related chargers operate from 480 V, 3-phase, 60 Hz sources supplied from separate 480 V motor control centers. Each of these motor control centers is connected to an independent emergency AC bus. The chargers for three Unit 2 and three Unit 3 batteries can be supplied from the other unit's emergency AC buses via manual transfer switches.

Charger voltage is maintained at (+/-) 1% from 0 to 100 percent of charger rating with a supply voltage variation of (+/-) 10%. The chargers are in compliance with all applicable NEC, NEMA, and ANSI standards.

The 125 V chargers are capable of carrying the normal DC system load and, at the same time, supplying charging current to keep the batteries in a fully charged condition.

In regards to PBAPS's specific parameters, the following values are listed below:

- Battery full charge (100%) voltage is 130.5 V.
- Battery full charge float voltage per cell is 2.25 VPC (volts per cell)
- TS minimum established float voltage (MEFV) is 123.5 V (battery is inoperable below this voltage).
- Battery cell voltage at minimum established float voltage is 2.13 VPC.
- Battery Charger float current is 2 amps, representing 98% charged battery (proposed TS float value).
- Battery Charger float current at 1 amp, represents 99% charged battery.

Alternate Battery Chargers

Adoption of TSTF-500, Revision 2, will extend the Completion Time for an inoperable battery charger from the existing two hours to 72 hours, provided that battery terminal voltage is restored to greater than or equal to the minimum established float voltage within 2 hours, and battery float current is verified to be less than or equal to 2 amps once per 12 hours.

In order to maintain the battery voltage above a minimum threshold while the required battery charger is inoperable, an alternate battery charger is required. Given that the DC bus remains energized, that the battery discharge is terminated based on restoration of the battery terminal voltage, and that the battery is fully charged based on battery float current, there is reasonable basis for extending the restoration time for an inoperable battery charger beyond the existing two hour Completion Time to 72 hours. The primary justification for the extended battery charger completion time is based on the availability of an alternate battery charger that is appropriately sized to perform the design function of the charger that becomes inoperable. PBAPS will provide two 200 amp permanently installed (one per unit) non safety-related alternate battery chargers. The design of providing an alternate battery charger for each unit will ensure it can be placed in service within two hours, assuring that the discharging battery remains above its minimum TS MEFV, assuring operability of the battery. Use of alternate battery chargers has been established in similar licensee submittals. See Section 4, Precedent, below.

Technical Evaluation 619878, "Charger Sizing for PBAPS TSTF-500 LAR" (Reference 2) was prepared to properly size the alternate battery chargers and concluded:

1. A 200 amp rated non-safety related battery charger is acceptable for use as an alternate battery charger for the 1E station battery chargers.
2. A 200 amp rated battery charger will be able to recharge the battery to 95% capacity within 8 hours after a 2-hour discharge under normal DC loading.
3. The alternate battery charger float and equalize voltages will be set to the same as the currently installed class 1E battery chargers.
4. Hydrogen generation is not expected to be a concern as the alternate battery charger is rated the same as the existing 1E battery chargers.

Attachment 8 provides a simplified single line diagram that illustrates the conceptual Alternate Battery Charger configuration when connected to the existing safety related battery chargers. The newly installed fuse boxes and transfer switches, along with operating procedures to connect the alternate battery chargers will assure proper separation between safety and non-safety related systems and that the worst case battery discharge period will be limited to within two hours.

Technical Evaluation 620526, "Battery Discharge Tech Eval," (Reference 4) was prepared to provide justification that after a 2-hour battery discharge under normal plant loading conditions, the battery will remain above 80% capacity (operable). The Technical Evaluation concluded:

1. A worst case 2-hour discharge under normal plant loading conditions results in less than 5% capacity removed from the battery, assuring the battery capacity will be greater than 80%.
2. When the alternate battery charger is connected and the battery terminal voltage is above the MEFV, the battery is able to be declared operable.

Applicable PBAPS TS sections

The following PBAPS TS sections are affected by the proposed changes:

- 3.8.4 DC Sources – Operating
- 3.8.5 DC Sources – Shutdown
- 3.8.6 Battery Cell Parameters
- 5.5 Programs and Manuals

2.2 Verification and Regulatory Commitments

PBAPS has reviewed the model safety evaluation referenced in the Federal Register Notice of Availability published on September 1, 2011 (76 FR 54510). This review included a review of the NRC staff's evaluation, as well as the supporting information provided to support TSTF-500. As described in the subsequent paragraphs, PBAPS has concluded that the justifications presented in the TSTF-500 proposal and the model safety evaluation prepared by the NRC staff are applicable to PBAPS and justify this amendment for the incorporation of the changes to the PBAPS TS.

As described in Section 4.7.1, "Verifications," in TSTF-500, PBAPS provides the following verifications:

1. In Enclosure 1, PBAPS has provided a letter from the battery manufacturer, EnerSys, of the batteries used at PBAPS verifying the acceptability of using float current monitoring instead of specific gravity monitoring as a reliable and accurate indication of the state-of-charge of the battery and that this will hold true over the life of the battery. Per EnerSys, the battery manufacturer, it can be reasonably assumed that when the float current is less than or equal to a 2-amp threshold, the model GN-23 station batteries will have achieved a nominal returned capacity of at least 98 percent. At a float current of less than or equal to 1-amp, the GN-23 batteries are expected to have achieved a nominal returned capacity of at least 99 percent. These values are expected to be valid for the service life of the batteries.
2. PBAPS verifies that battery room temperature is routinely monitored such that a room temperature excursion could reasonably expect to be detected and corrected prior to the average battery electrolyte temperature dropping below the minimum electrolyte temperature. There is control room annunciation if a battery room temperature is low (65°F) or high (100°F). In addition, if the alarm is in the 2(3)A or 2(3)C Battery rooms the battery pilot cell temperature is verified to be maintained greater than or equal to 40°F. As part of the commitment to maintain 5% design margin, the battery room temperature will be maintained above 50°F. Battery pilot cell temperature will be verified to be maintained greater than or equal to 50°F after TSTF-500 Rev 2 is implemented.

3. PBAPS verifies that the equipment that will be used to monitor float current under SR 3.8.6.1 will have the necessary accuracy and capability to measure electrical currents in the expected range. The float current is a measured value per procedure and typically uses a Fluke model 189 multi-meter, which has an accuracy of 0.5%.
4. PBAPS will not be requesting a Completion Time greater than 72 hours for an inoperable battery charger.
5. PBAPS will not be requesting a Completion Time longer than 2 hours for an inoperable battery or greater than 2 hours for an inoperable DC subdivision for other reasons than an inoperable battery or inoperable battery charger.
6. PBAPS verifies that there is an appropriate basis for the relocated inter-cell connection resistance limit of 40 micro-ohms, which is being relocated to the Battery Monitoring and Maintenance Program.

IEEE 450-2002 Annex D.2 identifies methods to establish inter-cell connection resistances. Method D.2, Connection resistance, states that the design maximum for the connection resistance may be calculated using manufacturer's connection voltage drop criterion. The maximum connection resistance can be calculated using $V=IR$. The current (I) should be equal to a current that bounds the continuous current in the duty cycle. Typically the performance test current rate bounds the continuous current in the duty cycle. Under these conditions, V = the manufacturer's connection voltage drop and I = the performance test rate.

The modified battery discharge performance tests identify the continuous duty current as $490/K1$ where $K1$ is the temperature correction factor. The acceptance criterion for cell temperature is 40-90°F. The correction factor for 90° is 0.940. This yields a continuous duty of 521 A.

Engineering Work Request (EWR) P-51694 (Reference 5) calculated the inter-cell connection resistance using the method described above. Per the EWR a 30mV drop across the connections is acceptable. The EWR used 555 A as the continuous battery duty current. This results in a maximum limit of 54 micro-ohms. As such, the 40 micro-ohm limit is acceptable. The proposed increase in acceptance criteria to 50-90°F will have a negligible effect on the 40 micro-ohm limit.

7. PBAPS has confirmed for SR 3.8.4.7 that the modified performance discharge test completely encompasses the load profile of the battery service test and that it adequately confirms the intent of the service test to verify the battery capacity to supply the design basis load profile.

As described in Section 4.7.2, "Commitments," in TSTF-500, PBAPS makes the following regulatory commitments:

1. EGC commits to include in a licensee-controlled program that is controlled under 10 CFR 50.59 a requirement to maintain a 5% design margin for the batteries. EnerSys (PBAPS battery manufacturer) has provided a letter which verifies that a 2 amp float current value is an indication that the battery is 98% charged. Using a 5% design margin is thus conservative in this aspect.

Technical Evaluation 619923, "Battery Size 5% Design Margin" (Reference 6) evaluated incorporating a 5% design margin, which includes raising the minimum battery cell electrolyte temperature from 40°F to 50°F. The 5% design margin is used to ensure that with a battery float current of 2 amps or less, the battery will have the capacity to support design basis accident DC loads. PBAPS has verified via the battery manufacturer (EnerSys) that a battery float current of 2 amps or less is indicative of a 98% battery charge. PBAPS will conservatively use a 5% design margin in the 1E battery sizing analysis. EnerSys reviewed the battery charging curves, Tafel curves, and service testing data and established empirical relationships between each individual cell's float current based on the Tafel curves and the approximate capacity returned to the battery. The trigger point was 2 amps because that was the bracketed quantity in the TS, but the battery vendor also estimated the returned capacity at other float current values. Per EnerSys, the culmination of that research, which they have stated is proprietary, has remained consistent with respect to returned capacity, and was the basis for the values provided in Enclosure 1.

To support maintaining the required 5% design margin, the minimum allowed battery electrolyte temperature will be changed from 40°F to 50°F. Historical battery room temperature records support this change. The current battery room low temperature control room alarm setpoint is 65°F. Additionally, battery room temperatures are monitored on a periodic basis and plant procedures provide operators with directions to take action upon receipt of high or low temperature alarms.

Technical Evaluation 619923 concluded:

1. It is acceptable for PBAPS to incorporate TSTF-500 and use float current as a method of monitoring for state of charge of the batteries and return to service limit.
 2. Use of 5% design margin and 50°F minimum electrolyte temperature is acceptable for the Peach Bottom 1E Batteries.
 3. The 5% design margin which will be incorporated into the PBAPS battery sizing analysis and the EnerSys letter on float current (Enclosure 1) ensures that when the Peach Bottom 1E batteries' float current is 2 amps or less, the batteries will be greater than 100% capacity to support design bases accident DC loads.
 4. With the incorporation of TSTF-500, the EnerSys model GN-23 battery cells are of adequate size to support the design basis DC load profile.
2. EGC commits that the required licensee-controlled program described in TS Section 5.5, "Programs and Manuals," and titled "Battery Monitoring and Maintenance Program," will require verification of the selection of the pilot cell when performing SR 3.8.6.5. The existing TS Table 3.8.6-1 Categories A, B, values (electrolyte, level, float voltage, and specific gravity) that will be relocated to proposed TS 5.5.15, will continue to be controlled at their current levels in the Battery Monitoring and Maintenance Program and that action to restore deficient values will be implemented in accordance with the EGC Corrective Action Program. The Battery Monitoring and Maintenance Program will reside as new section 3.21 in the existing PBAPS Technical Requirements Manual (TRM). A draft markup of the newly proposed TRM has been provided in Attachment 9.
 3. EGC commits to revise the PBAPS Updated Final Safety Analysis Report in accordance with Attachment 5, List of Required Updated Final Safety Analysis Report (UFSAR) Descriptions.

2.3 Optional Changes and Variations

PBAPS is proposing the following variations from the TS changes described in the TSTF-500, Revision 2, or the applicable parts of the NRC staff's model safety evaluation dated September 1, 2011.

PBAPS TS utilize different numberings than the improved Standard Technical Specifications on which TSTF-500 was based. The different numberings arise from the additional LCOs associated with the interdependence of Unit 2 and Unit 3 DC systems for certain loads. In addition, TSTF-500 deletes certain Surveillances and renumbers the subsequent Surveillances. PBAPS has chosen to retain the deleted Surveillance numbers, mark them "DELETED," and to not renumber the subsequent Surveillances. PBAPS has implemented TSTF 425, "Relocate Surveillance Frequencies to Licensee Control," via License Amendment Nos. 278 and 281 (Reference 7) for Units 2 and 3, respectively, and will maintain the existing proposed SR frequencies in accordance with the Surveillance Frequency Control Program's current frequencies. New proposed SR frequencies will be consistent with the TSTF-500 proposed frequencies and the TS Frequencies column will state "In accordance with the Surveillance Frequency Control Program." These differences are administrative in nature and do not affect the applicability of TSTF-500 to the PBAPS TS.

The PBAPS DC system design differs from the design assumed for the standard plant described in the Standard Technical Specifications Bases (STS) and TSTF-500 Rev 2, in two notable ways: 1) DC system inter-unit crossties, and 2) installed spare battery chargers in standby condition.

The DC system inter-unit crossties are related to the 4 KV Emergency Buses and Emergency Diesel Generators (EDGs). Note that PBAPS does not have a separate EDG DC battery subsystem. The EDGs receive their DC control power from the 125/250 DC System. Attachment 7 illustrates an example of this inter-unit dependence in regards to the EDGs. Each unit is provided with four 4 kV emergency buses for safety related equipment. A total of four EDGs provide AC power to each unit's four 4 kV emergency buses. The DC control power (which provides control power for the 4 kV load circuit breakers and the feeder breakers to the 4 kV emergency bus) for two of the four 4 kV emergency buses, as well as control power for two of the diesel generators, is provided by the Unit 3 DC electrical power subsystems. Therefore, the Unit 3 DC electrical power subsystems needed to support required Unit 2 components are also required to be OPERABLE. The Unit 3 DC electrical power subsystem OPERABILITY requirements are the same as those required for a Unit 2 DC electrical power subsystem. In addition, battery chargers (Unit 2 and Unit 3) can be powered from the opposite unit's AC source (as described in the Background section of the Bases for LCO 3.8.4, "DC Sources — Operating"), and be considered OPERABLE for the purpose of meeting this LCO.

Accordingly, PBAPS TS differ from the STS which were the basis for TSTF-500 due to the inter-unit crosstie design. The Unit 2 DC System contains a TS LCO Action (3.8.4.) for the Unit 3 DC system, and the Unit 3 DC System contains a TS LCO Action (3.8.4) for the Unit 2 DC System. These LCOs will remain unaffected by the proposed changes to adopt TSTF-500 Rev 2.

In regards to the installed spare battery chargers in standby condition, within each battery charger panel there is an operating battery charger and an identical installed standby battery charger that can be manually transferred if the operating battery charger becomes unavailable. For the purpose of adopting TSTF-500 Rev 2, the 72-hour inoperable battery charger LCO will be used when both the operating and standby battery chargers both become inoperable. The

published Safety Evaluation continues to be applicable to the plant-specific design. The two differences (DC system inter-unit crossties and installed standby battery chargers) do not affect the proposed actions for battery charger inoperability nor affect the proposed relocated preventative maintenance surveillances, certain operating limits, and actions to a newly-created licensee-controlled Battery Monitoring and Maintenance Program.

3.0 REGULATORY ANALYSIS

3.1 Applicable Regulatory Requirements / Criteria

The following NRC requirements and guidance document are applicable to the review of the proposed change.

The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met. EGC has determined that the proposed changes do not require any exemptions or relief from the applicable regulatory requirements. Note that PBAPS was designed and constructed taking into consideration the general design criteria for nuclear power plant construction permits as listed in the proposed AEC General Design Criteria, dated July 1967. The following current applicable regulations and regulatory requirements were reviewed in making this determination:

Title 10 of the Code of Federal Regulations (10 CFR) Part 50 Appendix A, General Design Criterion (GDC) 17, "Electric power systems," requires, in part, that nuclear power plants have onsite and offsite electric power systems to permit the functioning of structures, systems, and components (SSCs) that are important to safety. The onsite system is required to have sufficient independence, redundancy, and testability to perform its safety function, assuming a single failure. The offsite power system is required to be supplied by two physically independent circuits that are designed and located so as to minimize, to the extent practical, the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. In addition, this criterion requires provisions to minimize the probability of losing electric power from the remaining electric power supplies as a result of loss of power from the unit, the offsite transmission network, or the onsite power supplies.

GDC 18, "Inspection and testing of electric power systems," requires that electric power systems that are important to safety must be designed to permit appropriate periodic inspection and testing.

10 CFR 50.36, "Technical specifications," requires a licensee's TSs to establish limiting conditions for operation (LCOs), which include completion times (CTs) for equipment that is required for safe operation of the facility.

10 CFR 50.63, "Loss of all alternating current power," requires that each light-water cooled nuclear power plant licensed to operate must be able to withstand for a specified duration and recover from a station blackout (SBO).

10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," requires that preventive maintenance activities must not reduce the overall availability of the SSCs.

Regulatory Guide (RG) 1.75, Revision 3, "Criteria for Independence of Electrical Safety Systems," February 2005, provides guidance with respect to the physical independence requirements of the circuits and electrical equipment that comprise or are associated with safety related systems (ML043630448).

RG 1.129, Revision 2, "Maintenance, Testing, and Replacement of Vented Lead-Acid Storage Batteries for Nuclear Power Plants," February 2007, provides guidance with respect to the maintenance, testing, and replacement of vented lead-acid storage batteries in nuclear power plants. This RG endorses, in part, the Institute of Electrical and Electronics Engineers (IEEE) Standard 450-2002, "IEEE Recommended Practice for Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Stationary Applications" (ML063490110).

TSTF-500, Revision 2, "DC Electrical Rewrite – Update to TSTF-360," dated September 22, 2009 (ML092670242).

TSTF-425, Revision 3, "Relocate Surveillance Frequencies to Licensee Control – RITSTF Initiative 5b," dated March 18, 2009 (ML090850642).

Model application and Safety Evaluation for plant specific adoption of TSTF-500, Revision 2 (ML111751792), as published for availability in the Federal Register on September 1, 2011 (76 FR 54510).

3.2 No Significant Hazards Consideration

Exelon Generation Company, LLC (EGC), proposes changes to the Technical Specifications (TS), Appendix A of Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, respectively.

EGC requests adoption of Technical Specifications Task Force (TSTF)-500, Revision 2, "DC Electrical Rewrite-Update to TSTF-360," which is an approved change to the Standard Technical Specifications (STS), into the PBAPS TS. The proposed changes request new actions for an inoperable battery charger and alternate battery charger testing criteria for Limiting Condition for Operation (LCO) 3.8.4, "DC Sources-Operating," and LCO 3.8.5, "DC Sources-Shutdown." The proposed changes also include the relocation of a number of Surveillance Requirements (SRs) in TS 3.8.4 that perform preventive maintenance on the safety related batteries to a licensee controlled program. It is proposed that LCO 3.8.6, "Battery Parameters," be modified by relocating Table 3.8.6-1, "Battery Cell Parameter Requirements," to a licensee-controlled program, and that specific actions with associated Completion Times for out-of-limits conditions for battery cell voltage, electrolyte level, and electrolyte temperature be added to TS 3.8.6. In addition, specific SRs are being proposed for verification of these parameters.

A new program is being proposed for TS Section 5.5, Programs and Manuals, for the maintenance and monitoring of station batteries. The items proposed to be relocated will be contained within this new program, TS 5.5.15, titled the "Battery Monitoring and Maintenance Program."

EGC has reviewed the proposed no significant hazards consideration determination (NSHCD) published in the Federal Register (76 FR 54510) as part of the NRC approved TSTF-500, Rev 2. EGC has concluded that the proposed NSHCD presented in the Federal Register notice is applicable to PBAPS and is hereby incorporated by reference to satisfy the requirements of 10CFR 50.91(a):

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

Response: No.

The proposed change restructures the TS for the direct current (DC) electrical power system. The proposed changes add actions to specifically address battery charger inoperability. The DC electrical power system, including associated battery chargers, is not an initiator of any accident sequence analyzed in the Updated Final Safety Analysis Report (UFSAR). Operation in accordance with the proposed TS ensures that the DC electrical power system is capable of performing its function as described in the UFSAR. Therefore, the mitigative functions supported by the DC electrical power system will continue to provide the protection assumed by the analysis, and the probability of previously analyzed accidents will not increase by implementing these changes.

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

The integrity of fission product barriers, plant configuration, and operating procedures as described in the UFSAR will not be affected by the proposed changes. Therefore, the consequences of previously analyzed accidents will not increase by implementing these changes.

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

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

Response: No.

The proposed change involves restructuring the TS for the DC electrical power system. The DC electrical power system, including associated battery chargers, is not an initiator to any accident sequence analyzed in the UFSAR. Rather, the DC electrical power system is used to supply equipment used to mitigate an accident.

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

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

Response: No.

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

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

Based on the above, EGC concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

3.3 Conclusions

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

4.0 PRECEDENT

The following industry precedent is applicable to the PBAPS license amendment request:

Palo Verde Nuclear Generating Station, Units 1, 2, and 3 - Issuance of Amendments Re: License Amendment Request for Adoption of Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, DC Electrical Rewrite - Update to TSTF-360 (TAC NOS. MF0450, MF0451, and MF0452), dated June 25, 2014.

Arkansas Nuclear One, Unit 1 - Issuance of Amendment Re: Adoption of Technical Specifications Task Force (TSTF) Change Traveler TSTF-500, Revision 2, DC Electrical Rewrite - Update to TSTF-360 (TAC NO. MF0596), dated June 25, 2014.

Edwin I. Hatch Nuclear Plant - Units 1 and 2, License Amendment Request for Adoption of Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, "DC Electrical Rewrite - Update to TSTF-360," dated August 11, 2015.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. Federal Register (76 FR 54510): Notice of Availability of Proposed Models for Plant Specific Adoption of technical Specifications Task Force Traveler TSTF-500, Revision 2, "DC Electrical Rewrite-Update to TSTF-360," dated September 1, 2011.
2. PBAPS Technical Evaluation 619878, "Charger Sizing for PBAPS TSTF-500 LAR," dated August 1, 2017.
3. PBAPS PE-0017 Calculation, "Perform 125/250 V DC Class 1E Battery Capacity Analysis and Distribution System Voltage Analysis," Rev 13, dated August 21, 2015.
4. Technical Evaluation 620526, "Battery Discharge Tech Eval," dated August 1, 2017.
5. Engineering Work Request (EWR)-P-51694, "Inter-cell Connection Resistance," dated May 9, 1990.
6. PBAPS Technical Evaluation 619923, "Battery Size 5% Design Margin Tech Eval," dated July 31, 2017.
7. License Amendment Nos. 278 and 281: Peach Bottom Atomic Power Station Units 2 and 3- Issuance of Amendments Re: Adoption of TSTF Traveler 425, Revision 3, Relocate Surveillance Frequencies to Licensee Control (TAC NOS. ME2184 and ME2185), dated August 27, 2010.

ATTACHMENT 2

Markup of Technical Specifications Pages

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278

Revised Technical Specifications Pages

Unit 2 TS Pages

3.8-28	3.8-32	3.8-38a*
3.8-29	3.8-34	3.8-39
3.8-29a*	3.8-35	3.8-39a*
3.8-30	3.8-36	3.8-40
3.8-31	3.8-37	5.0-18b*
3.8-31a*	3.8-38	5.0-18c*

Unit 3 TS Pages

3.8-28	3.8-32	3.8-38a*
3.8-29	3.8-34	3.8-39
3.8-29a*	3.8-35	3.8-39a*
3.8-30	3.8-36	3.8-40
3.8-31	3.8-37	5.0-18b*
3.8-31a*	3.8-38	5.0-18c*

* Anticipated new pages, subject to change when clean pages are submitted and repagination is completed.

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources-Operating

- LCO 3.8.4 The following DC electrical power subsystems shall be OPERABLE:
- a. Unit 2 Division I and Division II DC electrical power subsystems; and
 - b. Unit 3 Division I and Division II DC electrical power subsystems.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One Unit 3 DC electrical power subsystem inoperable due to performance of SR 3.8.4.7 or SR 3.8.4.8. <u>6.6</u></p>	<p>-----NOTE----- Enter applicable Conditions and Required Actions of LCO 3.8.7, "Distribution Systems-Operating," when Condition A results in de-energization of a Unit 2 4 kV emergency bus or de-energization of a Unit 3 DC bus. -----</p> <p>A.1 Restore Unit 3 DC electrical power subsystem to OPERABLE status.</p>	<p>7 days</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. One Unit 3 DC electrical power subsystem inoperable for reasons other than Condition A.</p>	<p>-----NOTE----- Enter applicable Conditions and Required Actions of LCO 3.8.7, "Distribution Systems – Operating," when Condition B results in de-energization of a Unit 2 4 kV emergency bus. -----</p> <p>B.1 Restore Unit 3 DC electrical power subsystem to OPERABLE status.</p>	<p>12 hours</p>
<p><u>C. One battery charger on one subsystem inoperable.</u></p>	<p><u>C.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.</u></p> <p><u>AND</u></p> <p><u>C.2 Verify battery float current < 2 amps.</u></p> <p><u>AND</u></p> <p><u>C.3 Restore battery charger to OPERABLE status.</u></p>	<p><u>2 hours</u></p> <p><u>Once per 12 hours</u></p> <p><u>72 hours</u></p>
<p><u>D. One battery on one subsystem inoperable.</u></p>	<p><u>D.1 Restore battery to OPERABLE status.</u></p>	<p><u>2 hours</u></p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p><u>EE</u>. <u>One Unit 2 DC electrical power subsystem inoperable. For reasons other than conditions C, or D.</u></p>	<p><u>EE.1</u> Restore Unit 2 DC electrical power subsystem to OPERABLE status.</p>	<p>2 hours</p>
<p><u>EF</u>. Required Action and Associated Completion Time of Condition A, B, C, <u>D, or E</u> not met.</p>	<p><u>EF.1</u> Be in MODE 3. <u>AND</u> <u>F.2</u> <u>Be in MODE 4.</u></p>	<p>12 hours <u>36 hours</u></p>
<p><u>EG</u>. Two or more inoperable DC electrical power subsystems.</p>	<p><u>EG.1</u> Enter LCO 3.0.3.</p>	<p>Immediately</p>

SURVEILLANCE REQUIREMENTS

-----NOTE-----
 SR 3.8.4.1 through SR 3.8.4.8 are applicable only to the Unit 2 DC electrical power subsystems. SR 3.8.4.9 is applicable only to the Unit 3 DC electrical power subsystems.

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is <u>≥ 123.5 V on float charge, greater than or equal to the minimum established float voltage.</u>	In accordance with the Surveillance Frequency Control Program.
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. <u>OR</u> Verify battery connection resistance is $\leq 40 \times 10^{-6}$ ohms.	In accordance with the Surveillance Frequency Control Program.
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that could potentially degrade battery performance.	In accordance with the Surveillance Frequency Control Program.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.4.4 REMOVE Remove visible corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p>
<p>SR 3.8.4.5 VERIFY Verify battery connection resistance is $\leq 40 \text{ E-6 ohms}$.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p>
<p>SR 3.8.4.6 Verify each required battery charger supplies ≥ 200 amps at <u>greater than or equal to 125 V for the minimum established float voltage for</u> ≥ 4 hours.</p> <p><u>OR</u></p> <p><u>Verify each battery charger can recharge the battery to the fully charged state within 20 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.</u></p>	<p>In accordance with the Surveillance Frequency Control Program.</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.4.7 -----NOTES-----</p> <ol style="list-style-type: none"> 1. SR 3.8.4.8 may be performed in lieu of the service test in SR 3.8.4.7 when SR 3.8.4.8 envelops the duty cycle of the battery. The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.7. 2. This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.4.8 DELETED ----- NOTE ----- This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR.</p> <hr/> <p>Verify battery capacity is \geq 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p> <p>AND</p> <p>12 months when battery shows degradation or has reached 85% of expected life with capacity $<$ 100% of manufacturer's rating</p> <p>AND</p> <p>24 months when battery has reached 85% of the expected life with capacity \geq 100% of manufacturer's rating</p>

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources – Shutdown

- LCO 3.8.5 The following DC electrical power subsystems shall be OPERABLE:
- a. Unit 2 DC electrical power subsystems needed to support the DC electrical power distribution subsystem(s) required by LCO 3.8.8, "Distribution Systems – Shutdown"; and
 - b. Unit 3 DC electrical power subsystems needed to support the DC electrical power distribution subsystem(s) required by LCO 3.8.8, "Distribution Systems – Shutdown."

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

ACTIONS

-----NOTE-----
LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
<u>A. One battery charger on one subsystem inoperable.</u> <u>AND</u> <u>The redundant subsystem battery and chargers OPERABLE.</u>	<u>A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.</u>	<u>2 hours</u>
	<u>AND</u>	
	<u>A.2 Verify battery float current < 2 amps.</u>	<u>Once per 12 hours</u>
	<u>AND</u>	
	<u>A.3 Restore battery charger to OPERABLE status.</u>	<u>72 hours</u>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. (continued)</p> <p><u>AB. One or more required DC electrical power subsystems inoperable for reasons other than condition A.</u></p> <p><u>OR</u></p> <p><u>Required actions and associated completion time of condition A not met.</u></p>	<p><u>AB.1 Declare affected required feature(s) inoperable.</u></p> <p><u>OR</u></p> <p><u>AB.2.1 Suspend CORE ALTERATIONS.</u></p> <p><u>AND</u></p> <p><u>AB.2.2 Suspend movement of irradiated fuel assemblies in the secondary containment.</u></p> <p><u>AND</u></p> <p><u>AB.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel.</u></p> <p><u>AND</u></p> <p><u>AB.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.</u></p>	<p><u>Immediately</u></p> <p><u>Immediately</u></p> <p><u>Immediately</u></p> <p><u>Immediately</u></p> <p><u>Immediately</u></p> <p><u>Immediately</u></p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.8.5.1 -----NOTE----- The following SRs are not required to be performed: SR 3.8.4.7 6 and SR 3.8.4.8 7. -----</p> <p>For required Unit 2 DC electrical power subsystems, the following SRs are applicable:</p> <p>SR 3.8.4.1 SR 3.8.4.4 SR 3.8.4.7 SR 3.8.4.2 SR 3.8.4.5 SR 3.8.4.8 SR 3.8.4.3 SR 3.8.4.6</p>	<p>In accordance with applicable SRs</p>
<p>SR 3.8.5.2 -----NOTE----- When Unit 3 is in MODE 4 or 5, or moving irradiated fuel assemblies in the secondary containment, the Note to Unit 3 SR 3.8.5.1 is applicable. -----</p> <p>For required Unit 3 DC electrical power subsystems, the SRs of Unit 3 Specification 3.8.4 are applicable.</p>	<p>In accordance with applicable SRs</p>

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Cell Parameters

LCO 3.8.6 Battery cell parameters for the station electrical power subsystem batteries shall be within the limits of ~~Table 3.8.6-1.~~

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

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One or more batteries with one or more battery cell parameters not within Category A or B limits. One battery on one subsystem with one or more battery cells float voltage < 2.07.</p>	<p>A.1 Verify pilot cells electrolyte level and float voltage meet Table 3.8.6-1 Category C limits. Perform SR 3.8.4.1</p>	<p>± 2 hour</p>
	<p>AND</p> <p>A.2 Verify battery cell parameters meet Table 3.8.6-1 Category C limits. Perform SR 3.8.6.1</p>	<p>4 2 hours</p> <p>AND</p> <p>Once per 7 days thereafter</p>
	<p>AND</p> <p>A.3 Restore battery cell parameters to Category A and B limits of Table 3.8.6-1. Restore affected cell float voltage > 2.07 V.</p>	<p>31 days 24 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. Required Action and associated Completion Time of Condition A not met.</p> <p>OR</p> <p>One or more batteries with average electrolyte temperature of the representative cells not within limits.</p> <p>OR</p> <p>One or more batteries with one or more battery cell parameters not within Category C limits. One battery on one subsystem with float current > 2 amps.</p>	<p>B.1 <u>Declare associated battery inoperable. Perform SR 3.8.4.1.</u></p> <p>AND</p> <p>B.2 <u>Restore battery float current to < 2 amps.</u></p>	<p>Immediately 2 hours</p> <p>12 hours</p>
<p>-----NOTE----- Required Action C.2 shall be completed if electrolyte level was below the top of plates. -----</p> <p>C. <u>One battery on one subsystem with one or more cells electrolyte level less than minimum established design limits.</u></p>	<p>-----NOTE----- Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates. -----</p> <p>C.1 <u>Restore affected cell electrolyte level to above the top of plates.</u></p> <p>AND</p> <p>C.2 <u>Verify no evidence of leakage.</u></p> <p>AND</p> <p>C.3 <u>Restore electrolyte level to greater than or equal to minimum established design limits.</u></p>	<p>8 hours</p> <p>12 hours</p> <p>31 days</p>

(continued)

ACTIONS (continued)

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.8.6.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits. ----- NOTE Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. ----- <u>Verify each battery float current is < 2 amps.</u></p>	<p>In accordance with the Surveillance Frequency Control Program</p>
<p>SR 3.8.6.2 Verify each battery cell meets Table 3.8.6-1 Category B limits. Verify each battery pilot cell float voltage is > 2.07.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p> <p><u>AND</u></p> <p>Once within 24 hours after battery discharge < 100 V</p> <p><u>AND</u></p> <p>Once within 24 hours after battery overcharge > 145 V</p>
<p>SR 3.8.6.3 Verify average electrolyte temperature of representative cells is ≥ 40°F. Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

<u>SURVEILLANCE</u>	<u>FREQUENCY</u>
<u>SR 3.8.6.4</u> <u>Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.</u>	<u>In accordance with the Surveillance Frequency Control Program</u>
<u>SR 3.8.6.5</u> <u>Verify each battery cell float voltage is > 2.07 V.</u>	<u>In accordance with the Surveillance Frequency Control Program</u>
<u>SR 3.8.6.6</u> -----NOTE----- <u>This Surveillance shall not be performed in MODE 1, 2, 3. However credit may be taken for unplanned events that satisfy this SR.</u> <u>Verify battery capacity is > 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.</u>	<u>In accordance with the Surveillance Frequency Control Program</u> <u>AND</u> <u>12 months when battery shows degradation or has reached 85% of the expected life with capacity < 100% of manufacturer's rating</u> <u>AND</u> <u>24 months when battery has reached 85% of the expected life with capacity > 100% of manufacturer's rating</u>

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

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMIT FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and $\leq \frac{1}{2}$ inch above maximum level indication mark (a)	> Minimum level indication mark, and $\leq \frac{1}{2}$ inch above maximum level indication mark (a)	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity (b)(c)	≥ 1.195	≥ 1.195 <u>AND</u> Average of all connected cells > 1.205	Not more than 0.020 below average of all connected cells <u>AND</u> Average of all connected cells ≥ 1.190

- (a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during equalizing charges provided it is not overflowing.
- (b) Corrected for electrolyte temperature and level. Level correction is not required, however, when on float charge and battery charging current is < 1 amp.
- (c) A battery charging current of < 1 amp when on float charge is acceptable for meeting specific gravity limits following a battery recharge for: 1) a maximum of 30 days if a deep discharge did not occur; and 2) a maximum of 180 days if a deep discharge did occur. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to the expiration of the applicable allowance.

5.5 Programs and Manuals

5.5.15 Battery Monitoring and Maintenance Program

This Program provides controls for battery restoration and maintenance. The program shall be in accordance with IEEE Standard (Std) 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," as endorsed by Regulatory Guide 1.129, Revision 2 (RG), with RG exceptions and program provisions as identified below:

- a. The program allows the following RG 1.129, Revision 2 exceptions:
 1. Battery temperature correction may be performed before or after conducting discharge tests.
 2. RG 1.129, Regulatory Position 1, Subsection 2, "References," is not applicable to this program.
 3. In lieu of RG 1.129, Regulatory Position 2, Subsection 5.2, "Inspections," the following shall be used: "Where reference is made to the pilot cell, pilot cell selection shall be based on the lowest voltage cell in the battery."
 4. In Regulatory Guide 1.129, Regulatory Position 3, Subsection 5.4.1, "State of Charge Indicator," the following statements in paragraph (d) may be omitted: "When it has been recorded that the charging current has stabilized at the charging voltage for three consecutive hourly measurements, the battery is near full charge. These measurements shall be made after the initially high charging current decreases sharply and the battery voltage rises to approach the charger output voltage."
 5. In lieu of RG 1.129, Regulatory Position 7, Subsection 7.6, "Restoration," the following may be used: "Following the test, record the float voltage of each cell of the string."
- b. The program shall include the following provisions:

5.5 Programs and Manuals

5.5.15 Battery Monitoring and Maintenance Program (continued)

1. Actions to restore battery cells with float voltage < 2.13 V;
2. Actions to determine whether the float voltage of the remaining battery cells is > 2.07 V when the float voltage of a battery cell has been found to be < 2.13 V;
3. Actions to equalize and test battery cells that had been discovered with electrolyte level below the top of the plates;
4. Limits on average electrolyte temperature, battery connection resistance, and battery terminal voltage; and
5. A requirement to obtain specific gravity readings of all cells at each discharge test, consistent with manufacturer recommendations.

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources – Operating

- LCO 3.8.4 The following DC electrical power subsystems shall be OPERABLE:
- a. Unit 3 Division I and Division II DC electrical power subsystems; and
 - b. Unit 2 Division I and Division II DC electrical power subsystems.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One Unit 2 DC electrical power subsystem inoperable due to performance of SR 3.8.4.7 or SR 3.8.4.8.6.6</p>	<p>-----NOTE----- Enter applicable Conditions and Required Actions of LCO 3.8.7, "Distribution Systems – Operating," when Condition A results in de-energization of a Unit 3 4 kV emergency bus or de-energization of a Unit 2 DC bus. -----</p> <p>A.1 Restore Unit 2 DC electrical power subsystem to OPERABLE status.</p>	<p>7 days</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. One Unit 2 DC electrical power subsystem inoperable for reasons other than Condition A.</p>	<p>-----NOTE----- Enter applicable Conditions and Required Actions of LCO 3.8.7, "Distribution Systems-Operating," when Condition B results in de-energization of a Unit 3 4 kV emergency bus. -----</p> <p>B.1 Restore Unit 2 DC electrical power subsystem to OPERABLE status.</p>	<p>12 hours</p>
<p><u>C. One battery charger on one subsystem inoperable.</u></p>	<p><u>C.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.</u></p> <p><u>AND</u></p> <p><u>C.2 Verify battery float current < 2 amps.</u></p> <p><u>AND</u></p> <p><u>C.3 Restore battery charger to OPERABLE status.</u></p>	<p><u>2 hours</u></p> <p><u>Once per 12 hours</u></p> <p><u>72 hours</u></p>
<p><u>D. One battery on one subsystem inoperable.</u></p>	<p><u>D.1 Restore battery to OPERABLE status.</u></p>	<p><u>2 hours</u></p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p><u>EE</u>. <u>One Unit 2 DC electrical power subsystem inoperable. For reasons other than conditions C, or D.</u></p>	<p><u>EE.1</u> Restore Unit 2 DC electrical power subsystem to OPERABLE status.</p>	<p>2 hours</p>
<p><u>EF</u>. Required Action and Associated Completion Time of Condition A, B, C, <u>D</u>, or <u>E</u> not met.</p>	<p><u>EF.1</u> Be in MODE 3. <u>AND</u> <u>F.2</u> <u>Be in MODE 4.</u></p>	<p>12 hours <u>36 hours</u></p>
<p><u>EG</u>. Two or more inoperable DC electrical power subsystems.</p>	<p><u>EG.1</u> Enter LCO 3.0.3.</p>	<p>Immediately</p>

SURVEILLANCE REQUIREMENTS

-----NOTE-----
 SR 3.8.4.1 through SR 3.8.4.8 are applicable only to the Unit 3 DC electrical power subsystems. SR 3.8.4.9 is applicable only to the Unit 2 DC electrical power subsystems.

SURVEILLANCE	FREQUENCY
SR 3.8.4.1 Verify battery terminal voltage is ≥ 123.5 V on float charge greater than or equal to the minimum established float voltage.	In accordance with the Surveillance Frequency Control Program.
SR 3.8.4.2 VERIFY Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance is $\leq 40 \times 10^{-6}$ ohms.	In accordance with the Surveillance Frequency Control Program.
SR 3.8.4.3 VERIFY Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that could potentially degrade battery performance.	In accordance with the Surveillance Frequency Control Program.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.4.4 REMOVE Remove visible corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p>
<p>SR 3.8.4.5 VERIFY Verify battery connection resistance is $\leq 40 \text{ E-6 ohms}$.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p>
<p>SR 3.8.4.6 Verify each required battery charger supplies ≥ 200 amps at <u>greater than or equal to 125 V for the minimum established float voltage for</u> ≥ 4 hours.</p> <p><u>OR</u></p> <p><u>Verify each battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.</u></p>	<p>In accordance with the Surveillance Frequency Control Program.</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.4.7 -----NOTES-----</p> <p>1. SR 3.8.4.8 may be performed in lieu of the service test in SR 3.8.4.7 when SR 3.8.4.8 envelops the duty cycle of the battery. The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.7.</p> <p>2. This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR.</p> <p>-----</p> <p>Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.4.8 DELETED ----- NOTE ----- This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR.</p> <hr/> <p>Verify battery capacity is \geq 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.</p>	<p>In accordance with the Surveillance Frequency Control Program.</p> <p>AND</p> <p>12 months when battery shows degradation or has reached 85% of expected life with capacity $<$ 100% of manufacturer's rating</p> <p>AND</p> <p>24 months when battery has reached 85% of the expected life with capacity \geq 100% of manufacturer's rating</p>

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources – Shutdown

- LCO 3.8.5 The following DC electrical power subsystems shall be OPERABLE:
- a. Unit 3 DC electrical power subsystems needed to support the DC electrical power distribution subsystem(s) required by LCO 3.8.8, "Distribution Systems–Shutdown"; and
 - b. Unit 2 DC electrical power subsystems needed to support the DC electrical power distribution subsystem(s) required by LCO 3.8.8, "Distribution Systems–Shutdown."

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

ACTIONS

-----NOTE-----
LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
<u>A. One battery charger on one subsystem inoperable.</u> <u>AND</u> <u>The redundant subsystem battery and chargers OPERABLE.</u>	<u>A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.</u>	<u>2 hours</u>
	<u>AND</u>	
	<u>A.2 Verify battery float current < 2 amps.</u>	<u>Once per 12 hours</u>
	<u>AND</u>	
	<u>A.3 Restore battery charger to OPERABLE status.</u>	<u>72 hours</u>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. (continued)</p> <p><u>AB. One or more required DC electrical power subsystems inoperable for reasons other than condition A.</u></p> <p><u>OR</u></p> <p><u>Required actions and associated completion time of condition A not met.</u></p>	<p><u>AB.1 Declare affected required feature(s) inoperable.</u></p> <p><u>OR</u></p> <p><u>AB.2.1 Suspend CORE ALTERATIONS.</u></p> <p><u>AND</u></p> <p><u>AB.2.2 Suspend movement of irradiated fuel assemblies in the secondary containment.</u></p> <p><u>AND</u></p> <p><u>AB.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel.</u></p> <p><u>AND</u></p> <p><u>AB.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.</u></p>	<p><u>Immediately</u></p> <p><u>Immediately</u></p> <p><u>Immediately</u></p> <p><u>Immediately</u></p> <p><u>Immediately</u></p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.8.5.1 -----NOTE----- The following SRs are not required to be performed: SR 3.8.4.7 6 and SR 3.8.4.8. 7. ----- For required Unit 3 DC electrical power subsystems, the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.4 SR 3.8.4.7 SR 3.8.4.2 SR 3.8.4.5 SR 3.8.4.8. SR 3.8.4.3 SR 3.8.4.6</p>	<p>In accordance with applicable SRs</p>
<p>SR 3.8.5.2 -----NOTE----- When Unit 2 is in MODE 4 or 5, or moving irradiated fuel assemblies in the secondary containment, the Note to Unit 2 SR 3.8.5.1 is applicable. ----- For required Unit 2 DC electrical power subsystems, the SRs for Unit 2 Specification 3.8.4 are applicable.</p>	<p>In accordance with applicable SRs</p>

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Cell Parameters

LC0 3.8.6 Battery cell parameters for the station electrical power subsystem batteries shall be within the limits of ~~Table 3.8.6-1.~~

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

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more batteries with one or more battery cell parameters not within Category A or B limits. One battery on one subsystem with one or more battery cells float voltage < 2.07.	A.1 Verify pilot cells electrolyte level and float voltage meet Table 3.8.6-1 Category C limits. Perform SR 3.8.4.1	± 2 hour
	AND	
	A.2 Verify battery cell parameters meet Table 3.8.6-1 Category C limits. Perform SR 3.8.6.1	4 2 hours AND Once per 7 days thereafter
AND		
	A.3 Restore battery cell parameters to Category A and B limits of Table 3.8.6-1. Restore affected cell float voltage > 2.07 V.	31 days 24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. Required Action and associated Completion Time of Condition A not met.</p> <p>OR</p> <p>One or more batteries with average electrolyte temperature of the representative cells not within limits.</p> <p>OR</p> <p>One or more batteries with one or more battery cell parameters not within Category C limits. One battery on one subsystem with float current > 2 amps.</p>	<p>B.1 Declare associated battery inoperable. Perform SR 3.8.4.1.</p> <p>AND</p> <p>B.2 Restore battery float current to < 2 amps.</p>	<p>Immediately 2 hours</p> <p>12 hours</p>
<p>-----NOTE----- Required Action C.2 shall be completed if electrolyte level was below the top of plates. -----</p> <p>C. One battery on one subsystem with one or more cells electrolyte level less than minimum established design limits.</p>	<p>-----NOTE----- Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates. -----</p> <p>C.1 Restore affected cell electrolyte level to above the top of plates.</p> <p>AND</p> <p>C.2 Verify no evidence of leakage.</p> <p>AND</p> <p>C.3 Restore electrolyte level to greater than or equal to minimum established design limits.</p>	<p>8 hours</p> <p>12 hours</p> <p>31 days</p>

(continued)

ACTIONS (continued)

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.8.6.1 Verify battery cell parameters meet Table 3.8.6-1 Category A limits. ----- NOTE ----- Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. ----- <u>Verify each battery float current is < 2 amps.</u></p>	<p>In accordance with the Surveillance Frequency Control Program.</p>
<p>SR 3.8.6.2 Verify each battery cell meets Table 3.8.6-1 Category B limits. <u>Verify each battery pilot cell float voltage is > 2.07.</u></p>	<p>In accordance with the Surveillance Frequency Control Program.</p> <p><u>AND</u></p> <p>Once within 24 hours after battery discharge < 100 V</p> <p><u>AND</u></p> <p>Once within 24 hours after battery overcharge > 145 V</p>
<p>SR 3.8.6.3 Verify average electrolyte temperature of representative cells is \geq 40°F. <u>Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.</u></p>	<p>In accordance with the Surveillance Frequency Control Program.</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

<u>SURVEILLANCE</u>	<u>FREQUENCY</u>
<p>SR 3.8.6.4 <u>Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.</u></p>	<p><u>In accordance with the Surveillance Frequency Control Program</u></p>
<p>SR 3.8.6.5 <u>Verify each battery cell float voltage is > 2.07 V.</u></p>	<p><u>In accordance with the Surveillance Frequency Control Program</u></p>
<p>SR 3.8.6.6 -----NOTE----- <u>This Surveillance shall not be performed in MODE 1, 2, 3. However credit may be taken for unplanned events that satisfy this SR.</u> <u>Verify battery capacity is > 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.</u></p>	<p><u>In accordance with the Surveillance Frequency Control Program</u></p> <p><u>AND</u></p> <p><u>12 months when battery shows degradation or has reached 85% of the expected life with capacity < 100% of manufacturer's rating</u></p> <p><u>AND</u></p> <p><u>24 months when battery has reached 85% of the expected life with capacity > 100% of manufacturer's rating</u></p>

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

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMIT FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ ½ inch above maximum level indication mark^(a)	> Minimum level indication mark, and ≤ ½ inch above maximum level indication mark^(a)	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity^{(b)(c)}	≥ 1.195	≥ 1.195 <u>AND</u> Average of all connected cells ≥ 1.205	Not more than 0.020 below average of all connected cells - <u>AND</u> Average of all connected cells ≥ 1.190

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

~~(b) Corrected for electrolyte temperature and level. Level correction is not required, however, when on float charge and battery charging current is < 1 amp.~~

~~(c) A battery charging current of < 1 amp when on float charge is acceptable for meeting specific gravity limits following a battery recharge for: 1) a maximum of 30 days if a deep discharge did not occur; and 2) a maximum of 180 days if a deep discharge did occur. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to the expiration of the applicable allowance.~~

5.5 Programs and Manuals

5.5.15 Battery Monitoring and Maintenance Program

This Program provides controls for battery restoration and maintenance. The program shall be in accordance with IEEE Standard (Std) 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," as endorsed by Regulatory Guide 1.129, Revision 2 (RG), with RG exceptions and program provisions as identified below:

- a. The program allows the following RG 1.129, Revision 2 exceptions:
1. Battery temperature correction may be performed before or after conducting discharge tests.
 2. RG 1.129, Regulatory Position 1, Subsection 2, "References," is not applicable to this program.
 3. In lieu of RG 1.129, Regulatory Position 2, Subsection 5.2, "Inspections," the following shall be used: "Where reference is made to the pilot cell, pilot cell selection shall be based on the lowest voltage cell in the battery."
 4. In Regulatory Guide 1.129, Regulatory Position 3, Subsection 5.4.1, "State of Charge Indicator," the following statements in paragraph (d) may be omitted: "When it has been recorded that the charging current has stabilized at the charging voltage for three consecutive hourly measurements, the battery is near full charge. These measurements shall be made after the initially high charging current decreases sharply and the battery voltage rises to approach the charger output voltage."
 5. In lieu of RG 1.129, Regulatory Position 7, Subsection 7.6, "Restoration," the following may be used: "Following the test, record the float voltage of each cell of the string."
- b. The program shall include the following provisions:

5.5 Programs and Manuals

5.5.15 Battery Monitoring and Maintenance Program (continued)

1. Actions to restore battery cells with float voltage < 2.13 V;
2. Actions to determine whether the float voltage of the remaining battery cells is > 2.07 V when the float voltage of a battery cell has been found to be < 2.13 V;
3. Actions to equalize and test battery cells that had been discovered with electrolyte level below the top of the plates;
4. Limits on average electrolyte temperature, battery connection resistance, and battery terminal voltage; and
5. A requirement to obtain specific gravity readings of all cells at each discharge test, consistent with manufacturer recommendations.

ATTACHMENT 3

Markup of Technical Specifications Bases Pages (For Information Only)

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278

Revised Technical Specifications Bases Pages

Unit 2 TS Bases Pages

B 3.8-59	B 3.8-64a*	B 3.8-71	B 3.8-78	B 3.8-81
B 3.8-59a*	B 3.8-65	B 3.8-74	B 3.8-78a*	B 3.8-82
B 3.8-60	B 3.8-66	B 3.8-75	B 3.8-78b*	B 3.8-82a*
B 3.8-60a*	B 3.8-67	B 3.8-75a*	B 3.8-78c*	B 3.8-82b*
B 3.8-63	B 3.8-67a*	B 3.8-75b*	B 3.8-78d*	B 3.8-82c*
B 3.8-63a*	B 3.8-68	B 3.8-76	B 3.8-79	
B 3.8-63b*	B 3.8-69	B 3.8-77	B 3.8-79a*	
B 3.8-64	B 3.3-70	B 3.8-77a*	B 3.8-80	

Unit 3 TS Bases Pages

B 3.8-59	B 3.8-64a*	B 3.8-71	B 3.8-78	B 3.8-81
B 3.8-59a*	B 3.8-65	B 3.8-74	B 3.8-78a*	B 3.8-82
B 3.8-60	B 3.8-66	B 3.8-75	B 3.8-78b*	B 3.8-82a*
B 3.8-60a*	B 3.8-67	B 3.8-75a*	B 3.8-78c*	B 3.8-82b*
B 3.8-63	B 3.8-67a*	B 3.8-75b*	B 3.8-78d*	B 3.8-82c*
B 3.8-63a*	B 3.8-68	B 3.8-76	B 3.8-79	
B 3.8-63b*	B 3.8-69	B 3.8-77	B 3.8-79a*	
B 3.8-64	B 3.3-70	B 3.8-77a*	B 3.8-80	

* Anticipated new pages, subject to change when clean pages are submitted and repagination is completed.

BASES

BACKGROUND
(continued)

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC loads are powered from the batteries.

The DC power distribution system is described in more detail in Bases for LCO 3.8.7, "Distribution System–Operating," and LCO 3.8.8, "Distribution System–Shutdown."

~~Each battery has adequate storage capacity to carry the required load continuously for approximately 2 hours.~~

Each of the unit's two DC electrical power divisions, consisting of two 125 V batteries in series, four battery chargers (two normally inservice chargers and two spare chargers), and the corresponding control equipment and interconnecting cabling, is separately housed in a ventilated room apart from its chargers and distribution centers. Each division is separated electrically from the other division to ensure that a single failure in one division does not cause a failure in a redundant division. There is no sharing between redundant Class 1E divisions such as batteries, battery chargers, or distribution panels.

~~Each battery has adequate storage capacity to meet the duty cycle(s) discussed in the UFSAR, Chapter 8 (Ref 7). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.~~

The batteries for 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 105% design demand. ~~The minimum design voltage limit is 105/210 V. The minimum design voltage for sizing the battery using the methodology in IEEE 485 (Ref. 3) is based on a traditional 1.81 volts per cell at the end of a 2 hour load profile. The battery terminal voltage using 1.81 volts per cell is 105 V. Using the LOOP/LOCA load profile, the predicted value of the battery terminals is greater than 105 VDC at the end of the profile. Many 1E loads operate exclusively at the beginning of the profile and require greater than the design minimum terminal voltage. The analyzed voltage of the distribution panels and the MCCs is greater than that required during the LOOP/LOCA to support the operation of the 1E loads during the time period they are required to operate.~~

(continued)

BASES

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 120 V for a 58 cell battery (i.e., cell voltage of 2.07 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage > 2.07 Vpc, the battery cell will maintain its capacity for 30 days without further charging. Optimal long term performance however, is obtained by maintaining a float voltage 2.23 to 2.27 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.25 Vpc corresponds to a total float voltage output of 130.5 V for a 58 cell battery as discussed in the UFSAR, Chapter 8 (Ref. 7).

Each required battery charger of DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery

(continued)

BASES

BACKGROUND
(continued)

bank fully charged. Each battery charger has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 20 hours while supplying normal steady state loads following a LOCA coincident with a loss of offsite power.

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

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

A description of the Unit 3 DC power sources is provided in the Bases for Unit 3 LCO 3.8.4, "DC Sources – Operating."

(continued)

BASES

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 14 (Ref. 1), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources OPERABLE during accident conditions in the event of:

- a. An assumed loss of all offsite AC power or all onsite AC power; and
- b. A worst case single failure.

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

LCO

The Unit 2 Division I and Division II DC electrical power subsystems, with each DC subsystem consisting of two 125 V station batteries in series, two battery chargers (one per battery), and the corresponding control equipment and interconnecting cabling supplying power to the associated bus, are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an abnormal operational transient or a postulated DBA. In addition, DC control power (which provides control power for the 4 kV load circuit breakers and the feeder breakers to the 4 kV emergency bus) for two of the four 4 kV emergency buses, as well as control power for two of the diesel generators, is provided by the Unit 3 DC electrical power subsystems. Therefore, Unit 3 Division I and Division II DC electrical power subsystems are also required to be OPERABLE. A Unit 3

(continued)

BASES

ACTIONS

B.1 (continued)

If one of the Unit 3 DC electrical power subsystems is inoperable for reasons other than Condition A, the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in a loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 12 hours. The 12 hour Completion Time reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and takes into consideration the importance of the Unit 3 DC electrical power subsystem.

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

Condition C represents one subsystem with one battery charger inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). Condition C is exited when the standby battery charger is placed in service within two hours. However, if both the operating and standby battery chargers are inoperable, the ACTIONS must be completed while the alternate battery charger is in service. The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action C.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action C.2) from any discharge that might have occurred due to the charger inoperability.

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

(continued)

BASES

ACTIONS

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

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

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

Required Action C.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it is now fully capable of supplying the maximum expected load requirement. The 2 amp value is based on returning the battery to 98% charge and assumes a 5% design margin for the battery. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action C.3 limits the restoration time for the inoperable battery charger to 72 hours. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 72 hour Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

(continued)

BASES

ACTIONS

D.1 (continued)

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

EE.1

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

If one of the Unit 2 DC electrical power subsystems is inoperable for reasons other than conditions C, or D, (e.g., inoperable battery/batteries, inoperable required battery charger/chargers, or inoperable required battery charger/chargers and associated inoperable battery/batteries), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could result in the loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is consistent with Regulatory Guide 1.93 (Ref. 4) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power division and, if the Unit 2 DC electrical power division is not restored to OPERABLE status, to prepare to initiate an orderly and safe unit shutdown. The 2 hour limit is also consistent with the allowed time for an inoperable Unit 2 DC Distribution System Subsystem.

(continued)

BASES

ACTIONS
(continued)

DF.1

If the DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the overall plant risk is minimized. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and to MODE 4 within 36 hours. Remaining in the Applicability of the LCO is acceptable because the plant risk in MODE 3 is similar to or lower than the risk in MODE 4 (Ref. 6) and because the time spent in MODE 3 to perform the necessary repairs to restore the system to OPERABLE status will be short. However, voluntary entry into MODE 4 may be made as it is also an acceptable low-risk state. The allowed Completion Time is reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The completion time to bring the unit to MODE 4 is consistent with the time required in Regulatory Guide 1.93 (Ref. 4).

EG.1

Condition EG corresponds to a level of degradation in the DC electrical power subsystems that causes a required safety function to be lost. When more than one DC source is lost, this results in a loss of a required function, thus the plant is in a condition outside the accident analysis. Therefore, no additional time is justified for continued operation. LCO 3.0.3 must be entered immediately to commence a controlled shutdown.

SURVEILLANCE
REQUIREMENTS

As Noted at the beginning of the SRs, SR 3.8.4.1 through SR 3.8.4.8 are applicable only to the Unit 2 DC electrical power subsystems and SR 3.8.4.9 is applicable only to the Unit 3 DC electrical power subsystems.

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the ~~charging system and the ability of the batteries to perform their intended function~~ battery chargers, which support the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.1 (continued)

internal losses of a battery ~~(or battery cell)~~ and maintain the battery ~~(or a battery cell)~~ in a fully charged state while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum established float voltage (2.13 Vpc times the number of connected cells or 123.5 V for a 58 cell battery at the battery terminals). This voltage maintains the battery plates in a condition that supports maintaining the grid life.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.1 (continued)

~~based on the minimum cell voltage that will maintain a charged cell. This is consistent with the assumptions in the battery sizing calculations. The SR must be performed unless the battery is on equalize charge or has been on equalize charge any time during the previous 1 day. This allows the routine frequency to be extended until such a time that the SR can be properly performed and meaningful results obtained. The surveillance frequency is applicable and continues during the time that the battery is on equalize with the exception that the surveillance does not need to be performed if the battery has been on equalize during the previous 1 day. The additional 1 day allows time for battery voltage to return to normal after the equalize charge and time to perform the test. The intent of the Note is to allow orderly, yet prompt performance of the surveillance that will produce meaningful results once the equalize charge is complete. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.8.4.2

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

~~The battery connection resistance limits are established to maintain connection resistance as low as reasonably possible to minimize the overall voltage drop across the battery, and the possibility of battery damage due to heating of connections.~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.8.4.3

~~DELETED Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical damage or deterioration does not necessarily represent a failure of~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.3 (continued)

~~this SR, provided an evaluation determines that the physical damage or deterioration does not affect the OPERABILITY of the battery (its ability to perform its design function).~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.8.4.4 and SR 3.8.4.5

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

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

~~The battery connection resistance limits are established to maintain connection resistance as low as reasonably possible to minimize the overall voltage drop across the battery, and the possibility of battery damage due to heating of connections.~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.8.4.6

~~Battery charger capability requirements are based on This SR verifies the design capacity of the battery chargers. The minimum charging capacity requirement is based on the capacity to maintain the associated battery in its fully charged condition, and to restore the battery to its fully~~

~~(continued)~~

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.6 (continued)

charged condition following the worst case design discharge while supplying normal steady state loads. The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying 200 amps at the minimum established float voltage for 4 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

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

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.4.7

A battery service test is a special test of the battery's capability, as found, to satisfy the design requirements (battery duty cycle) of the DC Electrical Power System. The discharge rate and test length corresponds to the design duty cycle requirements.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.7 (continued)

This SR is modified by two Notes. Note 1 allows performance of ~~either~~ a modified performance discharge test ~~or a performance discharge test (described in the Bases for SR 3.8.4.8) in lieu of a service test,~~ provided the test performed envelops the duty cycle of the battery. This substitution is acceptable because as long as the test current is greater than or equal to the actual duty cycle of the battery, SR 3.8.4.8 represents a more severe test of battery capacity than a service test. —

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.7 (continued)

The reason for Note 2 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the Electrical Distribution System, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance.

SR 3.8.4.8

~~DELETED A battery performance discharge test is a test of the constant current capacity of a battery, performed between 3 and 30 days after an equalize charge of the battery, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.~~

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

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

~~Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, the discharge test may be~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTSSR 3.8.4.8 (continued)

~~used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time only if the test envelops the duty cycle of the battery.~~

~~The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 5) and IEEE-485 (Ref. 3). 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.~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity \geq 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 5), 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. If the rate of discharge varies significantly from the previous discharge test, the absolute battery capacity may change significantly, resulting in a capacity drop exceeding the criteria specified above. This absolute battery capacity change could be a result of acid concentration in the plate material, which is not an indication of degradation. Therefore, results of tests with significant rate differences should be discussed with the vendor and evaluated to determine if degradation has occurred. All these Frequencies, with the exception of the 24 month Frequency, are consistent with the recommendations in IEEE-450 (Ref. 5). The 24 month Frequency is acceptable, given the battery has shown no signs of degradation, the unit conditions required to perform the test and other requirements existing to ensure battery performance during these 24 month intervals. In addition, the 24 month Frequency is intended to be consistent with expected fuel cycle lengths.~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.8 (continued)

~~This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance. The DC batteries of the other unit are exempted from this restriction since they are required to be OPERABLE by both units and the Surveillance cannot be performed in the manner required by the Note without resulting in a dual unit shutdown.~~

SR 3.8.4.9

With the exception of this Surveillance, all other Surveillances of this Specification (SR 3.8.4.1 through SR 3.8.4.8) are applied only to the Unit 2 DC electrical power subsystems. This Surveillance is provided to direct that the appropriate Surveillances for the required Unit 3 DC electrical power subsystems are governed by the Unit 3 Technical Specifications. Performance of the applicable Unit 3 Surveillances will satisfy Unit 3 requirements, as well as satisfying this Unit 2 Surveillance Requirement.

The Frequency required by the applicable Unit 3 SR also governs performance of that SR for Unit 2. As Noted, if Unit 3 is in MODE 4 or 5, or moving irradiated fuel assemblies in the secondary containment, the Note to Unit 3 SR 3.8.5.1 is applicable. This ensures that a Unit 2 SR will not require a Unit 3 SR to be performed, when the Unit 3 Technical Specifications exempts performance of a Unit 3 SR. (However, as stated in the Unit 3 SR 3.8.5.1 Note, while performance of the SR is exempted, the SR still must be met.)

REFERENCES

1. UFSAR Chapter 14.
2. "Proposed IEEE Criteria for Class 1E Electrical Systems for Nuclear Power Generating Stations," June 1969.
3. IEEE Standard 485, 1983.

(continued)

BASES

REFERENCES
(continued)

4. Regulatory Guide 1.93, December 1974.
 5. IEEE Standard 450, 19872002.
 6. NEDC-32988-A, Revision 2, Technical Justification to Support Risk-Informed Modification to Selected Required End States for BWR Plants, December 2002.
 7. UFSAR, Chapter 8.
-

BASES

APPLICABILITY
(continued)

- b. Required features needed to mitigate a fuel handling accident are available;
- c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and
- d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

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

ACTIONS

LCO 3.0.3 is not applicable while in MODE 4 or 5. However, since irradiated fuel assembly movement can occur in MODE 1, 2, or 3, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 4 or 5, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

~~A.1, A.2.1, A.2.2, A.2.3, and A.2.4~~ A.2, and A.3

~~If more than one DC distribution subsystem is required according to LCO 3.8.8, the DC electrical power subsystems remaining OPERABLE with one or more DC electrical power subsystems inoperable may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel.~~

~~By allowance of the option to declare required features inoperable with associated DC electrical power subsystems inoperable, appropriate restrictions are implemented in accordance with the affected system LCOs' ACTIONS. However, in many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies in secondary containment, and any activities that could result in inadvertent draining of the reactor vessel).~~

(continued)

BASES

ACTIONS

~~A.1, A.2.1, A.2.2, A.2.3, and A.2.4~~ A.2, and A.3 (continued)

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

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

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

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

(continued)

BASES

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, and A.2.4 A.2, and A.3 (continued)

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

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

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

Required Action A.3 limits the restoration time for the inoperable battery charger to 72 hours. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 72 hour Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

(continued)

BASES

ACTIONS

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

If more than one DC distribution subsystem is required according to LCO 3.8.8, the DC subsystems remaining OPERABLE with one or more DC power sources inoperable may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. By allowance of the option to declare required features inoperable with associated DC power sources inoperable, appropriate restrictions are implemented in accordance with the affected system LCOs' ACTIONS. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and any activities that could result in inadvertent draining of the reactor vessel).

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

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

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.8.7. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

SR 3.8.5.2

This Surveillance is provided to direct that the appropriate Surveillances for the required Unit 3 DC electrical power subsystems are governed by the Unit 3 Technical Specifications. Performance of the applicable Unit 3 Surveillances will satisfy Unit 3 requirements, as well as satisfying this Unit 2 Surveillance Requirement. The Frequency required by the applicable Unit 3 SR also governs performance of that SR for Unit 2.

As Noted, if Unit 3 is in MODE 4 or 5, or moving irradiated fuel assemblies in the secondary containment, the Note to Unit 3 SR 3.8.5.1 is applicable. This ensures that a Unit 2 SR will not require a Unit 3 SR to be performed, when the Unit 3 Technical Specifications exempts performance of a Unit 3 SR. (However, as stated in the Unit 3 SR 3.8.5.1 Note, while performance of an SR is exempted, the SR still must be met.)

REFERENCES

1. UFSAR, Chapter 14.
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage, ~~and specific gravity~~ for the DC electrical power subsystems batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources- Operating," and LCO 3.8.5, "DC Sources-Shutdown." In addition to the limitations of this Specification, the licensee controlled program also implements a program specified in Specification 5.5.15 for monitoring various battery parameters.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 120 V for 58 cell battery (i.e., cell voltage of 2.07 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage > 2.07 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.23 to 2.27 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.25 Vpc corresponds to a total float voltage output of 130.5 V for a 58 cell battery as discussed in the UFSAR, Chapter 8 (Ref. 3).

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in UFSAR, Chapter 14 (Ref. 1), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power subsystems provide normal and emergency DC electrical power for the diesel generators (DGs), emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit as discussed in the Bases of LCO 3.8.4, "DC Sources-Operating," and LCO 3.8.5, "DC Sources-Shutdown.

(continued)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

APPLICABLE SAFETY ANALYSES	Since battery cell parameters support the operation of the DC electrical power subsystems, they satisfy Criterion 3 of the NRC Policy Statement.
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LCO	Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an abnormal operational transient or a postulated DBA. <u>Electrolyte Battery Parameter</u> limits are conservatively established, allowing continued DC electrical system function even with <u>Category A and B</u> limits not met. <u>Additional preventative maintenance, testing, and monitoring performed in accordance with the Technical Requirements Manual, Section 3.21, Battery Monitoring and Maintenance Program, is conducted as specified in Specification 5.5.15.</u>
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APPLICABILITY	The battery cell parameters are required solely for the support of the associated DC electrical power subsystem. Therefore, <u>these cell battery</u> parameters are only required when the DC power source is required to be OPERABLE. Refer to the Applicability discussions in Bases for LCO 3.8.4 and LCO 3.8.5.
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(continued)

BASES (continued)

ACTIONS

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

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

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

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

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

(continued)

BASES (continued)

ACTIONS

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

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

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

B.1 and B.2

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

(continued)

BASES (continued)ACTIONS
(continued)B.1, and B.2

The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 V, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 V there is good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action B.2) from any discharge that might have occurred due to a temporary loss of the battery charger.

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

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

(continued)

BASES (continued)

ACTIONS
(continued)

B.1, and B.2

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

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

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

With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 address this potential (as well as provisions in Specification 5.5.15, Battery Monitoring and Maintenance Program). They are modified by a Note that indicates they are only applicable if electrolyte level is below the top of the plates. Within 8 hours level is required to be restored to above the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Specification 5.5.15.b item to initiate action to equalize and test in accordance with manufacturer's recommendation. They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cells replaced.

(continued)

BASES (continued)

ACTIONS
(continued)

D.1

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

E.1

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

F.1

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

(continued)

BASES

ACTIONS
(continued)

B.1

~~When any battery parameter is outside the Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not ensured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 40 F, also are cause for immediately declaring the associated DC electrical power subsystem inoperable.~~

SURVEILLANCE
REQUIREMENTS

SR 3.8.6.1

~~This SR verifies that Category A battery cell parameters are consistent with IEEE-450 (Ref. 2), which recommends regular battery inspections including voltage, specific gravity, and electrolyte temperature of pilot cells. The SR must be performed unless the battery is on equalize charge or has been on equalize charge any time during the previous 4 days. This allows the routine frequency to be extended until such a time that the SR can be properly performed and meaningful results obtained. The surveillance frequency is applicable and continues during the time that the battery is on equalize with the exception that the surveillance does not need to be performed if the battery has been on equalize during the previous 4 days. The additional 4 days allows time for battery parameters to return to normal after the equalize charge (nominally 3 days) and time to perform the test (nominally 1 day). The intent of the Note is to allow orderly, yet prompt performance of the surveillance that will produce meaningful results once the equalize charge is complete. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

Verifying battery float current while on float charge is used to determine the state of charge of the battery. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a charged state. The equipment used to monitor float current must have the necessary accuracy and capability to measure electrical currents in the expected range. The float current requirements are based on the float current indicative of a charged battery. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.6.1

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

SR 3.8.6.2 and SR 3.8.6.5

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. In addition, within 24 hours of a battery discharge < 100 V or within 24 hours of a battery overcharge > 145 V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients which may momentarily cause battery voltage to drop to \leq 100 V, do not constitute battery discharge provided the battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 2), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.~~

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits, which corresponds to 130.5 V at the battery terminals, or 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltages in this range or less, but greater than 2.07 Vpc, are addressed in Specification 5.5.15. SRs 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V. The Surveillance Frequency is controlled under The Surveillance Frequency Control Program.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.6.3

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

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

Table 3.8.6-1 DELETED

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

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

~~The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 2), with the extra ½ inch allowance above the high water level indication for operating margin to account for temperature and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 2) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.~~

~~The Category A limit specified for float voltage is ≥ 2.13 V per cell. This value is based on the recommendation of IEEE-450 (Ref. 2), which states that prolonged operation of cells below 2.13 V can reduce the life expectancy of cells. The Category A limit specified for specific gravity for each pilot cell is ≥ 1.195 (0.020 below the manufacturer's fully~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

~~Table 3.8.6-1 (continued)~~

~~charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 2), the specific gravity readings are based on a temperature of 77°F (25°C).~~

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

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

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

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

~~The Category C limit specified for electrolyte level (above the top of the plates and not overflowing) ensure that the plates suffer no physical damage and maintain adequate electron transfer capability. The Category C Allowable Value for voltage is based on IEEE-450 (Ref. 2), which~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

~~Table 3.8.6-1 (continued)~~

~~states that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.~~

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

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

~~Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge of the designated pilot cell. This phenomenon is discussed in IEEE-450 (Ref. 2). Footnote c to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for up to 180 days following a battery recharge after a deep discharge. Within 180 days each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements must be made within 30 days.~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.6.3

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintains adequate electron transfer capability. The minimum design electrolyte level is the minimum level indication mark on the battery cell jar. The Surveillance Frequency is controlled under The Surveillance Frequency Control Program.

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e., 50°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 Surveillance Frequency is controlled under The Surveillance Frequency Control Program.

SR 3.8.6.6

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

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.6.6; however, only the modified performance discharge test may be used to satisfy the battery service test requirements of SR 3.8.4.7.

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

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.6.6 (continued)

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

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 2) and IEEE-485 (Ref. 4). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

The Frequency for this test is in accordance with The Frequency Control Program. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity > 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 2), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 10% below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 2).

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

(continued)

BASES

REFERENCES

1. UFSAR, Chapter 14.
 2. IEEE Standard 450, 19872002.
 3. UFSAR, Chapter 8.
 4. IEEE Standard 485, 1983.
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BASES

BACKGROUND
(continued)

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC loads are powered from the batteries.

The DC power distribution system is described in more detail in Bases for LCO 3.8.7, "Distribution System—Operating," and LCO 3.8.8, "Distribution System—Shutdown."

~~Each battery has adequate storage capacity to carry the required load continuously for approximately 2 hours.~~

Each of the unit's two DC electrical power divisions, consisting of two 125 V batteries in series, four battery chargers (two normally inservice chargers and two spare chargers), and the corresponding control equipment and interconnecting cabling, is separately housed in a ventilated room apart from its chargers and distribution centers. Each division is separated electrically from the other division to ensure that a single failure in one division does not cause a failure in a redundant division. There is no sharing between redundant Class 1E divisions such as batteries, battery chargers, or distribution panels.

Each battery has adequate storage capacity to meet the duty cycle(s) discussed in the UFSAR, Chapter 8 (Ref 7). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

The batteries for 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 105% design demand. The minimum design voltage limit is 105/210 V. The minimum design voltage for sizing the battery using the methodology in IEEE 485 (Ref. 3) is based on a traditional 1.81 volts per cell at the end of a 2 hour load profile. The battery terminal voltage using 1.81 volts per cell is 105 V. Using the LOOP/LOCA load profile, the predicted value of the battery terminals is greater than 105 VDC at the end of the profile. Many 1E loads operate exclusively at the beginning of the profile and require greater than the design minimum terminal voltage. The analyzed voltage of the distribution panels and the MCCs is greater than that required during the LOOP/LOCA to support the operation of the 1E loads during the time period they are required to operate.

(continued)

BASES

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 120 V for a 58 cell battery (i.e., cell voltage of 2.07 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage > 2.07 Vpc, the battery cell will maintain its capacity for 30 days without further charging. Optimal long term performance however, is obtained by maintaining a float voltage 2.23 to 2.27 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.25 Vpc corresponds to a total float voltage output of 130.5 V for a 58 cell battery as discussed in the UFSAR, Chapter 8 (Ref. 7).

Each required battery charger of DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery

(continued)

BASES

BACKGROUND
(continued)

bank fully charged. Each battery charger has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 20 hours while supplying normal steady state loads following a LOCA coincident with a loss of offsite power.

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

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

A description of the Unit 3 DC power sources is provided in the Bases for Unit 3 LCO 3.8.4, "DC Sources—Operating."

(continued)

BASES

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 14 (Ref. 1), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources OPERABLE during accident conditions in the event of:

- a. An assumed loss of all offsite AC power or all onsite AC power; and
- b. A worst case single failure.

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

LCO

The Unit 2 Division I and Division II DC electrical power subsystems, with each DC subsystem consisting of two 125 V station batteries in series, two battery chargers (one per battery), and the corresponding control equipment and interconnecting cabling supplying power to the associated bus, are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an abnormal operational transient or a postulated DBA. In addition, DC control power (which provides control power for the 4 kV load circuit breakers and the feeder breakers to the 4 kV emergency bus) for two of the four 4 kV emergency buses, as well as control power for two of the diesel generators, is provided by the Unit 3 DC electrical power subsystems. Therefore, Unit 3 Division I and Division II DC electrical power subsystems are also required to be OPERABLE. A Unit 3

(continued)

BASES

ACTIONS

B.1 (continued)

If one of the Unit 3 DC electrical power subsystems is inoperable for reasons other than Condition A, the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in a loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 12 hours. The 12 hour Completion Time reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and takes into consideration the importance of the Unit 3 DC electrical power subsystem.

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

Condition C represents one subsystem with one battery charger inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). Condition C is exited when the standby battery charger is placed in service within two hours. However, if both the operating and standby battery chargers are inoperable, the ACTIONS must be completed while the alternate battery charger is in service. The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action C.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action C.2) from any discharge that might have occurred due to the charger inoperability.

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

(continued)

BASES

ACTIONS

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

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

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

Required Action C.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it is now fully capable of supplying the maximum expected load requirement. The 2 amp value is based on returning the battery to 98% charge and assumes a 5% design margin for the battery. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action C.3 limits the restoration time for the inoperable battery charger to 72 hours. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 72 hour Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

(continued)

BASES

ACTIONS

D.1 (continued)

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

GE.1

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

If one of the Unit 2 DC electrical power subsystems is inoperable for reasons other than conditions C, or D, (e.g., ~~inoperable battery/batteries, inoperable required battery charger/chargers, or~~ inoperable ~~required~~ battery charger/~~chargers~~ and associated ~~inoperable~~ ~~battery/batteries~~), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could result in the loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is consistent with Regulatory Guide 1.93 (Ref. 4) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power division and, if the Unit 2 DC electrical power division is not restored to OPERABLE status, to prepare to initiate an orderly and safe unit shutdown. The 2 hour limit is also consistent with the allowed time for an inoperable Unit 2 DC Distribution System Subsystem.

(continued)

BASES

ACTIONS
(continued)

DF.1

If the DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the overall plant risk is minimized. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours. Remaining in the Applicability of the LCO is acceptable because the plant risk in MODE 3 is similar to or lower than the risk in MODE 4 (Ref. 6) and because the time spent in MODE 3 to perform the necessary repairs to restore the system to OPERABLE status will be short. However, voluntary entry into MODE 4 may be made as it is also an acceptable low-risk state. The allowed Completion Time is reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The completion time to bring the unit to MODE 4 is consistent with the time required in Regulatory Guide 1.93 (Ref. 4).

EG.1

Condition EG corresponds to a level of degradation in the DC electrical power subsystems that causes a required safety function to be lost. When more than one DC source is lost, this results in a loss of a required function, thus the plant is in a condition outside the accident analysis. Therefore, no additional time is justified for continued operation. LCO 3.0.3 must be entered immediately to commence a controlled shutdown.

SURVEILLANCE
REQUIREMENTS

As Noted at the beginning of the SRs, SR 3.8.4.1 through SR 3.8.4.8 are applicable only to the Unit 3 DC electrical power subsystems and SR 3.8.4.9 is applicable only to the Unit 2 DC electrical power subsystems.

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the ~~charging system and the ability of the batteries to perform their intended function~~ battery chargers, which support the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.1 (continued)

internal losses of a battery ~~(or battery cell)~~ and maintain the battery ~~(or a battery cell)~~ in a fully charged state while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum established float voltage (2.13 Vpc times the number of connected cells or 123.5 V for a 58 cell battery at the battery terminals). This voltage maintains the battery plates in a condition that supports maintaining the grid life.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.1 (continued)

~~based on the minimum cell voltage that will maintain a charged cell. This is consistent with the assumptions in the battery sizing calculations. The SR must be performed unless the battery is on equalize charge or has been on equalize charge any time during the previous 1 day. This allows the routine Frequency to be extended until such a time that the SR can be properly performed and meaningful results obtained. The surveillance frequency is applicable and continues during the time that the battery is on equalize with the exception that the surveillance does not need to be performed if the battery has been on equalize during the previous 1 day. The additional 1 day allows time for battery voltage to return to normal after the equalize charge and time to perform the test. The intent of the Note is to allow orderly, yet prompt performance of the surveillance that will produce meaningful results once the equalize charge is complete. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.8.4.2

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

~~The battery connection resistance limits are established to maintain connection resistance as low as reasonably possible to minimize the overall voltage drop across the battery, and the possibility of battery damage due to heating of connections.~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.8.4.3

~~DELETED Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical damage or deterioration does not necessarily represent a failure of~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.3 (continued)

~~this SR, provided an evaluation determines that the physical damage or deterioration does not affect the OPERABILITY of the battery (its ability to perform its design function).~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.8.4.4 and SR 3.8.4.5

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

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

~~The battery connection resistance limits are established to maintain connection resistance as low as reasonably possible to minimize the overall voltage drop across the battery, and the possibility of battery damage due to heating of connections.~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.8.4.6

~~Battery charger capability requirements are based on This SR verifies the design capacity of the battery chargers. The minimum charging capacity requirement is based on the capacity to maintain the associated battery in its fully charged condition, and to restore the battery to its fully~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.6 (continued)

charged condition following the worst case design discharge while supplying normal steady state loads. The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying 200 amps at the minimum established float voltage for 4 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

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

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.4.7

A battery service test is a special test of the battery's capability, as found, to satisfy the design requirements (battery duty cycle) of the DC Electrical Power System. The discharge rate and test length corresponds to the design duty cycle requirements.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.7 (continued)

This SR is modified by two Notes. Note 1 allows performance of ~~either~~ a modified performance discharge test ~~or a performance discharge test (described in the Bases for SR 3.8.4.8)~~ in lieu of a service test, ~~provided the test performed envelops the duty cycle of the battery. This substitution is acceptable because as long as the test current is greater than or equal to the actual duty cycle of the battery, SR 3.8.4.8 represents a more severe test of battery capacity than a service test.~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.7 (continued)

The reason for Note 2 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the ~~E~~lectrical ~~D~~istribution ~~S~~ystem, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance.

SR 3.8.4.8

~~DELETED A battery performance discharge test is a test of the constant current capacity of a battery, performed between 3 and 30 days after an equalize charge of the battery, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.~~

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

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

~~Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR-3.8.4.8; however, the discharge test may be~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.8 (continued)

~~used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time only if the test envelops the duty cycle of the battery.~~

~~The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 5) and IEEE-485 (Ref. 3). 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.~~

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity \geq 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 5), 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. If the rate of discharge varies significantly from the previous discharge test, the absolute battery capacity may change significantly, resulting in a capacity drop exceeding the criteria specified above. This absolute battery capacity change could be a result of acid concentration in the plate material, which is not an indication of degradation. Therefore, results of tests with significant rate differences should be discussed with the vendor and evaluated to determine if degradation has occurred. All these Frequencies, with the exception of the 24 month Frequency, are consistent with the recommendations in IEEE-450 (Ref. 5). The 24 month Frequency is acceptable, given the battery has shown no signs of degradation, the unit conditions required to perform the test and other requirements existing to ensure battery performance during these 24 month intervals. In addition, the 24 month Frequency is intended to be consistent with expected fuel cycle lengths.~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.8 (continued)

~~This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance. The DC batteries of the other unit are exempted from this restriction since they are required to be OPERABLE by both units and the Surveillance cannot be performed in the manner required by the Note without resulting in a dual unit shutdown.~~

SR 3.8.4.9

With the exception of this Surveillance, all other Surveillances of this Specification (SR 3.8.4.1 through SR 3.8.4.8) are applied only to the Unit 3 DC electrical power subsystems. This Surveillance is provided to direct that the appropriate Surveillances for the required Unit 2 DC electrical power subsystems are governed by the Unit 2 Technical Specifications. Performance of the applicable Unit 2 Surveillances will satisfy Unit 2 requirements, as well as satisfying this Unit 3 Surveillance Requirement.

The Frequency required by the applicable Unit 2 SR also governs performance of that SR for Unit 3. As Noted, if Unit 2 is in MODE 4 or 5, or moving irradiated fuel assemblies in the secondary containment, the Note to Unit 2 SR 3.8.5.1 is applicable. This ensures that a Unit 3 SR will not require a Unit 2 SR to be performed, when the Unit 2 Technical Specifications exempts performance of a Unit 2 SR. (However, as stated in the Unit 2 SR 3.8.5.1 Note, while performance of the SR is exempted, the SR still must be met.)

REFERENCES

1. UFSAR, Chapter 14.
2. "Proposed IEEE Criteria for Class 1E Electrical Systems for Nuclear Power Generating Stations," June 1969.
3. IEEE Standard 485, 1983.

(continued)

BASES

REFERENCES
(continued)

4. Regulatory Guide 1.93, December 1974.
 5. IEEE Standard 450, ~~1987~~2002.
 6. NEDC-32988-A, Revision 2, Technical Justification to Support Risk-Informed Modification to Selected Required End States for BWR Plants, December 2002.
 7. UFSAR, Chapter 8.
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BASES

APPLICABILITY
(continued)

- b. Required features needed to mitigate a fuel handling accident are available;
- c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and
- d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

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

ACTIONS

LCO 3.0.3 is not applicable while in MODE 4 or 5. However, since irradiated fuel assembly movement can occur in MODE 1, 2, or 3, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 4 or 5, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

~~A.1, A.2.1, A.2.2, A.2.3, and A.2.4~~ A.2, and A.3

~~If more than one DC distribution subsystem is required according to LCO 3.8.8, the DC electrical power subsystems remaining OPERABLE with one or more DC electrical power subsystems inoperable may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel.~~

~~By allowance of the option to declare required features inoperable with associated DC electrical power subsystems inoperable, appropriate restrictions are implemented in accordance with the affected system LCOs' ACTIONS. However, in many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies in secondary containment, and any activities that could result in inadvertent draining of the reactor vessel).~~

(continued)

BASES

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, and A.2.4 A.2. and A.3 (continued)

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

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

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

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

(continued)

BASES

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, and A.2.4 A.2, and A.3 (continued)

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

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

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

Required Action A.3 limits the restoration time for the inoperable battery charger to 72 hours. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 72 hour Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

(continued)

BASES

ACTIONS

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

If more than one DC distribution subsystem is required according to LCO 3.8.8, the DC subsystems remaining OPERABLE with one or more DC power sources inoperable may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. By allowance of the option to declare required features inoperable with associated DC power sources inoperable, appropriate restrictions are implemented in accordance with the affected system LCOs' ACTIONS. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and any activities that could result in inadvertent draining of the reactor vessel).

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

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

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.8. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

SR 3.8.5.2

This Surveillance is provided to direct that the appropriate Surveillances for the required Unit 2 DC electrical power subsystems are governed by the Unit 2 Technical Specifications. Performance of the applicable Unit 2 Surveillances will satisfy Unit 2 requirements, as well as satisfying this Unit 3 Surveillance Requirement. The Frequency required by the applicable Unit 2 SR also governs performance of that SR for Unit 3.

As Noted, if Unit 2 is in MODE 4 or 5, or moving irradiated fuel assemblies in the secondary containment, the Note to Unit 2 SR 3.8.5.1 is applicable. This ensures that a Unit 3 SR will not require a Unit 2 SR to be performed, when the Unit 2 Technical Specifications exempts performance of a Unit 2 SR. (However, as stated in the Unit 2 SR 3.8.5.1 Note, while performance of an SR is exempted, the SR still must be met.)

REFERENCES

1. UFSAR, Chapter 14.
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery ~~Cell~~ Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage, and specific gravity for the DC electrical power subsystems batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources— Operating," and LCO 3.8.5, "DC Sources—Shutdown." In addition to the limitations of this Specification, the licensee controlled program also implements a program specified in specification 5.5.15 for monitoring various battery parameters.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 120 V for 58 cell battery (i.e., cell voltage of 2.07 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage > 2.07 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.23 to 2.27 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.25 Vpc corresponds to a total float voltage output of 130.5 V for a 58 cell battery as discussed in the UFSAR, Chapter 8 (Ref. 3).

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in UFSAR, Chapter 14 (Ref. 1), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power subsystems provide normal and emergency DC electrical power for the diesel generators (DGs), emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit as discussed in the Bases of LCO 3.8.4, "DC Sources—Operating," and LCO 3.8.5, "DC Sources—Shutdown.

(continued)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery ~~Cell~~ Parameters

BASES

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

LCO Battery ~~cell~~ parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an abnormal operational transient or a postulated DBA. ~~Electrolyte Battery Parameter~~ limits are conservatively established, allowing continued DC electrical system function even with ~~Category A and B~~ limits not met. Additional preventative maintenance, testing, and monitoring performed in accordance with the Technical Requirements Manual, Section 3.21, Battery Monitoring and Maintenance Program, is conducted as specified in Specification 5.5.15.

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

(continued)

BASES (continued)

ACTIONS

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

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

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

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

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

(continued)

BASES (continued)

ACTIONS

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

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

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

B.1 and B.2

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

(continued)

BASES (continued)ACTIONS
(continued)B.1, and B.2

The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 V, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 V there is good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action B.2) from any discharge that might have occurred due to a temporary loss of the battery charger.

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

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

(continued)

BASES (continued)ACTIONS
(continued)B.1, and B.2

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

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

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

With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 address this potential (as well as provisions in Specification 5.5.15, Battery Monitoring and Maintenance Program). They are modified by a Note that indicates they are only applicable if electrolyte level is below the top of the plates. Within 8 hours level is required to be restored to above the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Specification 5.5.15.b item to initiate action to equalize and test in accordance with manufacturer's recommendation. They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cells replaced.

(continued)

BASES (continued)

ACTIONS
(continued)

D.1

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

E.1

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

F.1

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

(continued)

BASES

~~ACTIONS
(continued)~~

~~B.1~~

~~When any battery parameter is outside the Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not ensured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 40°F, also are cause for immediately declaring the associated DC electrical power subsystem inoperable.~~

~~SURVEILLANCE
REQUIREMENTS~~

~~SR 3.8.6.1~~

~~This SR verifies that Category A battery cell parameters are consistent with IEEE-450 (Ref. 2), which recommends regular battery inspections including voltage, specific gravity, and electrolyte temperature of pilot cells. The SR must be performed unless the battery is on equalize charge or has been on equalize charge any time during the previous 4 days. This allows the routine Frequency to be extended until such a time that the SR can be properly performed and meaningful results obtained. The surveillance frequency is applicable and continues during the time that the battery is on equalize with the exception that the surveillance does not need to be performed if the battery has been on equalize during the previous 4 days. The additional 4 days allows time for battery parameters to return to normal after the equalize charge (nominally 3 days) and time to perform the test (nominally 1 day). The intent of the Note is to allow orderly, yet prompt performance of the surveillance that will produce meaningful results once the equalize charge is complete. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

Verifying battery float current while on float charge is used to determine the state of charge of the battery. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a charged state. The equipment used to monitor float current must have the necessary accuracy and capability to measure electrical currents in the expected range. The float current requirements are based on the float current indicative of a charged battery. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

BASESSURVEILLANCE
REQUIREMENTS
(continued)SR 3.8.6.1

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

SR 3.8.6.2 and SR 3.8.6.5

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. In addition, within 24 hours of a battery discharge < 100 V or within 24 hours of a battery overcharge > 145 V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients which may momentarily cause battery voltage to drop to \leq 100 V, do not constitute battery discharge provided the battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 2), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.~~

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits, which corresponds to 130.5 V at the battery terminals, or 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltages in this range or less, but greater than 2.07 Vpc, are addressed in Specification 5.5.15. SRs 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V. The Surveillance Frequency is controlled under The Surveillance Frequency Control Program.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.6.3

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

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

~~Table 3.8.6-1~~ DELETED

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

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

~~The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 2), with the extra $\frac{1}{8}$ inch allowance above the high water level indication for operating margin to account for temperature and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron-transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 2) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.~~

~~The Category A limit specified for float voltage is ≥ 2.13 V per cell. This value is based on the recommendation of IEEE-450 (Ref. 2), which states that prolonged operation of cells below 2.13 V can reduce the life expectancy of cells. The Category A limit specified for specific gravity for each pilot cell is ≥ 1.195 (0.020 below the manufacturer's fully~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

~~Table 3.8.6-1 (continued)~~

~~charged nominal specific gravity or a battery charging-current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 2), the specific gravity readings are based on a temperature of 77°F (25°C).~~

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

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

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

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

~~The Category C limit specified for electrolyte level (above the top of the plates and not overflowing) ensure that the plates suffer no physical damage and maintain adequate electron transfer capability. The Category C Allowable Value for voltage is based on IEEE-450 (Ref. 2), which~~

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

~~Table 3.8.6-1 (continued)~~

~~states that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.~~

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

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

~~Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge of the designated pilot cell. This phenomenon is discussed in IEEE-450 (Ref. 2). Footnote c to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for up to 180 days following a battery recharge after a deep discharge. Within 180 days each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirming measurements must be made within 30 days.~~

(continued)

BASESSURVEILLANCE
REQUIREMENTS
(continued)SR 3.8.6.3

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintains adequate electron transfer capability. The minimum design electrolyte level is the minimum level indication mark on the battery cell jar. The Surveillance Frequency is controlled under The Surveillance Frequency Control Program.

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e., 50°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 Surveillance Frequency is controlled under The Surveillance Frequency Control Program.

SR 3.8.6.6

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

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.6.6; however, only the modified performance discharge test may be used to satisfy the battery service test requirements of SR 3.8.4.7.

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

(continued)

BASESSURVEILLANCE
REQUIREMENTSSR 3.8.6.6 (continued)

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

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 2) and IEEE-485 (Ref. 4). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

The Frequency for this test is in accordance with The Frequency Control Program. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity > 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 2), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 10% below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 2).

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

(continued)

BASES

REFERENCES

1. UFSAR, Chapter 14.
 2. IEEE Standard 450, ~~1987~~2002.
 3. UFSAR, Chapter 8.
 4. IEEE Standard 485, 1983.
-

ATTACHMENT 4

Summary of Regulatory Commitments

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278

SUMMARY OF REGULATORY COMMITMENTS

The following table identifies commitments made in this document. (Any other actions discussed in the submittal represent intended or planned actions. They are described to the NRC for the NRC's information and are not regulatory commitments.)

COMMITMENT	COMMITTED DATE OR "OUTAGE"	COMMITMENT TYPE	
		ONE-TIME ACTION (Yes/No)	PROGRAMMATIC (Yes/No)
The 2 amp float current value is an indication that the battery is 98 percent charged. PBAPS is committed to maintain a 5 percent design margin for the batteries.	Upon implementation of the approved TS amendment.	No	Yes
The Battery Monitoring and Maintenance Program, which will be contained in the PBAPS Technical Requirements Manual will require verification of the selection of the pilot cell or cells when performing SR 3.8.6.5.	Upon implementation of the approved TS amendment.	No	Yes
EGC will revise the PBAPS Updated Final Safety Analysis Report in accordance with Attachment 5, List of Required Updated Final Safety Analysis Report (UFSAR) Descriptions	Upon implementation of the approved TS amendment.	Yes	No

ATTACHMENT 5

List of Required Updated Final Safety Analysis Report (UFSAR) Descriptions

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278

LIST OF REQUIRED UPDATED FINAL SAFETY ANALYSIS REPORT (UFSAR) DESCRIPTIONS

The following table identifies UFSAR descriptions required by EGC as part of the adoption of TSTF-500, Revision 2 for Peach Bottom Atomic Power Station.

Required UFSAR Descriptions	DUE DATE / EVENT
1. Describes how a 5 percent design margin for the batteries corresponds to 2 amp float current value, for the station batteries, indicating the batteries are 98 percent charged.	Upon implementation of the approved Technical Specification amendment
2. States that long term battery performance is supported by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 2.25 V per connected cell and that there are 58 connected cells in the battery, which corresponds to 130.5 V at the battery terminals.	Upon implementation of the approved Technical Specification amendment
3. Describes how the batteries are sized with correction margins that include temperature and aging and how these margins are maintained.	Upon implementation of the approved Technical Specification amendment
4. States the minimum established design limit for battery terminal float voltage.	Upon implementation of the approved Technical Specification amendment
5. States the minimum established design limit for electrolyte level.	Upon implementation of the approved Technical Specification amendment
6. States the minimum established design limit for electrolyte temperature.	Upon implementation of the approved Technical Specification amendment
7. Describes how each battery is designed with additional capacity above that required by the design duty cycles to allow for temperature variations and other factors.	Upon implementation of the approved Technical Specification amendment
8. Describes normal DC system operation (i.e., powered from the battery chargers) with the batteries floating on the system, and a loss of normal power to the battery charger describing how the DC load is automatically powered from the station batteries.	Upon implementation of the approved Technical Specification amendment

ATTACHMENT 6

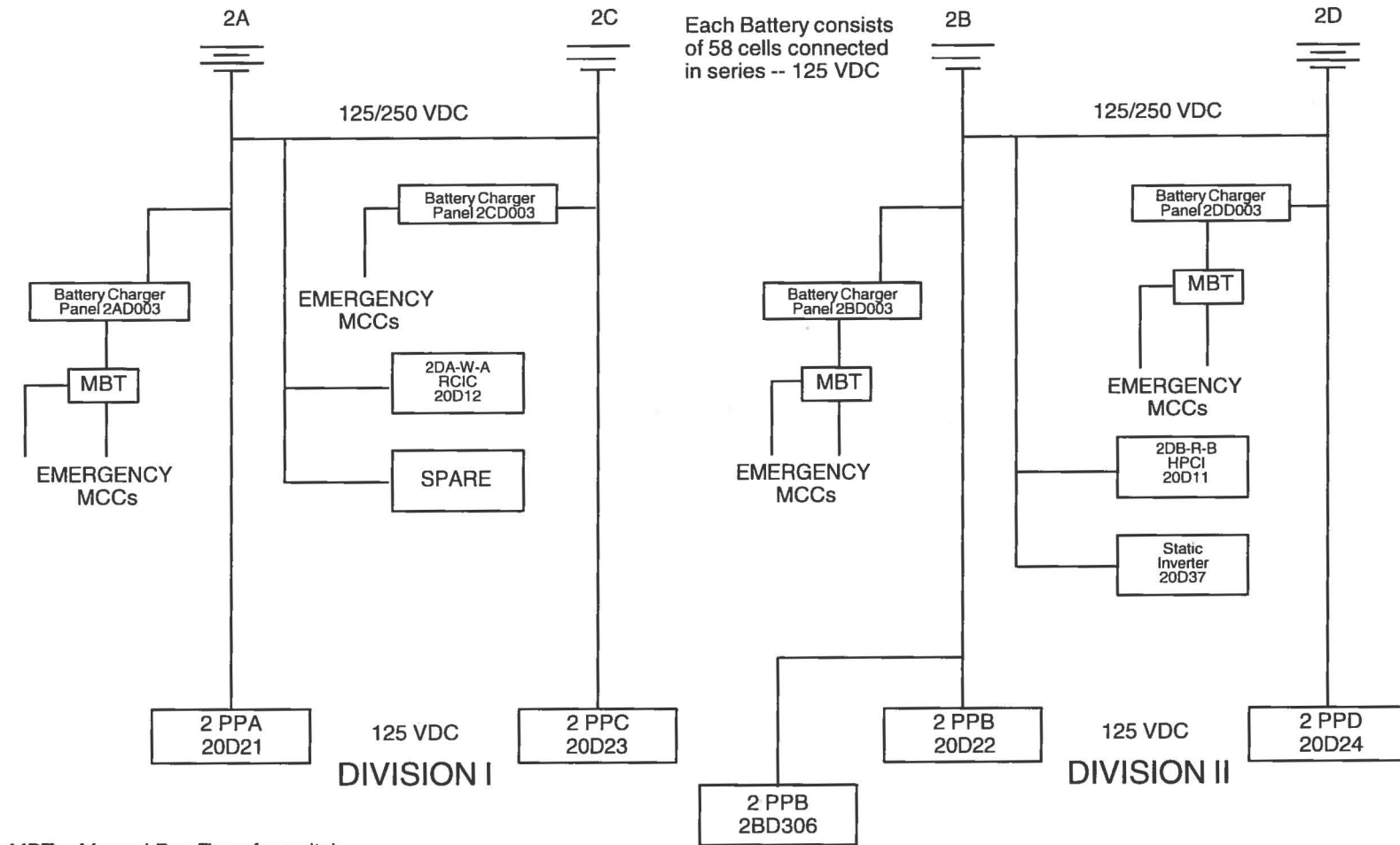
PBAPS DC System Simplified Diagram

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278

Peach Bottom Atomic Power Station-Unit 2



MBT = Manual Bus Transfer switch
 RCIC = Reactor Core Isolation Cooling
 HPCI = High Pressure Core Injection

**SINGLE LINE DIAGRAM OF
 125/250 VDC SAFEGUARD DISTRIBUTION SYSTEM (UNIT 2)**

ATTACHMENT 7

PBAPS 4kV Emergency Bus System Cross Ties

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278

EDGs E1 AND E2 / 4KV SYSTEM CROSSTIES
AND ALTERNATE POWER SUPPLIES

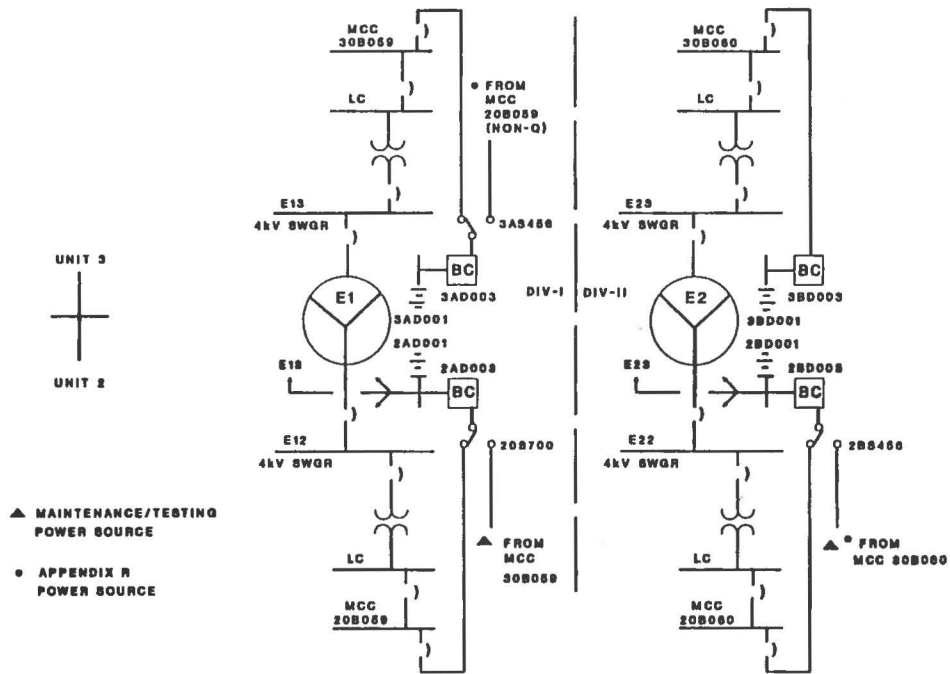


FIGURE F3.1-1

Peach Bottom Atomic Power Station, Units 2 and 3
125/250vDC And 24/48vDC System

DBD No. P-S-01A
Revision No. 14
F3.1-1, Page 1 of 1

EDGs E3 AND E4 / 4KV SYSTEM CROSSTIES
AND ALTERNATE POWER SUPPLIES

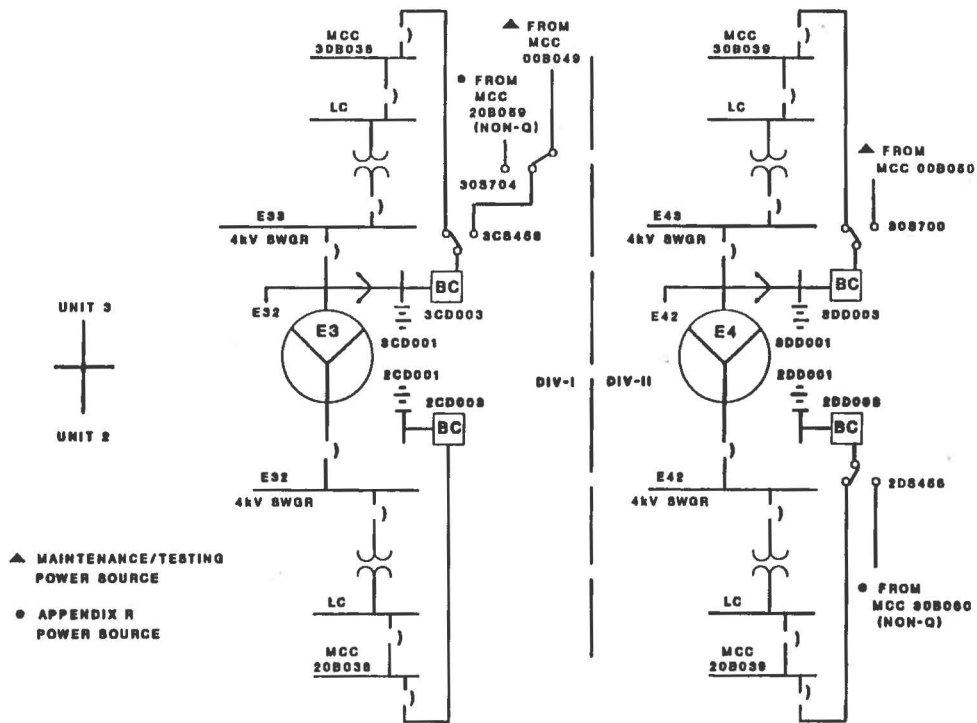


FIGURE F3.1-2

Peach Bottom Atomic Power Station, Units 2 and 3
125/250vDC And 24/48vDC System

DBD No. P-S-01A
Revision No. 14
F3.1-2, Page 1 of 1

ATTACHMENT 8

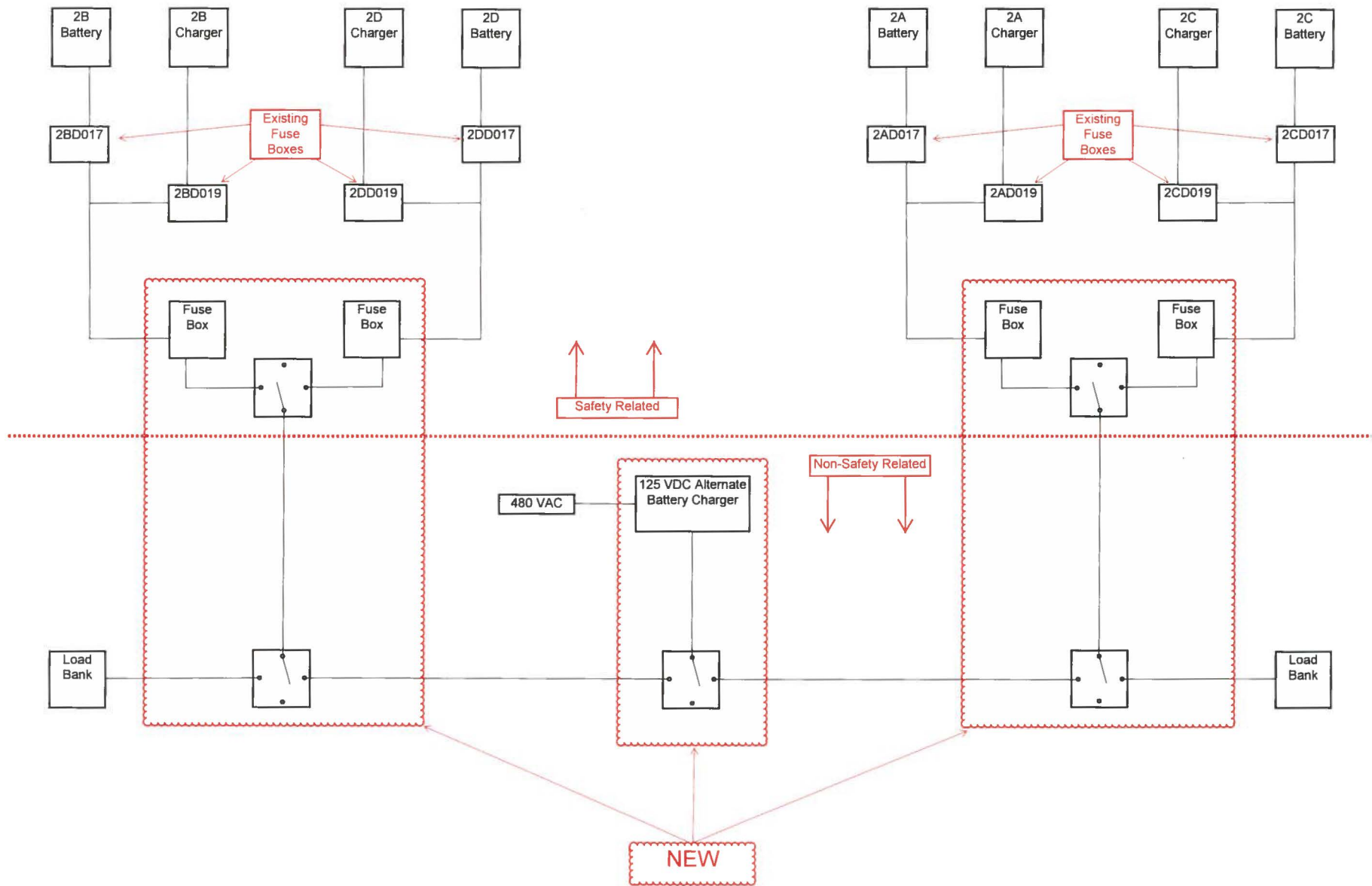
Conceptual Alternate Battery Charger Diagram

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

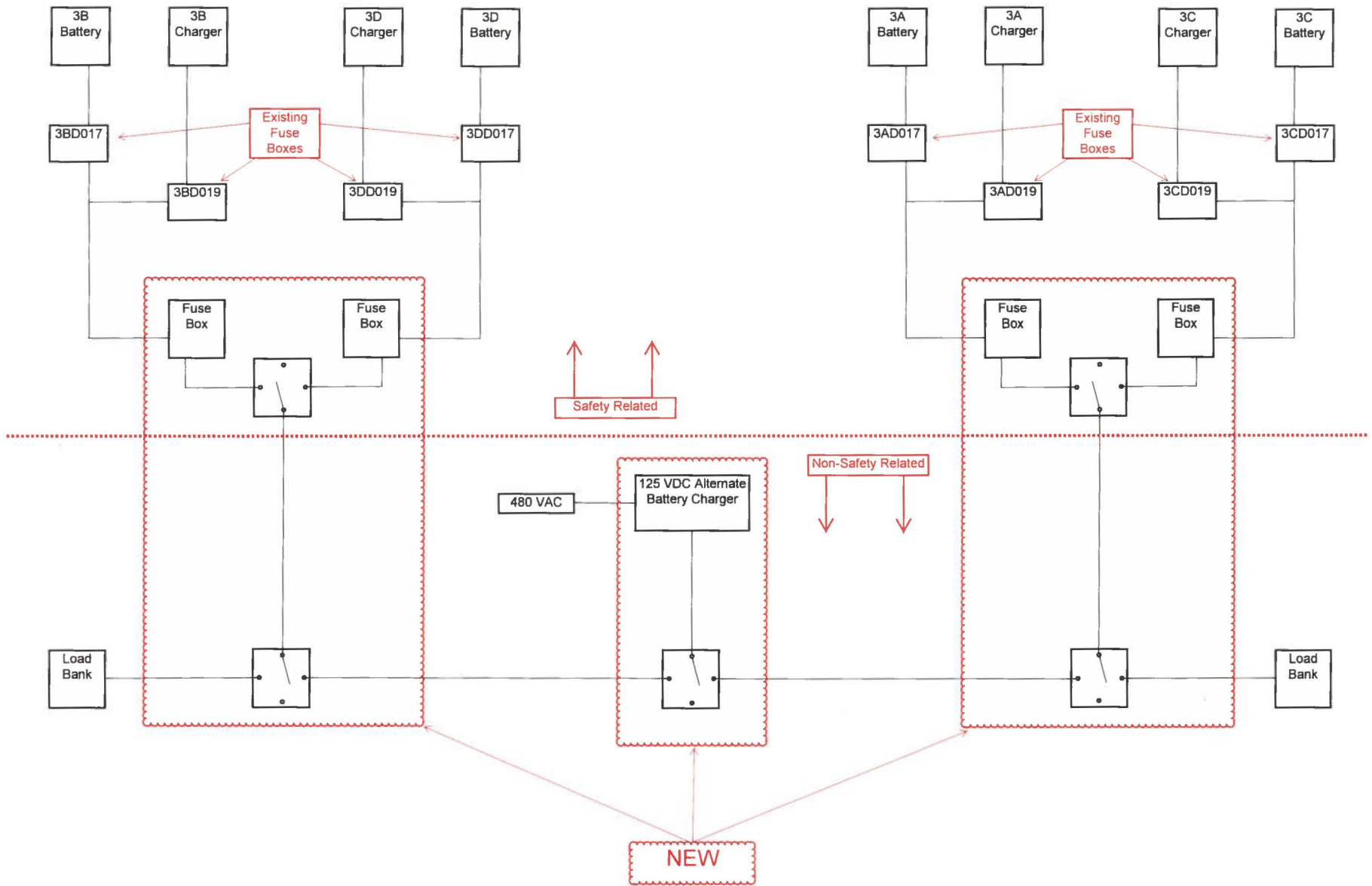
Docket Nos. 50-277 and 50-278

Attachment 8 Conceptual Alternate Battery Charger Diagram



UNIT 2

Attachment 8 Conceptual Alternate Battery Charger Diagram



UNIT 3

ATTACHMENT 9

PBAPS Technical Requirements Manual Section 3.21 Markup

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278

3.21 BATTERY MONITORING AND MAINTENANCE PROGRAM

TRMS 3.21 Battery and Battery Cell Parameters and Test Requirement Criteria shall be met.

APPLICABILITY: When associated Battery is required to be OPERABLE by TS.

COMPENSATORY MEASURES

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

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. One or more batteries with one or more battery cell do not meet Table 3.21-1 Category A Float Voltage.	A.1 Verify other battery cells in affected battery are within Table 3.21-1 parameters.	1 hour
	<u>AND</u>	
	A.2 Verify battery cell meets Table 3.21-1 Category B limit.	1 hour <u>AND</u> Once per 7 days thereafter
	<u>AND</u>	
	B.2 Restore battery cell parameters to Category A limit of Table 3.21-1.	31 days
B. Required Compensatory Measure and associated Completion Time of Condition A not met.	B.1 Initiate a Condition Report to perform corrective actions in accordance with the Battery Monitoring and Maintenance Program.	Immediately

(continued)

Battery Monitoring and Maintenance Program
3.21

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
C. One or more batteries with one or more battery cells do not meet Table 3.21-1 Category A Electrolyte Level.	C.1 Verify battery cell meets Table 3.21-1 Category B limit.	1 hour
	<u>AND</u> C.2 Restore battery cell parameters to Category A limit of Table 3.21-1.	7 days
D. Required Compensatory Measure and associated Completion Time of Required Action C.1 not met.	D.1 Equalize and test battery cell(s)	24 hours
E. Required Compensatory Measure and associated Completion Time of Required Action C.2 not met.	E.1 Initiate a Condition Report to perform corrective actions in accordance with the Battery Monitoring and Maintenance Program.	Immediately

(continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
<p>F. One or more batteries with one or more battery cell do not meet Table 3.21-1 Category A specific gravity.</p>	<p>F.1 Verify battery cell meets Table 3.21-1 Category B limit.</p> <p><u>AND</u></p> <p>F.2 Restore battery cell parameters to Category A limit of Table 3.21-1.</p>	<p>1 hour</p> <p>7 days</p>
<p>G. Required Compensatory Measure and associated Completion Time of Condition F not met.</p>	<p>G.1 Initiate a Condition Report to perform corrective actions in accordance with the Battery Monitoring and Maintenance Program.</p>	<p>Immediately</p>
<p>H. TRMS not met for reasons other than Condition A, C or F or Compensatory Measure and Completion Time not met.</p>	<p>H.1 Initiate a Condition Report to perform corrective actions in accordance with the Battery Monitoring and Maintenance Program.</p>	<p>Immediately</p>

TEST REQUIREMENTS

TEST	FREQUENCY
<p>TR 3.21.1 Verify battery terminal voltage is \geq 123.5 V on float charge.</p>	<p>-----NOTE----- The 7 day Frequency is not applicable if the battery is on equalize charge or has been on equalize charge at any time during the previous 1 day. -----</p> <p>7 days</p> <p><u>AND</u></p> <p>14 days</p>
<p>TR 3.21.2 Verify battery cell parameters meet Table 3.21-1 Category A limits.</p>	<p>-----NOTE----- The 7 day Frequency is not applicable if the battery is on equalize charge or has been on equalize charge at any time during the previous 4 days. -----</p> <p>7 days</p> <p><u>AND</u></p> <p>14 days</p>

(continued)

TEST REQUIREMENTS (continued)

TEST		FREQUENCY
TR 3.21.3	Verify battery cell parameters meet Table 3.8.6-1 Category B limits.	92 days
TR 3.21.4	Verify battery connection resistance is $\leq 40 \text{ E-6}$ ohms.	12 months
TR 3.21.5	Verify Battery Room temperature is $< 100^{\circ}\text{F}$ and ventilation is in service.	24 hours
TR 3.21.6	Verify average electrolyte temperature of 10% of (representative) cells is $\geq 50^{\circ}\text{F}$.	92 days
TR 3.21.7	Verify adequate appearance, cleanliness of the battery rack and area including the existence of any cell cracks or electrolyte leakage and any evidence of corrosion of terminals, connectors or racks.	31 days
TR 3.21.8	Verify no unintentional battery grounds.	31 days
TR 3.21.9	Verify battery monitoring system is functional.	31 days
TR 3.21.10	Verify battery cells meet the specific gravity requirements based on manufacturer's recommendations.	During performance of discharge test required by TS SR 3.8.4.6

(continued)

TEST REQUIREMENTS (continued)

TEST		FREQUENCY
TR 3.21.11	Verify acceptable specific gravity and temperature of each cell.	12 months
TR 3.21.12	Verify acceptable condition of battery cells in accordance with manufacturer's recommendations and the Battery Monitoring and Maintenance Program	12 months
TR 3.21.13	Verify acceptable cell-to-cell and terminal connection resistance in accordance with the Battery Monitoring and Maintenance Program	12 months
TR 3.21.14	Verify acceptable structural condition of the battery rack in accordance with the Battery Monitoring and Maintenance Program.	12 months

Table 3.21-1 (page 1 of 1)
Battery Cell Parameter Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and $\leq \frac{1}{2}$ inch above maximum level indication mark ^(a)	> Minimum level indication mark, and $\leq \frac{1}{2}$ inch above maximum level indication mark ^(a)
Float Voltage	≥ 2.13 V	≥ 2.13 V
Specific Gravity ^{(b)(c)}	≥ 1.195	≥ 1.195 <u>AND</u> Average of all connected cells > 1.205

- (a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during equalizing charges provided it is not overflowing.
- (b) Corrected for electrolyte temperature and level. Level correction is not required, however, when on float charge and battery charging current is < 1 amp.
- (c) A battery charging current of < 1 amp when on float charge is acceptable for meeting specific gravity limits following a battery recharge for: 1) a maximum of 30 days if a deep discharge did not occur; and 2) a maximum of 180 days if a deep discharge did occur. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to the expiration of the applicable allowance.

B 3.21 Battery Monitoring and Maintenance Program

BASES

TS 5.5.14 requires that a Battery Monitoring and Maintenance Program be established to ensure proper battery restoration and maintenance. The program is in accordance with IEEE 450-2002, "IEEE Recommended Practice for Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Stationary Applications". IEEE 450-22002 is endorsed by the NRC by virtue of NRC RG 1.129, Rev. 2, "Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Nuclear Power Plants".

The program allows for the following exceptions:

1. The battery temperature correction may be performed before or after concluding discharge tests.
2. RG 1.129, Regulatory Position 1, Subsection 2, "References" is not applicable to this program
3. In lieu of RG 1.129, Regulatory Position 2, Subsection 5.2, "Inspection", the following shall be used: "Where reference is made to the pilot cell, pilot cell selection shall be based on the lowest voltage cell in the battery."
4. In RG 1.129, Regulatory Position 3, Subsection 5.4.1, "State of Charge Indicator," the following statements in paragraph 9d) may be omitted: "When it has been recorded that the charging current has stabilized at the charging voltage for three consecutive hourly measurements, the battery is near full charge. These measurements shall be made after the initially high charging current decreases sharply and the battery voltage rises to approach the charger output voltage."
5. In lieu of RG 1.129, Regulatory Position 7, Subsection 7.6, "Restoration", the following may be used: "Following the test, record the float voltage of each cell of the string."

Other RG 1.129 NRC positions (Positions 4, 5, 6 and 8) apply.

COMPENSATORY MEASURES:

When the TRM references in the COMPENSATORY MEASURES that corrective actions must be taken in accordance with the Battery Monitoring and Maintenance Program, section 5.3 and Annexes C, D and F of IEEE 450-2002 must also be utilized as applicable.

(continued)

BASES (continued)

TEST REQUIREMENTS:

When implementing TEST REQUIREMENTS, the contents of the surveillances and maintenance shall meet IEEE-450-2002 (with noted exceptions above).

TEST REQUIREMENTS FREQUENCY:

Because the testing and maintenance of batteries must be in accordance with IEEE-450-2002 (as modified by RG 1.129 and TS 5.5.14), the frequencies of the applicable TRs may not be changed without a license amendment. Some test frequencies are more than required by IEEE-450-2002 since they were relocated from the former requirements in TS 3.8.4 / 3.8.6. These frequencies may be changed using 10CFR 50.59 as long as the IEEE-450-2002 frequencies are not exceeded.

3.21 BATTERY MONITORING AND MAINTENANCE PROGRAM

TRMS 3.21 Battery and Battery Cell Parameters and Test Requirement Criteria shall be met.

APPLICABILITY: When associated Battery is required to be OPERABLE by TS.

COMPENSATORY MEASURES

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

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. One or more batteries with one or more battery cell do not meet Table 3.21-1 Category A Float Voltage.	A.1 Verify other battery cells in affected battery are within Table 3.21-1 parameters.	1 hour
	<u>AND</u>	
	A.2 Verify battery cell meets Table 3.21-1 Category B limit.	1 hour
	<u>AND</u>	Once per 7 days thereafter
	B.2 Restore battery cell parameters to Category A limit of Table 3.21-1.	31 days
B. Required Compensatory Measure and associated Completion Time of Condition A not met.	B.1 Initiate a Condition Report to perform corrective actions in accordance with the Battery Monitoring and Maintenance Program.	Immediately

(continued)

Battery Monitoring and Maintenance Program
3.21

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
C. One or more batteries with one or more battery cells do not meet Table 3.21-1 Category A Electrolyte Level.	C.1 Verify battery cell meets Table 3.21-1 Category B limit.	1 hour
	<u>AND</u> C.2 Restore battery cell parameters to Category A limit of Table 3.21-1.	7 days
D. Required Compensatory Measure and associated Completion Time of Required Action C.1 not met.	D.1 Equalize and test battery cell(s)	24 hours
E. Required Compensatory Measure and associated Completion Time of Required Action C.2 not met.	E.1 Initiate a Condition Report to perform corrective actions in accordance with the Battery Monitoring and Maintenance Program.	Immediately

(continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
<p>F. One or more batteries with one or more battery cell do not meet Table 3.21-1 Category A specific gravity.</p>	<p>F.1 Verify battery cell meets Table 3.21-1 Category B limit.</p> <p><u>AND</u></p> <p>F.2 Restore battery cell parameters to Category A limit of Table 3.21-1.</p>	<p>1 hour</p> <p>7 days</p>
<p>G. Required Compensatory Measure and associated Completion Time of Condition F not met.</p>	<p>G.1 Initiate a Condition Report to perform corrective actions in accordance with the Battery Monitoring and Maintenance Program.</p>	<p>Immediately</p>
<p>H. TRMS not met for reasons other than Condition A, C or F or Compensatory Measure and Completion Time not met.</p>	<p>H.1 Initiate a Condition Report to perform corrective actions in accordance with the Battery Monitoring and Maintenance Program.</p>	<p>Immediately</p>

TEST REQUIREMENTS

TEST		FREQUENCY
TR 3.21.1	Verify battery terminal voltage is ≥ 123.5 V on float charge.	<p>-----NOTE----- The 7 day Frequency is not applicable if the battery is on equalize charge or has been on equalize charge at any time during the previous 1 day. -----</p> <p>7 days</p> <p><u>AND</u></p> <p>14 days</p>
TR 3.21.2	Verify battery cell parameters meet Table 3.21-1 Category A limits.	<p>-----NOTE----- The 7 day Frequency is not applicable if the battery is on equalize charge or has been on equalize charge at any time during the previous 4 days. -----</p> <p>7 days</p> <p><u>AND</u></p> <p>14 days</p>

(continued)

TEST REQUIREMENTS (continued)

TEST		FREQUENCY
TR 3.21.3	Verify battery cell parameters meet Table 3.8.6-1 Category B limits.	92 days
TR 3.21.4	Verify battery connection resistance is $\leq 40 \text{ E-6}$ ohms.	12 months
TR 3.21.5	Verify Battery Room temperature is $< 100^{\circ}\text{F}$ and ventilation is in service.	24 hours
TR 3.21.6	Verify average electrolyte temperature of 10% of (representative) cells is $\geq 50^{\circ}\text{F}$.	92 days
TR 3.21.7	Verify adequate appearance, cleanliness of the battery rack and area including the existence of any cell cracks or electrolyte leakage and any evidence of corrosion of terminals, connectors or racks.	31 days
TR 3.21.8	Verify no unintentional battery grounds.	31 days
TR 3.21.9	Verify battery monitoring system is functional.	31 days
TR 3.21.10	Verify battery cells meet the specific gravity requirements based on manufacturer's recommendations.	During performance of discharge test required by TS SR 3.8.4.6

(continued)

TEST REQUIREMENTS (continued)

TEST		FREQUENCY
TR 3.21.11	Verify acceptable specific gravity and temperature of each cell.	12 months
TR 3.21.12	Verify acceptable condition of battery cells in accordance with manufacturer's recommendations and the Battery Monitoring and Maintenance Program	12 months
TR 3.21.13	Verify acceptable cell-to-cell and terminal connection resistance in accordance with the Battery Monitoring and Maintenance Program	12 months
TR 3.21.14	Verify acceptable structural condition of the battery rack in accordance with the Battery Monitoring and Maintenance Program.	12 months

Table 3.21-1 (page 1 of 1)
Battery Cell Parameter Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and $\leq \frac{1}{2}$ inch above maximum level indication mark ^(a)	> Minimum level indication mark, and $\leq \frac{1}{2}$ inch above maximum level indication mark ^(a)
Float Voltage	≥ 2.13 V	≥ 2.13 V
Specific Gravity ^{(b)(c)}	≥ 1.195	≥ 1.195 <u>AND</u> Average of all connected cells > 1.205

- (a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during equalizing charges provided it is not overflowing.
- (b) Corrected for electrolyte temperature and level. Level correction is not required, however, when on float charge and battery charging current is < 1 amp.
- (c) A battery charging current of < 1 amp when on float charge is acceptable for meeting specific gravity limits following a battery recharge for: 1) a maximum of 30 days if a deep discharge did not occur; and 2) a maximum of 180 days if a deep discharge did occur. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to the expiration of the applicable allowance.

B 3.21 Battery Monitoring and Maintenance Program

BASES

TS 5.5.14 requires that a Battery Monitoring and Maintenance Program be established to ensure proper battery restoration and maintenance. The program is in accordance with IEEE 450-2002, "IEEE Recommended Practice for Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Stationary Applications". IEEE 450-22002 is endorsed by the NRC by virtue of NRC RG 1.129, Rev. 2, "Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Nuclear Power Plants".

The program allows for the following exceptions:

1. The battery temperature correction may be performed before or after concluding discharge tests.
2. RG 1.129, Regulatory Position 1, Subsection 2, "References" is not applicable to this program
3. In lieu of RG 1.129, Regulatory Position 2, Subsection 5.2, "Inspection", the following shall be used: "Where reference is made to the pilot cell, pilot cell selection shall be based on the lowest voltage cell in the battery."
4. In RG 1.129, Regulatory Position 3, Subsection 5.4.1, "State of Charge Indicator," the following statements in paragraph 9d) may be omitted: "When it has been recorded that the charging current has stabilized at the charging voltage for three consecutive hourly measurements, the battery is near full charge. These measurements shall be made after the initially high charging current decreases sharply and the battery voltage rises to approach the charger output voltage."
5. In lieu of RG 1.129, Regulatory Position 7, Subsection 7.6, "Restoration", the following may be used: "Following the test, record the float voltage of each cell of the string."

Other RG 1.129 NRC positions (Positions 4, 5, 6 and 8) apply.

COMPENSATORY MEASURES:

When the TRM references in the COMPENSATORY MEASURES that corrective actions must be taken in accordance with the Battery Monitoring and Maintenance Program, section 5.3 and Annexes C, D and F of IEEE 450-2002 must also be utilized as applicable.

(continued)

BASES (continued)

TEST REQUIREMENTS:

When implementing TEST REQUIREMENTS, the contents of the surveillances and maintenance shall meet IEEE-450-2002 (with noted exceptions above).

TEST REQUIREMENTS FREQUENCY:

Because the testing and maintenance of batteries must be in accordance with IEEE-450-2002 (as modified by RG 1.129 and TS 5.5.14), the frequencies of the applicable TRs may not be changed without a license amendment. Some test frequencies are more than required by IEEE-450-2002 since they were relocated from the former requirements in TS 3.8.4 / 3.8.6. These frequencies may be changed using 10CFR 50.59 as long as the IEEE-450-2002 frequencies are not exceeded.

Enclosure 1

**Letter from Jan G. Reber, Director of Assembly Engineering, EnerSys to
Dipen Patel, System Engineer, Peach Bottom Atomic Power Station, Re:
Stabilized Float Current for EnerSys GN Batteries,"
dated March 31, 2017.**

Peach Bottom Atomic Power Station Units 2 and 3

Renewed Facility Operating License Nos. DPR-44 and DPR-56

Docket Nos. 50-277 and 50-278



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Jan G. Reber
Director of Assembly Engineering
North America

3/31/17

Dipen Patel
System Engineer
Peach Bottom Atomic Power Station
1848 Lay Road
Delta, PA 17314

Re: Stabilized Float Current for EnerSys GN Batteries

Dear Mr. Patel,

EnerSys confirms that a stabilized float current is a necessary condition to determine if a battery has achieved a full state of charge. This value, however, is a variable of battery size and float voltage. It is also dependant on temperature and to a lesser degree on battery age and manufacturing process variation. Due to the asymptotic nature of the charge current to state of charge relationship, EnerSys states that there exists a float current value that can be selected for each battery type that, given no other extraneous conditions, can be used to justify that the monitored battery has achieved more than a particular state of charge. It would be ideal to develop this value for each individual battery specifically. However, given the limits of 2.25 VPC nominal string average cell voltage and an average 72-80°F battery temperature, a reasonable estimate of the capacity returned to the battery can be made based on a particular float current by battery type. This value is referenced to the full charge capacity that the battery is capable of at the time the measurement is taken. With the above stipulations as prerequisites, it can be reasonably assumed that when the float current is less than or equal to a 2-amp threshold the GN-23 station batteries located at Peach Bottom APS will have achieved a nominal returned capacity of at least 98 percent. At a float current of less than or equal to 1-amp the GN-23 batteries are expected to have achieved a nominal returned capacity of at least 99 percent. These values are expected to be valid for the service life of the batteries. Note: this evaluation requires that a positive float current is verified, i.e. that the battery has not been opened, resulting in zero float current.

If you have any questions regarding this letter, please contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Jan G. Reber", is written over a light blue horizontal line.

Jan G. Reber
Cc: File 352, S. Vechy, B. Ross