Energy Harbor Nuclear Corp.
Perry Nuclear Power Plant
10 Center Road
P.O. Box 97
Perry, Ohio 44081

Frank R. Payne
Site Vice President, Perry Nuclear

_440-280-5382_

April 24, 2020
L-19-274

10 CFR 50.90

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

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
License Amendment Request for Adoption of Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, "DC Electrical Rewrite - Update to TSTF-360"

In accordance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.90, Energy Harbor Nuclear Corp. is submitting a request for an amendment to the Perry Nuclear Power Plant Technical Specifications (TSs) to incorporate the NRC-approved TSTF-500, Revision 2, "DC Electrical Rewrite - Update to TSTF-360."

Enclosure A provides a description and assessment of the proposed changes including the requested confirmation of applicability and plant-specific verifications; technical analyses; regulatory analyses; environmental considerations; summary of the required Updated Safety Analysis Report (USAR) descriptions; markup pages of existing TSs and TS Bases; and the revised (clean) TS pages. Enclosure B provides several battery manufacturer letters regarding float current monitoring.

Energy Harbor Nuclear Corp. requests approval of the proposed license amendment by April 30, 2021, with the amendment being implemented within 75 days.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Phil H. Lashley, Acting Manager-Nuclear Licensing and Regulatory Affairs at (330) 315-6808.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 24, 2020.

Sincerely,

Payne, Frank C6395 Payne, Frank C6395
Apr 24 2020 11:11 AM

Frank R. Payne

Enclosures:
A. Evaluation of Proposed License Amendment
B. Letters from Battery Manufacturers Verifying the Acceptability of Using Float Current Monitoring

cc: NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
Executive Director, Ohio Emergency Management Agency, State of Ohio (NRC Liaison)
Utility Radiological Safety Board

Enclosure A

Evaluation of Proposed License Amendment

Subject: License Amendment Request for Adoption of Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, “DC Electrical Rewrite – Update to TSTF-360”

1.0 DESCRIPTION

The Technical Specification (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. The proposed amendment would revise TS requirements related to direct current (DC) electrical systems in TS limiting condition for operation (LCO) 3.8.4, "DC Sources – Operating;" LCO 3.8.5, "DC Sources – Shutdown;" and LCO 3.8.6, "Battery Cell Parameters." A new "Battery Monitoring and Maintenance Program" is being proposed for Section 5.5, "Programs and Manuals."

Specifically, the proposed changes request new actions for an inoperable battery charger and alternate battery charger testing criteria for 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 and TS 3.8.5 that perform preventive maintenance on the safety-related batteries to a licensee-controlled program. It is proposed that LCO 3.8.6, "Battery Cell Parameters," is renamed "Battery Parameters," and is 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 (CTs) 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 Section 5.5 of the Programs and Manuals for the maintenance and monitoring of station batteries. The items proposed to be relocated will be contained within this program, titled the "Battery Monitoring and Maintenance Program."

The proposed changes provide new Actions for an inoperable battery charger and alternate battery charger testing criteria. In addition, a number of SRs are relocated to licensee control including the monitoring of battery cell parameter requirements and performance of battery maintenance activities.

These changes are consistent with the U.S. Nuclear Regulatory Commission (NRC)-approved Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, "DC Electrical Rewrite – Update to TSTF-360" (Reference 2). The availability of this TS improvement was announced in the *Federal Register* on September 1, 2011 (76 FR 54510) (Reference 1), as supplemented on November 8, 2011 (76 FR 69296).

2.0 ASSESSMENT

2.1 Applicability of TSTF-500 and Model Safety Evaluation

Energy Harbor Nuclear Corp. has reviewed the model Safety Evaluation (SE) (Reference 3) referenced in the *Federal Register* Notice of Availability published on September 1, 2011 (76 FR 54510). The review included the NRC staff's SE, as well as the supporting information provided in TSTF-500, Revision 2, "DC Electrical Rewrite – Update to TSTF-360." As described herein, Energy Harbor Nuclear Corp. has concluded that the technical bases for the proposed changes presented in TSTF-500, Revision 2, and the model SE prepared by the NRC staff are applicable to the Perry Nuclear Power Plant (PNPP) and support incorporation of this amendment into the PNPP TSs.

The PNPP TSs use different numbering than the Standard TS (STS) (NUREG-1434) on which TSTF-500, Revision 2, is based. The new "Battery Monitoring and Maintenance Program" is contained in TS 5.5.16 as opposed to TS 5.5.14. These differences are editorial and do not affect the applicability of TSTF-500, Revision 2, to the PNPP TSs.

The PNPP DC system is 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. However, the PNPP 125 VDC Class 1E electrical power system consists of a combined Unit 1 and Unit 2 system, each separated into three independent Class 1E DC electrical power subsystems per unit. Following is a brief description of the PNPP system.

General Description: Class 1E, Division 1 and 2 Direct Current Systems

The Class 1E, Division 1 and Division 2, 125-volt direct current (DC) systems are two completely independent and redundant systems. Each is capable of supplying required DC power to associated loads needed for safe shutdown. Each system includes a 1260 ampere hour battery and a 400 ampere battery charger. For Division 1, both Unit 1 and Unit 2 have identical 61-cell batteries. For Division 2, both Unit 1 and Unit 2 have identical 60-cell batteries. In addition, a 400 ampere reserve battery charger is provided for each division. The reserve battery chargers are located with the equipment associated with Unit 1, but can be connected to the appropriate division of either the Unit 1 or Unit 2, Class 1E, 125-volt DC systems by means of the maintenance tie buses. No interdivisional ties are provided between the divisions associated with Unit 1 or Unit 2 during normal operating conditions. Maintenance tie buses only connect the same divisions of the two units (Unit 1, Division 1 to Unit 2, Division 1; and Unit 1, Division 2 to Unit 2, Division 2). The maintenance tie bus circuit breakers are normally open and are manually operated under administrative control. These breakers permit isolation of the battery and normal battery charger associated with either Unit 1 or Unit 2 for purposes of maintenance, testing, or equalizing the battery. If the DC batteries are the only available power source, the maintenance tie circuit breakers may be closed to allow the Unit 1 and Unit 2 batteries to be paralleled.

Battery design (loading, sizing, and capacity) used the guidance in IEEE 485-1997, "IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications." The Division 1 and 2 batteries have a manufacturer rated expected life of 20 years and are typically replaced every 17 years.

General Description: Class 1E, Division 3 Direct Current System

The Class 1E, Division 3, 125-volt DC system is an independent and redundant system capable of supplying required DC power to the high pressure core spray (HPCS) system logic, the Division 3 diesel generator control system, and other Division 3 DC controls. The system includes a 250 ampere hour battery and a 50 ampere battery charger. For Division 3, both Unit 1 and Unit 2 have identical 60-cell batteries. In addition, a 50 ampere reserve battery charger is provided. The reserve battery charger is located with the equipment associated with Unit 1 but can be connected to the Unit 2, Class 1E, 125-volt DC system by means of a maintenance tie bus. No interdivisional ties are provided between the divisions associated with Unit 1 or Unit 2. The maintenance tie bus only connects Unit 1, Division 3 to Unit 2, Division 3. The maintenance tie bus circuit breaker is normally open and is manually operated under administrative control. This breaker permits isolation of the battery and normal battery charger associated with either Unit 1 or Unit 2 for purposes of maintenance, testing or equalizing the battery. If the DC batteries are the only available power source, the maintenance tie circuit breaker may be closed to allow the Unit 1 and Unit 2 batteries to be paralleled.

Battery design (loading, sizing, and capacity) used the guidance in IEEE 485-1997. The Division 3 batteries have a manufacturer rated expected life of 20 years and are typically replaced every 17 years.

The PNPP TSs differ from the Standard TS (STS) (NUREG-1434) which were the basis for TSTF-500, Revision 2, in the following ways:

1. The PNPP Division 1, 2, and 3 batteries have different required currents for determining that their respective batteries are charged. Therefore, the proposed PNPP SR 3.8.4.2 is divided into a requirement for Divisions 1 and 2 and a separate requirement for Division 3. PNPP SR 3.8.4.2 includes the following additional language to address Division 3 surveillance requirements, "and each required Division 3 battery charger supplies ≥ 50 amps at ≥ 125 V for ≥ 8 hours." This additional surveillance action is in the current technical specifications and does not affect the applicability of the published model SE.

2. The PNPP was designed with qualified Unit 1 and Unit 2 class 1E, safety related batteries, and has the ability to tie in the Unit 2 batteries to their respective Unit 1 buses. Based on the operational flexibility of having both Unit 1 and Unit 2 batteries, required battery and/or charger testing does not require declaring a division inoperable, and does not require entry into an LCO action statement. Therefore, the standard technical specification note, which states battery load testing cannot be

completed with the plant in Modes 1, 2, or 3, does not apply to the PNPP. Battery load testing is possible in all plant operating modes if there exists a fully qualified reserve that can support Unit 1 bus operability. Current PNPP surveillance requirements (SR) SR 3.8.4.7 does not contain the Note stating that the surveillance shall not be performed in Modes 1, 2, or 3. Therefore, this specification will not be modified, other than to be re-numbered. In addition, the Note was not incorporated into SR 3.8.6.6. This does not affect the applicability of the published model SE.

3. The PNPP was designed with qualified Unit 1 and Unit 2 class 1E, safety related batteries, and has the ability to tie in the Unit 2 batteries to their respective Unit 1 buses. Based on the operational flexibility of having both Unit 1 and Unit 2 batteries, loss of one of two batteries and/or chargers on one subsystem does not require declaring a division inoperable, and therefore TS 3.8.4, "DC Sources - Operating," specifically Condition A was revised to state "Required" *battery charger on one subsystem inoperable* and Condition B was revised to state "Required" *battery on one subsystem inoperable*. In addition, TS 3.8.5, "DC Sources – Shutdown" Condition A was also revised to state the "Required" *battery charger on one subsystem inoperable.* Because this change does not alter the intended application of the LCO and its related Actions, the change is considered a minor variation from TSTF-500.

4. The current PNPP SR 3.8.4.7 does not include the 60-month provision for the modified performance test, which TSTF-500 removes, consequently, this SR will not be modified, other than to be re-numbered. Otherwise, the changes to this SR are the same as the TSTF. This does not affect the applicability of the published model SE.

5. The proposed PNPP Actions for LCO 3.8.5 Condition B includes an action to suspend movement of recently irradiated fuel assemblies in the "fuel handling building" as well as in "primary containment." This additional action does not affect the applicability of the published model SE.

6. PNPP has implemented the Surveillance Frequency Control Program (SFCP) per the provisions of TSTF-425, and as approved by the NRC via Amendment 171. As a result, the surveillance frequencies in this submittal are listed as "In accordance with the Surveillance Frequency Control Program," or similar language. Therefore, the SR frequencies specified in TSTF-500, Revision 2, "DC Electrical Rewrite – Update to TSTF-360" will be incorporated into the PNPP SFCP upon implementation of the proposed amendment. In the current PNPP TSs, the surveillances that verify battery terminal voltage, charger function, battery capacity, electrolyte level and temperature, specific gravity (which, per procedure, includes a measurement of float current) and cell float voltage have frequencies controlled by the SFCP. Proposed frequency changes are evaluated by NEI 04-10, "Risk Informed Method for Control of Surveillance Frequencies," Revision 1.

7. The proposed PNPP TSs pages include a page marked as "This Page Intentionally Left Blank." The TSTF does not include this page. The proposed page was added to maintain the PY TS page numbering structure due to the deletion of multiple Surveillance Requirements. This does not affect the applicability of the published model SE.

8. The proposed PNPP TSs pages include a Table of Contents. The TSTF does not include this page. The page was added as a result of the proposed renaming of LCO 3.6.8, from "Battery Cell Parameters," to "Battery Parameters."

9. The PNPP TSs pages do not contain the OPDRV action statement to, "Initiate action to suspend operations with a potential for draining the reactor vessel" in LCO 3.8.5 Condition A as it was removed by Amendment 184, which was based on TSTF-542, "Reactor Pressure Vessel Water Inventory Control."

2.2 Verifications and Required Updated Safety Analysis Report Changes

As described in Section 4.7.1, "Verifications," in TSTF-500, Energy Harbor Nuclear Corp. provides the following verifications.

1. Enclosure B contains letters from the manufacturers of the batteries used at the PNPP 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.

2. Energy Harbor Nuclear Corp. 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. Additionally, Energy Harbor Nuclear Corp. verifies that the minimum required procedural time to measure battery float current will be 30 seconds or as recommended by the float current measurement instrument manufacturer. This minimum float current measurement time is required to provide a more accurate battery float current reading.

3. Energy Harbor Nuclear Corp. 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.

4. The cell resistance limits in existing SR 3.8.4.5 are relocated to the "Battery Monitoring and Maintenance Program." The connection resistance limit is 50 μOhm for Divisions 1 and 2, and 100 μOhm for Division 3. The resistance limits apply to the overall connection resistance and allows for normal degradation while maintaining battery operability.

5. Monitoring of battery parameters (that is, specific gravity, electrolyte level, cell temperature, float voltage, connection resistance, and physical condition) will be relocated to the licensee-controlled program, required and described in TS Section 5.5, “Programs and Manuals,” and titled the “Battery Monitoring and Maintenance Program.”

6. Energy Harbor Nuclear Corp. verifies that plant procedures will require verification of the selection of the pilot cell or cells when performing SR 3.8.6.5.

As described in Attachment 1, “List of Required Updated Safety Analysis Report (USAR) Descriptions,” Energy Harbor Nuclear Corp. will revise the USAR to include the following, as part of the adoption of TSTF-500, Revision 2:

1. How a 15 percent design margin for the batteries corresponds to a 2 amp float current value indicating that the battery is 92 percent charged for Division 1, 96 percent charged for Division 2, and 95 percent charged for Division 3.

2. How long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer.

3. How the batteries are sized with correction margins that include temperature and aging and how these margins are maintained.

4. The minimum established design limit for battery terminal float voltage.

5. The minimum established design limit for electrolyte level.

6. The minimum established design limit for electrolyte temperature.

7. How each battery is designed with additional capacity above that required by the design duty cycles to allow for temperature variations and other factors.

8. Normal DC system operation i.e., powered from the battery chargers with the batteries floating on the system, and with a loss of normal power to the battery charger.

2.3 Optional Changes and Variations

Other than the differences listed in Section 2.1, Energy Harbor Nuclear Corp. is not proposing any variations or deviations from the TS changes described in the TSTF-500, Revision 2, or the applicable parts of the NRC staff’s model SE referenced in the *Federal Register* on September 1, 2011 (76 FR54510).

3.0 REGULATORY ANALYSIS

3.1 No Significant Hazards Consideration Determination

Energy Harbor Nuclear Corp. has evaluated the proposed changes to the Technical Specifications (TS) using the criteria in Section 50.92 to Title 10 of the *Code of Federal Regulations* (10 CFR) and has determined that the proposed changes do not involve a significant hazards consideration.

The proposed amendment would revise TS requirements related to direct current (DC) electrical systems in TS limiting condition for operation (LCO) 3.8.4, "DC Sources - Operating," LCO 3.8.5, "DC Sources - Shutdown," and LCO 3.8.6, "Battery Cell Parameters." A new "Battery Monitoring and Maintenance Program" is being proposed for TS 5.5 "Programs and Manuals."

Basis for proposed no significant hazards consideration determination: As required by 10 CFR 50.91(a), the Energy Harbor Nuclear Corp. analysis of the issue of no significant hazards consideration is presented below:

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

   Response: No.

   The proposed changes restructure the Technical Specifications (TS) for the direct current (DC) electrical power system and are consistent with TSTF-500, Revision 2, "DC Electrical Rewrite – Update to TSTF-360." The proposed changes modify TS Actions relating to battery and battery charger inoperability. The DC electrical power system, including associated battery chargers, is not an initiator of any accident sequence analyzed in the Updated Safety Analysis Report (USAR). Rather, the DC electrical power system supports equipment used to mitigate accidents. The proposed changes to restructure TS and change surveillances for batteries and chargers to incorporate the updates included in TSTF-500, Revision 2, will maintain the same level of equipment performance required for mitigating accidents assumed in the USAR. Operation in accordance with the proposed TS would ensure that the DC electrical power system is capable of performing its specified safety function as described in the USAR. Therefore, the mitigating functions supported by the DC electrical power system will continue to provide the protection assumed by the analysis. The relocation of preventive maintenance surveillances, and certain operating limits and actions, to a 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 that are 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 USAR 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 changes do 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 previously evaluated?

   Response: No

   The proposed changes involve 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 USAR. Rather, the DC electrical power system supports equipment used to mitigate accidents. The proposed changes to restructure the TS and change surveillances for batteries and chargers to incorporate the updates included in TSTF-500, Revision 2, “DC Electrical Rewrite – Update to TSTF-360,” will maintain the same level of equipment performance required for mitigating accidents assumed in the USAR. Administrative and mechanical controls are in place to ensure the design and operation of the DC systems continues to meet the plant design basis described in the USAR. Therefore, operation of the facility in accordance with this proposed change will 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 the 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 equipment margins will be maintained in accordance with the plant-specific design bases as a result of the proposed changes. 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.

TS changes made in accordance with TSTF-500, Revision 2, "DC Electrical Rewrite – Update to TSTF-360," maintain the same level of equipment performance stated in the USAR and the current TSs. Therefore, the proposed changes do not involve a significant reduction of safety.

Based on the above, Energy Harbor Nuclear Corp. concludes that the proposed amendment does not involve a 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.

3.2 Applicable Regulatory Requirements/Criteria

Energy Harbor Nuclear Corp. has reviewed the NRC staff's model SE referenced in the Notice of Availability and concluded that the Regulatory Evaluation section is applicable to PNPP. The PNPP is committed to different Regulatory Guide (RG) 1.32 and 1.75 revisions than those referenced in the Regulatory Evaluation section in the model SE as described below.

- The model SE refers to Revision 3 of RG 1.32, "Criteria for Power Systems for Nuclear Power Plants." However, as described in USAR Section 1.8 and TS Bases 3.8.4, PNPP is committed to RG 1.32, Revision 2 (February 1977).

- The model SE refers to Revision 3 of RG 1.75, "Criteria for Independence of Electrical Safety Systems." However, as described in USAR Section 1.8, PNPP is committed to Revision 2 of RG 1.75 (September 1978), "Physical Independence of Electrical Systems," with clarifications and/or exceptions.

Energy Harbor Nuclear Corp. concluded these differences do not result in any needed changes for adoption of TSTF-500, Revision 2 at the PNPP and do not affect the applicability of the NRC staff model SE.

4.0 ENVIRONMENTAL CONSIDERATION

The proposed TS change would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20, and would change an inspection or surveillance requirement. However, the proposed change 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 TS change 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 TS change.

5.0 REFERENCES

1. *Federal Register* 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* (77 FR 545410, September 1, 2011)
2. Technical Specifications Task Force Traveler TSTF-500 Revision 2 (Accession No. ML092670242)
3. Model Application and Safety Evaluation for Plant-Specific Adoption of TSTF-500, Revision 2 (Accession No. ML111751792)

6.0 ATTACHMENTS

1. List of Required Updated Safety Analysis Report (USAR) Descriptions

2. Proposed Technical Specification Changes (Mark-Up)

3. Proposed Technical Specification Changes (Retyped)

4. Proposed Technical Specification Bases Changes (Mark-Up) For Information Only

Attachment 1
Evaluation of Proposed License Amendment

List of Required Updated Safety Analysis Report (USAR) Descriptions
(1 Page Follows)

ATTACHMENT 1

LIST OF REQUIRED UPDATED SAFETY ANALYSIS REPORT (USAR) DESCRIPTIONS

The following table identifies USAR descriptions required by Energy Harbor Nuclear Corp. as part of the adoption of TSTF-500, Revision 2.

REQUIRED USAR DESCRIPTIONS Energy Harbor Nuclear Corp. will change or verify that the USAR:	DUE DATE/EVENT
1. Describes how a 15 percent design margin for the batteries corresponds to a 2 amp float current value indicating that the battery is 92 percent charged for Division 1, 96 percent charged for Division 2, and 95 percent charged for Division 3.	Upon implementation of the approved Technical Specification amendment (applies to all)
2. States that the long term battery performance is supported by maintaining float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 2.21 V per connected cell and that there are 61 connected cells in the battery, which corresponds to 135 V at the battery terminals for Division 1, and 2.25 V per connected cell and that there are 60 connected cells in the battery, which corresponds to 135 V at the battery terminals for Divisions 2 and 3.	
3. Describes how the batteries are sized with correction margins that include temperature and aging and how these margins are maintained.	
4. States the minimum established design limit for battery terminal float voltage.	
5. States the minimum established design limit for electrolyte level.	
6. States the minimum established design limit for electrolyte temperature.	
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.	
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.	

Attachment 2
Evaluation of Proposed License Amendment

Proposed Technical Specification Changes (Mark-Up)
(19 Pages Follow)

TECHNICAL SPECIFICATION MARK-UP

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources - Operating

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

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required battery charger on one subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage. AND A.2 Verify battery float current ≤ 2 amps. AND A.3 Restore battery charger to OPERABLE status.	2 hours Once per 12 hours 72 hours
B. Required battery on one subsystem inoperable.	B.1 Restore battery to OPERABLE status.	2 hours
C~~A~~. Division 1 or 2 DC electrical power subsystem inoperable for reasons other than Condition A or B.	C~~A~~.1 Restore Division 1 and 2 DC electrical power subsystems to OPERABLE status.	2 hours
D~~B~~. Division 3 DC electrical power subsystem inoperable.	D~~B~~.1 Declare High Pressure Core Spray System inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
EC. Required Action and associated Completion Time not met.	EC.1	Be in MODE 3.	12 hours
	AND		
	EC.2	Be in MODE 4.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is greater than or equal to the minimum established float voltage≥ 129 V on float charge.	In accordance with the Surveillance Frequency Control Program
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance is ≤ 5.0 E-5 ohm for inter-cell connections, ≤ 5.0 E-5 ohm for inter-rack connections, ≤ 5.0 E-5 ohm for inter-tier connections, ≤ 5.0 E-5 ohm for terminal connections; for Div 1 and Div 2 and ≤ 1.0 E-4 ohm for inter-cell connections, ≤ 1.0 E-4 ohm for inter-rack connections, ≤ 1.0 E-4 ohm for inter-tier connections, ≤ 1.0 E-4 ohm for terminal connections, for Div 3.	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 degrade battery performance.	In accordance with the Surveillance Frequency Control Program
SR 3.8.4.4	Remove visible corrosion, and verify battery cell to cell and terminal connections are coated with anti-corrosion material.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.8.4.5~~	~~Verify battery connection resistance is~~ ~~≤ 5.0 E-5 ohm for inter-cell connections,~~ ~~≤ 5.0 E-5 ohm for inter-rack connections,~~ ~~≤ 5.0 E-5 ohm for inter-tier connections,~~ ~~≤ 5.0 E-5 ohm for terminal connections;~~ ~~for Div 1 and Div 2~~ ~~and~~ ~~≤ 1.0 E-4 ohm for inter-cell connections,~~ ~~≤ 1.0 E-4 ohm for inter-rack connections,~~ ~~≤ 1.0 E-4 ohm for inter-tier connections,~~ ~~≤ 1.0 E-4 ohm for terminal connections~~ ~~for Div 3.~~	~~In accordance with the Surveillance Frequency Control Program~~
SR 3.8.4.2~~6~~	Verify each required Division 1 and 2 battery charger supplies ≥ 400 amps at ≥ 125 V for ≥ 8 hours; and each required Division 3 battery charger supplies ≥ 50 amps at ≥ 125 V for ≥ 8 hours. OR Verify each battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	In accordance with the Surveillance Frequency Control Program
SR 3.8.4.3~~7~~	-------------------------------NOTE---------------------------- SR 3.8.6.6~~4.8~~ may be performed in lieu of SR 3.8.4.3~~7~~. --- 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.	In accordance with the Surveillance Frequency Control Program

~~(continued)~~

~~SURVEILLANCE REQUIREMENTS (continued)~~

~~SURVEILLANCE~~		~~FREQUENCY~~
~~SR 3.8.4.8~~	~~-----NOTE-----~~ ~~Credit may be taken for unplanned events that satisfy this SR.~~ ~~----------~~ ~~Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test.~~	~~In accordance with the Surveillance Frequency Control Program~~ ~~AND~~ ~~12 months when battery shows degradation, or has reached 85% of the expected life with capacity < 100% of manufacturer's rating~~ ~~AND~~ ~~24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating~~

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TECHNICAL SPECIFICATION PROVIDED FOR CONTEXT - NO CHANGES -

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. One Class 1E DC electrical power subsystem capable of supplying one division of the Division 1 or 2 onsite Class 1E electrical power distribution subsystem(s) required by LCO 3.8.8, "Distribution Systems - Shutdown";

b. One Class 1E battery or battery charger, other than the DC electrical power subsystem in LCO 3.8.5.a, capable of supplying the remaining Division 1 or Division 2 onsite Class 1E DC electrical power distribution subsystem when required by LCO 3.8.8; and

c. The Division 3 DC electrical power subsystem capable of supplying the Division 3 onsite Class 1E DC electrical power distribution subsystem, when the Division 3 onsite Class 1E DC electrical power distribution subsystem is required by LCO 3.8.8.

APPLICABILITY: MODES 4 and 5,
During movement of recently irradiated fuel assemblies in the primary containment or fuel handling building.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required battery charger on one subsystem inoperable. AND The redundant subsystem battery and charger OPERABLE.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore battery charger to OPERABLE status.	72 hours
BA. One or more required DC electrical power subsystems inoperable.	BA.1 Declare affected required feature(s) inoperable.	Immediately
	OR	
	BA.2.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	BA.2.2 Suspend movement of recently irradiated fuel assemblies in the primary containment and fuel handling building.	Immediately
	AND	
	BA.2.3 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

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

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery ~~Cell~~ Parameters

LCO 3.8.6 Battery ~~cell~~ parameters for the Division 1, 2, and 3 electrical power subsystem batteries shall be within limits.

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

ACTIONS

--NOTE--

Separate Condition entry is allowed for each battery.

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
	A.3 Restore affected cell voltage ≥ 2.07 V.	24 hours
B. One or two batteries on one subsystem with float current > 2 amps.	B.1 Perform SR 3.8.4.1. AND B.2 Restore battery float current to ≤ 2 amps.	2 hours 12 hours

(continued)

ACTIONS (continued)

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

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
FB. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR One or two batteries on one subsystem with one or more battery cells float voltage < 2.07 V and float current > 2 amps. One or more batteries with average electrolyte temperature of the representative cells < 72°F. OR One or more batteries with one or more battery cell parameters not within Table 3.8.6-1 Category C limits.	FB.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	-----------------------------NOTE----------------------------- Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. -- Verify each battery float current is ≤ 2 amps. Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	In accordance with the Surveillance Frequency Control Program

(continued)

TECHNICAL SPECIFICATION MARK-UP

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.2	Verify each battery pilot cell float voltage is ≥ 2.07 V. Verify battery cell parameters meet Table 3.8.6-1 Category B limits.	In accordance with the Surveillance Frequency Control Program AND Once within 72 hours after battery overcharge > 145 V
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits. Verify average electrolyte temperature of representative cells is ≥ 72°F.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.5	Verify each battery connected cell float voltage is ≥ 2.07 V.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.6	Verify battery capability is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	In accordance with the Surveillance Frequency Control Program AND 12 months when battery shows degradation, or has reached 85% of the expected life with capacity < 100% of the manufacturer's rating AND 24 months when the battery has reached 85% of the expected life with capacity ≥ 100% of the manufacturer's rating

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

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ 1/4 inch above maximum level indication mark[(a)]	> Minimum level indication mark, and ≤ 1/4 inch above maximum level indication mark[(a)]	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity[(b) (c)]	≥ 1.200 for Div 1 and Div 2, ≥ 1.195 for Div 3	≥ 1.195 for Div 1 and Div 2, ≥ 1.190 for Div 3 AND Average of all connected cells ≥ 1.205 for Div 1 and Div 2, ≥ 1.200 for Div 3	Not more than 0.020 below average of all connected cells AND Average of all connected cells ≥ 1.195 for Div 1 and Div 2, ≥ 1.190 for Div 3

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

(b) Corrected for electrolyte temperature and level. Level correction is not required, however, when battery charging is < 2 amps when on float charge.

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

5.5 Programs and Manuals (continued)

5.5.15 Surveillance Frequency Control Program

This program provides controls for Surveillance Frequencies. The program shall ensure that Surveillance Requirements specified in the Technical Specifications are performed at intervals sufficient to assure the associated Limiting Conditions for Operation are met.

a. The Surveillance Frequency Control Program shall contain a list of Frequencies of those Surveillance Requirements for which the Frequency is controlled by the program.

b. Changes to the Frequencies listed in the Surveillance Frequency Control Program shall be made in accordance with NEI 04-10, "Risk-Informed Method for Control of Surveillance Frequencies." Revision 1

c. The provisions of Surveillance Requirements 3.0.2 and 3.0.3 are applicable to the Frequencies established in the Surveillance Frequency Control Program.

5.5.16 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 for 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."

(continued)

5.5 Programs and Manuals

5.5.16 Battery Monitoring and Maintenance Program (continued)

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:

1. Actions to restore battery cells with float voltage < 2.13V;

2. Actions to determine whether the float voltage of the remaining battery cells is ≥ 2.13 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
Evaluation of Proposed License Amendment

Proposed Technical Specification Changes (Re-Typed)
[Provided for Information Only]
(15 Pages Follow)

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources - Operating

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

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required battery charger on one subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore battery charger to OPERABLE status.	72 hours
B. Required battery on one subsystem inoperable.	B.1 Restore battery to OPERABLE status.	2 hours
C. Division 1 or 2 DC electrical power subsystem inoperable for reasons other than Condition A or B.	C.1 Restore Division 1 and 2 DC electrical power subsystems to OPERABLE status.	2 hours
D. Division 3 DC electrical power subsystem inoperable.	D.1 Declare High Pressure Core Spray System inoperable.	Immediately

(continued)

TECHNICAL SPECIFICATION
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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time not met.	E.1 Be in MODE 3. <u>AND</u> E.2 Be in MODE 4.	12 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is greater than or equal to the minimum established float voltage.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.2	Verify each required Division 1 and 2 battery charger supplies ≥ 400 amps at ≥ 125 V for ≥ 8 hours; and each required Division 3 battery charger supplies ≥ 50 amps at ≥ 125 V for ≥ 8 hours. <u>OR</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.	In accordance with the Surveillance Frequency Control Program
SR 3.8.4.3	-------------------------------NOTE---------------------------- SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3. -- 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.	In accordance with the Surveillance Frequency Control Program

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ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required battery charger on one subsystem inoperable. AND The redundant subsystem battery and charger OPERABLE.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore battery charger to OPERABLE status.	72 hours
B. One or more required DC electrical power subsystems inoperable.	B.1 Declare affected required feature(s) inoperable.	Immediately
	OR	
	B.2.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	B.2.2 Suspend movement of recently irradiated fuel assemblies in the primary containment and fuel handling building.	Immediately
	AND	
	B.2.3 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.5.1	------------------------------NOTE------------------------------ The following SRs are not required to be performed: SR 3.8.4.2 and SR 3.8.4.3. -- For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.2 SR 3.8.4.3	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Parameters

LCO 3.8.6 Battery parameters for the Division 1, 2, and 3 electrical power subsystem batteries shall be within limits.

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

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two batteries on one subsystem with one or more battery cell float voltage < 2.07 V.	A.1 Perform SR 3.8.4.1.	2 hours
	AND	
	A.2 Perform SR 3.8.6.1.	2 hours
	AND	
	A.3 Restore affected cell voltage ≥ 2.07 V.	24 hours
B. One or two batteries on one subsystem with float current > 2 amps.	B.1 Perform SR 3.8.4.1.	2 hours
	AND	
	B.2 Restore battery float current to ≤ 2 amps.	12 hours

(continued)

ACTIONS (continued)

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

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR One or two batteries on one subsystem with one or more battery cells float voltage < 2.07 V and float current > 2 amps.	F.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	------------------------------NOTE------------------------------ Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. --- Verify each battery float current is ≤ 2 amps.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.2	Verify each battery pilot cell float voltage is ≥ 2.07 V.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	In accordance with the Surveillance Frequency Control Program
SR 3.8.6.5	Verify each battery connected cell float voltage is ≥ 2.07 V.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.6	Verify battery capability is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	In accordance with the Surveillance Frequency Control Program <u>AND</u> 12 months when battery shows degradation, or has reached 85% of the expected life with capacity < 100% of the manufacturer's rating <u>AND</u> 24 months when the battery has reached 85% of the expected life with capacity ≥ 100% of the manufacturer's rating

5.5 Programs and Manuals (continued)

5.5.15 Surveillance Frequency Control Program

This program provides controls for Surveillance Frequencies. The program shall ensure that Surveillance Requirements specified in the Technical Specifications are performed at intervals sufficient to assure the associated Limiting Conditions for Operation are met.

a. The Surveillance Frequency Control Program shall contain a list of Frequencies of those Surveillance Requirements for which the Frequency is controlled by the program.

b. Changes to the Frequencies listed in the Surveillance Frequency Control Program shall be made in accordance with NEI 04-10, “Risk-Informed Method for Control of Surveillance Frequencies.” Revision 1

c. The provisions of Surveillance Requirements 3.0.2 and 3.0.3 are applicable to the Frequencies established in the Surveillance Frequency Control Program.

5.5.16 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 for 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.”

(continued)

5.5 Programs and Manuals

5.5.16 Battery Monitoring and Maintenance Program (continued)

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:

1. Actions to restore battery cells with float voltage < 2.13V;

2. Actions to determine whether the float voltage of the remaining battery cells is ≥ 2.13 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 4
Evaluation of Proposed License Amendment

Proposed Technical Specification Bases Changes (Mark-Up)
For Information Only
(34 Pages Follow)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources – Operating

BASES

BACKGROUND

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

The 125 VDC electrical power system consists of three independent Class 1E DC electrical power subsystems, Divisions 1, 2, and 3. Each subsystem consists of a battery, a battery charger, a reserve battery charger, and all the associated control equipment and interconnecting cabling. In addition, the ability exists to tie in the Unit 2 batteries in each division to their respective Unit 1 buses.

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

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

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

(continued)

BASES

BACKGROUND (continued)

~~Each Division 1, 2 and 3 battery has adequate storage capacity to carry the required load continuously for at least 2 hours as discussed in the USAR, Section 8.3.2 (Ref. 4).~~

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

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

Each battery has adequate storage capacity to meet the duty cycles discussed in the USAR, Section 8 (Ref. 4). 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 a DC electrical power subsystem are sized to produce required capacity at 80% of nameplate rating. The minimum voltage design limit is 1.875 V per cell for Division 1, 1.863 V per cell for Division 2 and 1.905 V per cell for Division 3 batteries (Ref. 4).

The battery cells are flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 125 V for a 61 cell battery for Division 1 and a 60 cell battery for Division 2 and Division 3 (i.e., cell voltage of 2.049 volts per cell (Vpc) for Division 1 and cell voltage of 2.083 Vpc for Division 2 and Division 3)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.049 Vpc, the Division 1 battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Likewise, once fully charged with its open circuit voltage ≥ 2.083 Vpc, the Division 2 battery cell and Division 3 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 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge. The nominal float voltage of 2.21 Vpc for Division 1 and 2.25 Vpc for Division 2 and Division 3 corresponds to a total float voltage output of 135 V for a 61/60 cell battery as discussed in the USAR, Section 8 (Ref. 4).

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

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

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 performance test) until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

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

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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

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

b. A worst case single failure.

The DC sources satisfy Criterion 3 of the NRC Final Policy Statement on Technical Specification Improvements (58 FR 39132).

LCO

The DC electrical power subsystems, each subsystem consisting of either the Unit 1 or 2 battery, either the normal or reserve battery charger, and the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the divisions, are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4).

Division 1 consists of:
1. 125 volt battery 1R42-S002 or 2R42-S002.
2. 125 volt full capacity charger 1R42-S006 or 0R42-S007.

Division 2 consists of:
1. 125 volt battery 1R42-S003 or 2R42-S003.
2. 125 volt full capacity charger 1R42-S008 or 0R42-S009.

Division 3 consists of:
1. 125 volt battery 1E22-S005 or 2E22-S005.
2. 125 volt full capacity charger 1E22-S006 or 0R42-S011.

APPLICABILITY

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

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

(continued)

BASES

APPLICABILITY (continued)

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

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

ACTIONS

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

Condition A represents one subsystem with required 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, avoiding a premature shutdown with its own attendant risk.

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

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 characteristics 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 a 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 for Division 1 to 92% charge, the battery for Division 2 to 96% charge, and the battery for Division 3 to 95% 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 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.

B.1

Condition B represents one subsystem with required battery inoperable. With required battery inoperable, the DC bus is being supplied by the OPERABLE battery charger(s). Any event that results in a loss of the AC bus supporting the battery charger(s) will also result in loss of DC to that 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 batteries. In addition, the energization transients of any DC loads that are beyond the capability of the battery chargers and normally require the assistance of the batteries 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.

C~~A~~.1

Condition C~~A~~ represents one ~~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 ~~division~~ subsystem. The

2 hour limit is consistent with the allowed time for an inoperable DC distribution system ~~division~~ subsystem.

If one of the required Division 1 or 2 DC electrical power subsystems is inoperable for reasons other than Condition A or B (e.g., ~~both Unit 1 and 2 batteries inoperable, normal and reserve battery chargers inoperable, or both batteries and chargers inoperable~~inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 7) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

D~~B~~.1

With the Division 3 DC electrical power subsystem inoperable, the HPCS System may be incapable of performing its intended function and must be immediately declared inoperable. This declaration also requires entry into applicable Conditions and Required Actions of LCO 3.5.1, "ECCS – Operating."

(continued)

BASES

ACTIONS (continued)

EC.1 and EC.2

If the DC electrical power subsystem cannot be restored to OPERABLE status within the associated Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours and to MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 4 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge helps to ensure the effectiveness of the battery chargers, which support charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or battery cell) in a fully charged state while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum float voltage established by the battery manufacturer 2.20 Vpc times the number of connected cellsinitial voltages assumed in the battery sizing calculations. This voltage maintains the battery plates in a condition that supports maintaining the grid life. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.8.4.2

Visual inspection to detect corrosion of the battery 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 Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~SR 3.8.4.3~~

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

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

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

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

~~(continued)~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.62

This SR verifies Battery charger capability requirements are based on the design capacity of the battery chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 89), the battery charger supply is requiredrecommended to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensure that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying 400 amps for Division 1 and 2 and 50 amps for Division 3 at the minimum established float voltage for 8 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

The other option requires that each battery charger be capable of recharging the battery after a performance 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 performance 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 3.8.4.73

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

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

This SR is modified by a Note. The Note allows the periodic performance of SR 3.8.6.64.8 in lieu of SR 3.8.4.37. This substitution is acceptable because SR 3.8.6.64.8 represents a more severe test of battery capacity than SR 3.8.4.37.

~~(continued)~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.8

A battery performance 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.

The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 8) and IEEE-485 (Ref. 11). 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 for this test is normally performed in accordance with 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 ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 8), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 10% below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 8). This SR is modified by a Note. Credit may be taken for unplanned events that satisfy this SR. This note is provided to prevent unnecessary cycling of plant equipment.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE Standard 308, 1978.
4. USAR, Section 8.3.2.
5. USAR, Chapter 6.
6. USAR, Chapter 15.
7. Regulatory Guide 1.93, December 1974.

(continued)

REFERENCES (continued)

8. ~~IEEE Standard 450, 1995.~~

89. Regulatory Guide 1.32, February 1977.

910. Regulatory Guide 1.129, December 1974.

~~11. IEEE Standard 485.~~

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources – Shutdown

BASES

BACKGROUND

A description of the DC sources is provided in the Bases for LCO 3.8.4, “DC Sources – Operating.”

APPLICABLE SAFETY ANALYSES

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

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

The OPERABILITY of the minimum DC electrical power sources during MODES 4 and 5 and during movement of recently irradiated fuel assemblies in the primary containment or fuel handling building ensures that:

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

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

c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as a fuel handling accident involving handling of recently irradiated fuel, i.e., fuel that has occupied part of a critical reactor core within the previous 24 hours.

The DC sources satisfy Criterion 3 of the NRC Final Policy Statement on Technical Specification Improvements (58 FR 39132).

LCO

One DC electrical power subsystem (consisting of either the Unit 1 or 2 battery, either the normal or reserve battery charger, and all the associated control equipment and interconnecting cabling supplying power to the associated

(continued)

BASES

LCO (continued)

bus), associated with the Division 1 or Division 2 onsite Class 1E DC electrical power distribution subsystem(s) required OPERABLE by LCO 3.8.8, "Distribution Systems – Shutdown," is required to be OPERABLE. Similarly, when the High Pressure Core Spray (HPCS) System is required to be OPERABLE, the Division 3 DC electrical power subsystem associated with the Division 3 onsite Class 1E DC electrical power distribution subsystem required OPERABLE by LCO 3.8.8 is required to be OPERABLE. In addition to the preceding subsystems required to be OPERABLE, a Class 1E battery or battery charger and the associated control equipment and interconnecting cabling capable of supplying power to the remaining Division 1 or Division 2 onsite Class 1E DC electrical power distribution subsystem, when portions of both Division 1 and Division 2 DC electrical power distribution subsystems are required to be OPERABLE by LCO 3.8.8. This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents involving handling of recently irradiated fuel).

Division 1 consists of:
1. 125 volt battery 1R42-S002 or 2R42-S002.
2. 125 volt full capacity charger 1R42-S006 or 0R42-S007.

Division 2 consists of:
1. 125 volt battery 1R42-S003 or 2R42-S003.
2. 125 volt full capacity charger 1R42-S008 or 0R42-S009.

Division 3 consists of:
1. 125 volt battery 1E22-S005 or 2E22-S005.
2. 125 volt full capacity charger 1E22-S006 or 0R42-S011.

APPLICABILITY

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

a. Required features to provide core cooling are available;

(continued)

BASES

APPLICABILITY (continued)

b. Required features used to mitigate a fuel handling accident involving handling of recently irradiated fuel are available (due to radioactive decay, handling of fuel only requires OPERABILITY of the DC Sources when the fuel being handled is recently irradiated, i.e., fuel that has occupied part of a critical reactor core within the previous 24 hours);

(continued)

BASES

APPLICABILITY (continued)

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

The ACTIONS are modified by a Note indicating that LCO 3.0.3 does not apply. If moving recently irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of recently irradiated fuel assemblies is not sufficient reason to require reactor shutdown.

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

Condition A represents one subsystem with required 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, avoiding a premature shutdown with its own attendant risk.

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

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.

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

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 and movement of recently irradiated fuel. By allowing the option to declare required features associated with an inoperable DC power source(s) inoperable, appropriate restrictions are implemented in accordance with the Required Actions of the LCOs for these associated required features. Since this option may involve undesired administrative efforts, the allowance for sufficiently conservative alternate actions (i.e., to suspend CORE ALTERATIONS and movement of recently irradiated fuel assemblies in the primary containment and fuel handling building) is made.

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.

(continued)

BASES

APPLICABILITY

AB.1, AB.2.1, AB.2.2, and AB.2.3 (continued)

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.83. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

REFERENCES

1. USAR, Chapter 6.

2. USAR, Chapter 15.

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 power source batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources – Operating," and LCO 3.8.5, "DC Sources – Shutdown." In addition to the limitations of this Specification, the battery monitoring and maintenance program also implements a program specified in Specification 5.5.16 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 61 cell battery for Division 1 and a 60 cell battery for Division 2 and Division 3 (i.e., cell voltage of 2.049 volts per cell (Vpc) for Division 1 and cell voltage of 2.083 Vpc for Division 2 and 3)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.049 Vpc, the Division 1 battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Likewise, once fully charged with its open circuit voltage ≥ 2.083 Vpc, the Division 2 battery cell and Division 3 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 2.20 to 2.25 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self-discharge. The nominal float voltage of 2.21 Vpc for Division 1 and 2.25 Vpc for Division 2 and Division 3 corresponds to a total float voltage output of 135 V for a 61/60 cell battery as discussed in the USAR, Section 8 (Ref. 2).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in USAR, Chapter 6 (Ref. 13) and Chapter 15 (Ref. 24), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power subsystems provide normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

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

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

b. A worst case single failure.

Since battery ~~cell~~ parameters support the operation of the DC power sources, they satisfy Criterion 3 of the NRC Final Policy Statement on Technical Specification Improvements (58 FR 39132).

LCO

Battery ~~cell~~ parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Battery parameter~~Electrolyte~~ limits are conservatively established, allowing continued DC electrical system function even with limits not met. Additional preventative maintenance, testing, and monitoring performed in accordance with the Battery Monitoring and Maintenance Program is conducted as specified in Specification 5.5.16.

(continued)

TS BASES MARK-UP - PROVIDED FOR INFORMATION ONLY

BASES (continued)

APPLICABILITY

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

ACTIONS

The ACTIONS Table is modified by a Note indicating that separate Condition entry is allowed for each battery. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each inoperable battery. Complying with the Required Actions for one inoperable battery may allow for continued operation, and subsequent inoperable batteries are governed by separate Condition entry and application of associated Required 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. 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 indication of a substantially discharged battery and 12 hours is a reasonable time prior to declaring the battery inoperable.

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

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

With one or 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 5.5.16, 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 5.5.16.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 batteries may have to be declared inoperable and the affected cells replaced.

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.

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

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

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

confirm the float voltage of the pilot cell. One hour is considered a reasonable amount of time to perform the required verification.

Verification that the Category C limits are met (Required Action A.2) provides assurance that, during the time needed to restore the parameters to the Category A and B limits, the battery is still capable of performing its intended function. A period of 24 hours is allowed to complete the initial verification because specific gravity measurements

(continued)

BASES

ACTIONS

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

must be obtained for each connected cell. Taking into consideration both the time required to perform the required verification and the assurance that the battery cell parameters are not severely degraded, this time is considered reasonable. The verification is repeated at 7 day intervals until the parameters are restored to Category A and B limits. This periodic verification is consistent with the normal Frequency of pilot cell surveillances.

Continued 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.

FB.1

When any battery parameter is outside the allowances of the Required Actions for Condition A, B, C, D, or E, Category C limits for any connected cell, sufficient capacity to supply the maximum expected load requirement is not assured and the associated 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. 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 72°F, also are cause for immediately declaring the associated battery inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

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

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

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 135 V at the battery terminals, or 2.25 Vpc for a 60 cell battery and 2.21 Vpc for a 61 cell battery. 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 5.5.16. SRs 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

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., 40°F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The 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 3.8.4.3.

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.

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. 1) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed durty cycle loads when the battery design capacity reaches this 80% limit. 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 ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 1), 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. 1).

The SR verifies that Category A battery cell parameters are consistent with IEEE-450 (Ref. 3), which recommends regular battery inspections including electrolyte level, float voltage, and specific gravity of pilot cells.

TS BASES MARK-UP - PROVIDED FOR INFORMATION ONLY

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

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.6.2

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. In addition, within 72 hours of a battery overcharge > 145 V, the battery must be demonstrated to meet Category B limits. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such overcharge.

SR 3.8.6.3

This Surveillance verifies that the average temperature of representative cells is ≥ 72°F is consistent with a recommendation of IEEE-450 (Ref. 3). The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. Ten connected cells shall be sampled during this Surveillance.

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

Table 3.8.6-1

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

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

The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra 1/4 inch allowance above the maximum level indication mark 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

(continued)

TS BASES MARK-UP - PROVIDED FOR INFORMATION ONLY

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

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. 3) recommends that electrolyte level readings should be made only after the battery has been on a float charge for at least 72 hours.

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

The Category A limit specified for specific gravity for each pilot cell is ≥ 1.200 for Divisions 1 and 2 and ≥ 1.195 for Division 3 (0.015 below the manufacturer's fully charged nominal specific gravity). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

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

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

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ 1.195 for Division 1 and Division 2 and ≥ 1.190 for Division 3 (0.020 below the manufacturer's fully charged, nominal specific gravity) with the average of all connected cells ≥ 1.205 for Divisions 1 and 2 and ≥ 1.200 for Division 3 (0.010 below the manufacturer's fully charged, nominal specific gravity).

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BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell do not mask overall degradation of the battery.

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

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

The Category C limit of average specific gravity (≥ 1.195 for Division 1 and Division 2 and ≥ 1.190 for Division 3), is based on manufacturer's recommendations (0.020 below the manufacturer's recommended fully charged, nominal specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell does not mask overall degradation of the battery.

The footnotes to Table 3.8.6-1 that apply to specific gravity are applicable to Category A, B, and C specific gravity.

Footnote (b) in Table 3.8.6-1 requires the above mentioned correction for electrolyte level and temperature, with the exception that level correction is not required when battery charging current is < 2 amps on float charge. This current provides, in general, an indication of overall battery condition.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in IEEE-450 (Ref. 3). Footnote (c) to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for up to 7 days following a battery recharge. Within 7 days each connected cell's specific gravity must be measured to confirm the state of charge. Following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant, and confirmatory measurements may be made in less than 7 days.

REFERENCES

1. IEEE-450.

2. USAR, Chapter 8.

31. USAR, Chapter 6.

42. USAR, Chapter 15.

3. IEEE Standard 450, 1995.

5. IEEE Standard 485, 1983.

Enclosure B

Letters from Battery Manufacturers Verifying the Acceptability of Using Float Current Monitoring

C&D TECHNOLOGIES, INC.
Power Solutions

1400 Union Meeting Road
Blue Bell, PA 19422
Phone: (215) 775-1314
Fax: (215) 619-7887

Sent via Email to: jpetty@firstenergycorp.com

October 6, 2017

Mr. Justin Petty
First Energy Corp.

Subject: Perry Nuclear Plant – Using Float Current for State of Charge

Dear Justin:

In regards to the C&D battery model KCR in safety related (Class 1-E) applications at Perry, it is acceptable to use float current monitoring instead of specific gravity monitoring as a reliable and accurate indication of the state of charge of the battery. This relationship remains valid for the life of these batteries.

For technical basis, please reference IEEE 450-2010, Annex A.2, which indicates in part:

A.2 Stabilized charging current used to determine a fully charged condition

The pattern of charging current delivered by a conventional voltage-regulated charger after a discharge is the most accurate method for determining the state of charge. As the cells approach full charge, the battery voltage rises to approach the charger output voltage, and the charging current decreases. When the charging current has stabilized at the charging voltage for three consecutive hourly measurements, the battery is near full charge. The expected charging current range applicable to each model may be verified by test or in consultation with the manufacturer.

I hope that this information meets your needs. If you require any additional information, please contact me.

Regards,

Larry A. Carson

Larry A. Carson
Sr. Product Manager – Utility & Nuclear
C&D Technologies, Inc.

EnerSys
P.O. Box 14145
Reading, PA 19612-4145
800-538-3627 x 1680
Fax 610-208-1971
Email: jan.reber@enersys.com
www.enersys.com

Jan G. Reber
Director of RP Assembly Engineering
Technology & Engineering

10/20/17

Justin Petty
Plant Engineering
Perry Nuclear Power Station
Mail Stop PYA-250
10 Center Rd
Perry, OH 44081

Re: Use of Stabilized Float Current for SOC determination for EnerSys GN Batteries

Dear Mr. Petty,

EnerSys confirms that a stabilized float current is a necessary condition to determine that a battery is approaching 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 assuming all other monitored individual attributes of the system are within the guidelines of IEEE 450.

It would be ideal to develop this value for each individual battery specifically to account for individual variations in battery and system circumstances. However, if we assume operating parameters of a 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 and float voltage. 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 60 cell and 61 cell 2GN-15 station batteries located at Perry NPS will have achieved a nominal returned capacity. The capacity values for the two string counts at a stabilized nominal 135 Volt are as listed below. 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 experienced an open, resulting in zero or virtually zero float current.

2 GN-15 string count floating at 135 VPC	Percentage of Available Capacity Returned (Measured Float Current is < or = 2 amps)
60 cell (2.25 VPC)	96
61 cell (2.21 VPC)	92

These values have been determined from review of internal recharge curves and Tafel plots from various GN tests, scaled to size. The estimations are, in EnerSys opinion, conservative.

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

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