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SOUTHERN COMPANY
Energy to Serve Your World℠

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

Vogtle Electric Generating Plant
Request to Revise Technical Specifications
DC Sources and TSTF-360, Revision 1

Ladies and Gentlemen:

In accordance with the requirements of 10 CFR 50.90, Southern Nuclear Operating Company (SNC) proposes to revise the Vogtle Electric Generating Plant (VEGP) Unit 1 and Unit 2 Technical Specifications (TS). The proposed changes would revise TS Limiting Conditions for Operation (LCO) 3.8.4, "DC Sources – Operating," LCO 3.8.5, "DC Sources – Shutdown," and LCO 3.8.6, "Battery Cell Parameters." The proposed changes are based on Industry/TSTF Standard Technical Specification Change Traveler TSTF-360, Revision 1.

The proposed changes would:

- Add a new Condition and Required Action with an increased Completion Time for a DC source inoperable due to an inoperable battery;
- Provide alternate testing criteria for battery charger testing;
- Relocate preventive maintenance Surveillance Requirements (SRs) to a licensee controlled program;
- Replace battery specific gravity monitoring with float current monitoring;
- Add appropriate Conditions and Required Actions with increased Completion Times for out-of-limit conditions for cell voltage, electrolyte level, and electrolyte temperature; and
- Create TS 5.5.19, Battery Monitoring and Maintenance Program, based on IEEE-450, 1995. This program will contain the relocated preventive maintenance SRs as well as:
  - Category A and B value limits for cell voltage and electrolyte level, along with the associated compensatory actions;
  - Category C specific value limit for electrolyte level;
  - The specific value limit for electrolyte temperature; and
  - Specific value for the minimum battery charging float voltage.

Enhanced Bases are provided consistent with the above changes.

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The proposed changes and their basis are described in Enclosure 1. An evaluation demonstrating that the proposed changes do not involve a significant hazard as defined in 10 CFR 50.92 is provided in Enclosure 2. Marked-up TS and Bases pages are provided in Enclosure 3, and clean-typed pages are provided in Enclosure 4. SNC requests approval of the proposed changes by November 1, 2004 to facilitate the implementation of the proposed changes for Unit 1 no later than the end of the next refueling outage. The proposed changes would be implemented for Unit 1 no later than the end of refueling outage 1R12 (Spring 2005) and for Unit 2 no later than the end of refueling outage 2R11 (Fall 2005).

Mr. J. T. Gasser states he is a Vice President of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company, and to the best of his knowledge and belief, the facts set forth in this letter are true.

This letter contains no NRC commitments. If you have any questions, please advise.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Jeffrey T. Gasser

Sworn to and subscribed before me this 13th *day of* October *, 2003.*

Notary Public

My commission expires: 06/07/05

JTG/tdh/daj

Enclosure 1: Basis for Proposed Changes
Enclosure 2: No Significant Hazard Consideration Evaluation
Enclosure 3: Marked-up TS and Bases Pages
Enclosure 4: Clean-typed TS and Bases Pages

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Enclosure 1

Vogtle Electric Generating Plant
Request to Revise Technical Specifications
DC Sources and TSTF-360, Revision 1

Basis for Proposed Changes

Proposed Changes

Southern Nuclear Operating Company (SNC) proposes to revise the Vogtle Electric Generating Plant (VEGP) Unit 1 and Unit 2 Technical Specifications (TS). The proposed changes would revise TS Limiting Conditions for Operation (LCO) 3.8.4, "DC Sources – Operating," LCO 3.8.5, "DC Sources – Shutdown," and LCO 3.8.6, "Battery Cell Parameters." The proposed changes are based on Industry/TSTF Standard Technical Specification Change Traveler TSTF-360, Revision 1. The following is a detailed description of the proposed changes.

LCO 3.8.4 – The following changes are proposed for LCO 3.8.4.

- A new Condition A for an inoperable DC source due to an inoperable battery, with associated Required Actions and Completion Times, is proposed.
- Existing Condition A is renamed Condition B and revised to address one DC electrical power source inoperable for reasons other than Condition A. The terminology "DC electrical power source" is used throughout for the sake of consistency with the LCO statement.
- Existing Condition B is renamed Condition C.
- Existing SR 3.8.4.1 would be revised to "Verify battery terminal voltage is greater than or equal to the minimum established float voltage."
- Existing SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 would be removed from the TS, and their requirements would become part of the Battery Monitoring and Maintenance Program that will be required by new TS 5.5.19.
- Existing SR 3.8.4.6 would be renumbered to SR 3.8.4.2. The Note associated with this SR would be deleted and the SR would be revised to replace the 125 V criteria with "greater than or equal to the minimum established float voltage." The charging time requirement for systems C and D is revised from ≥ 8 hours to ≥ 3 hours. An alternative criteria would be added to the SR that allows the charger operability to be verified by recharging its associated battery to the fully charged state within 12 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.
- Existing SR 3.8.4.7 would be renumbered to SR 3.8.4.3, and the reference to SR 3.8.4.6 in the Note associated with existing SR 3.8.4.7 would be renumbered to SR 3.8.6.6.
- Existing SR 3.8.4.8 would be moved to LCO 3.8.6 and renumbered to SR 3.8.6.6. In addition, existing Table 3.8.4-1 would be deleted and replaced with the Frequency from the associated SR in NUREG-1431, i.e., "60 months <u>AND</u> 12 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating <u>AND</u> 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating."

LCO 3.8.5 – The following changes are proposed for LCO 3.8.5.

- SR 3.8.5.1 would be revised to delete reference to the SRs relocated from LCO 3.8.4 and renumber the remaining referenced SRs.

LCO 3.8.6 – The following changes are proposed for LCO 3.8.6.

Enclosure 1

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Basis for Proposed Changes

- The word "cell" is deleted, and the LCO statement is revised to delete reference to the specific limits of Table 3.8.6-1. With regard to the specific limits of Table 3.8.6-1, the following limits are relocated to the Battery Monitoring and Maintenance Program specified in new TS 5.5.19:
  - Category A and B limits for cell voltage and electrolyte level; and
  - Category C specific value limit for electrolyte level.
  - The requirements for specific gravity will be replaced with float current monitoring.
- Existing Condition A, associated Required Actions and Completion Times will be deleted and replaced with the following new Conditions:
  - A new Condition A, associated Required Actions and Completion Times for one battery with one or more battery cells float voltage < 2.07 V.
  - A new Condition B, associated Required Actions and Completion Times for one battery with float current > 2 amps for batteries A or B, or > 1 amp for battery C or D.
  - A new Condition C, associated Required Actions and Completion Times for one battery with one or more cells electrolyte level less than minimum established design limits.
  - A new Condition D, associated Required Actions and Completion Times for one battery with pilot cell electrolyte temperature less than minimum established design limits.
  - A new Condition E, associated Required Actions and Completion Times for two or more batteries with battery parameters not within limits.
- Existing Condition B would be renamed Condition F and revised by referencing the new Conditions B, C, D, and E. In addition, the existing portions of the Condition that address electrolyte temperature and battery cell parameters not within Category C limits would be deleted and replaced with a Condition that addresses battery cell voltage and float current.
- The existing SRs and Table 3.8.6-1 would be deleted and replaced with an SR for float current, pilot cell voltage, electrolyte level, pilot cell temperature, and connected cell voltage.

A new program, the Battery Monitoring and Maintenance Program, to be specified in new TS 5.5.19, will be created. The requirements of this program will be based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications."

Associated enhanced Bases changes consistent with TSTF-360 and the proposed changes to the LCOs are provided.

Bases for Proposed Changes

The existing Vogtle Electric Generating Plant (VEGP) Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.8.4, "DC Sources – Operating," specifies DC source operability in terms of individual DC sources. Four class 1E 125 V DC electrical power sources are required to be operable. There are four safety feature 125 V DC systems (identified A, B, C, and D) per unit. Each system has a 59 cell lead-calcium battery, switchgear, two redundant battery chargers, two inverters, and 125 V DC distribution panels. Systems A, B, and C each have a 125 V DC motor control center for motor-operated valves. The 125 V DC systems A, B, C, and D supply 120 V AC power via the inverters to the reactor protection system (RPS) and engineered safety feature actuation system (ESFAS) instrumentation channels 1, 2, 3, and 4, respectively. Each instrumentation channel provides input to the Train A and B RPS and ESFAS actuation logic. Systems A and B provide 120 V AC power to the RPS/ESFAS

actuation logic Trains A and B, respectively. In addition, systems C and D provide redundant power to the actuation logic Trains A and B, respectively. Each 125 V DC motor control center supplies power to safety features motor-operated valves. The 125 V DC distribution panels supply power for safety features control, switching, and field flashing for emergency diesel generators. System C provides all power required for successful operation of the turbine-driven auxiliary feedwater pump, with the exception of the steam generator-to-auxiliary feedwater turbine motor-operated valves (redundant valves) which are provided power from the systems A and B DC motor control centers. The batteries are sized in accordance with IEEE-485.

Each 125 V DC battery is provided with two battery chargers, each of which is sized to supply the continuous (long term) demand on its associated DC system while providing sufficient power to replace 110 percent of the equivalent ampere-hours removed from the battery during a design basis battery discharge cycle within a 12-hour period after charger input power is restored. The sizing of each battery charger meets the requirements of IEEE-308 and Regulatory Guide 1.32. Systems A and C receive power from Train A ESF buses, and Systems B and D receive power from Train B ESF buses.

The LCO discussion of the Bases for LCO 3.8.4 defines an operable DC source as consisting of one battery, battery charger, and the corresponding control equipment and interconnecting cabling supplying power to the associated bus.

LCO 3.8.4, New Condition A

The first change to LCO 3.8.4 (and LCO 3.8.5) recommended by TSTF-360, Revision 1 was to add a new Condition for inoperable charger(s) on one train. The new Required Actions would restore battery terminal voltage to the minimum established float voltage within 2 hours, verify battery float current ≤ 2 amps once per 12 hours, and restore the inoperable charger(s) within 7 days. As described above, VEGP is equipped with redundant chargers for each battery, and in the highly unlikely event that both chargers for a battery became inoperable at the same time, it would be very difficult to establish temporary charging capable of restoring battery terminal voltage to the minimum established float value within 2 hours. There is no capability to connect the DC systems between themselves, between Unit 1 and Unit 2 systems, or between the safety features systems and the non-safety features systems. Therefore, VEGP elects not to incorporate this feature of TSTF-360 for LCOs 3.8.4 and 3.8.5.

However, TSTF-360 also recommends a new Condition for inoperable batteries, with an extended Completion Time provided that the new Completion Time can be shown to be appropriate in accordance with the guidance of Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decision Making: Technical Specifications." The proposed change would add new Condition A to LCO 3.8.4 to address one DC source inoperable due to an inoperable battery. The Required Action is to restore the DC source to operable status and the Completion Time is 24 hours. The wording for the new Required Action differs from that of TSTF-360 because of the fact that the VEGP TS specify DC source operability in terms of individual sources rather than trains. In addition, the proposed change is conservative with respect to TSTF-360 because only one DC source is allowed to be inoperable, whereas TSTF-360 would allow an entire train to be inoperable. The proposed change to allow 24 hours to restore a DC source that is inoperable due to an inoperable battery is requested to reduce unnecessary burdens in complying with current TS requirements. Presently, if a battery is inoperable, or if maintenance such as cell replacement is required, the 2-hour Completion Time is severely restrictive. Allowing 24 hours for

maintenance on the batteries will facilitate a more orderly and effective work process. It will also minimize the potential for an additional shutdown/restart transient to comply with the TS in order to accomplish the required maintenance.

At VEGP, no single failure in any 125 V DC system will result in conditions that will prevent the safe shutdown of the unit. Therefore, with one DC source inoperable, the capability to respond to design basis events, excluding a single failure due to the time-limited Condition, is maintained. A comparison of systems A and B shows that key safety features that would be affected by a loss of offsite power with one system having an inoperable battery include the following. Note that the loss of system A or B alone would not result in loss of any redundant features.

- Train A(B) 4160 V and 480 V switchgear breaker control circuits would be disabled. This means that the circuit breakers would fail as is. Breakers that are closed at the time of the event would remain closed, and breakers that are open would remain open and would require manual action to close them.
- The Train A(B) diesel generator (DG) voltage regulator, speed control, and engine control panels would be disabled, thereby disabling the associated DG.
- Train A(B) sequencer would be disabled and Train A(B) auxiliary feedwater actuation would be blocked .
- For system A, all of the solid state protection system (SSPS) Channel 1 inputs to the Train A and B actuation logic would be de-energized. The nuclear instrumentation system (NIS) (source range, intermediate range, and power range) channel 1 would be de-energized, and the Train A SSPS output relays would also be de-energized. Control of Train A reactor trip and bypass breakers would be lost.
- For system B, all of the SSPS Channel 2 inputs to the Train A and B actuation logic would be de-energized. The NIS channel 2 would be de-energized, and the Train B SSPS output relays would also be de-energized. Control of Train B reactor trip and bypass breakers would be lost.
- Train A(B) control room isolation on high radiation or safety injection would be disabled.
- Loss of control and indication for various isolation valves and HVAC dampers.
- Loss of train-related actuation of main feedwater isolation and main steam isolation.
- System A - Power-operated relief valve (PORV) 455A would be disabled.
- System B – PORV 456A would be disabled.
- System A – Steam generator (SG) outlet valve HV 3019 to turbine driven auxiliary feedwater pump (TDAFWP) would be disabled. This valve is normally open to provide steam to the TDAFWP, and it would fail as is on loss of power.
- System B – SG outlet valve HV 3009 to TDAFWP would be disabled. This valve is normally open to provide steam to the TDAFWP, and it would fail as is on loss of power.
- System A – SG atmospheric relief valves (ARV) 3000 and 3030 control power would be lost, but valves remain capable of being manually cycled via installed hand pumps.
- System B – SG atmospheric relief valves (ARV) 3010 and 3020 control power would be lost, but valves remain capable of being manually cycled via installed hand pumps.

Similarly, a review of systems C and D shows that key safety features that would be affected by a loss of offsite power with one system having an inoperable battery include the following:

Basis for Proposed Changes

- System C – All of the solid state protection system (SSPS) Channel 3 inputs to the Train A and B actuation logic would be de-energized. The nuclear instrumentation system (NIS) (source range, intermediate range, and power range) channel 3 would be de-energized.
- System C – TDAFWP control power and power to the associated trip and throttle valve and discharge valves would be lost.
- System D – All of the solid state protection system (SSPS) Channel 4 inputs to the Train A and B actuation logic would be de-energized. The nuclear instrumentation system (NIS) (source range, intermediate range, and power range) channel 4 would be de-energized.
- System C(D) – Loss of a single RHR suction isolation valve on each train.

With the exception of the TDAFWP, systems C and D are identical, and loss of either system would not result in loss of redundant features.

As can be seen from the preceding discussion, the one non-redundant design feature of the 125 V DC system at VEGP is the TDAFWP control power and power for associated valves derived from system C. However, if a loss of offsite power were to occur with the battery of system C inoperable, adequate auxiliary feedwater flow would be available from either or both motor driven trains. The availability of the motor driven trains of auxiliary feedwater would not be affected by the inoperable system C battery. A single failure is not postulated while in the time-limited LCO for the battery, so the remaining motor driven trains of the auxiliary feedwater system would be capable of mitigating any design basis event in conjunction with a loss of offsite power. The capability that would be adversely affected by the inoperability of the system C battery would be station blackout coping capability. In accordance with Regulatory Guide (RG) 1.155 "Station Blackout" and NUMARC 87-00 "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout At Light Water Reactors," Revision 1, August 1991, the station blackout (SBO) coping duration for VEGP has been determined to be 4 hours. (Compliance with 10 CFR 50.63, Station Blackout Rule, for VEGP is discussed in detail in section 8.4 of the FSAR.) The SBO coping capability relies, in part, on the availability of auxiliary feedwater as provided by the turbine driven train of the auxiliary feedwater system. Therefore, if an SBO were to occur during the time that the battery of system C was inoperable, the capability to provide auxiliary feedwater would be adversely affected.

The frequency of an SBO at VEGP is approximately 1.680 E-05 per year, and the probability of an SBO during a 24-hour interval would be approximately 4.6 E-08. Procedure 18034-1(2), Loss of Class 1E 125 V DC Power, provides instructions for operating the TDAFWP if its associated DC bus is de-energized. Steam to the turbine can be manually throttled to control pump speed using the pump miniflow indicator. The pump discharge valves are normally open, so once proper pump speed is achieved, auxiliary feedwater flow to the SGs will be established. Operators are trained on the use of this guidance. In addition, the VEGP switchyard is equipped with a standby auxiliary transformer (SAT). The SAT is a 13.8 kV qualified offsite source that can be connected to any one safety bus on either unit. The offsite power circuit, which provides AC power through the SAT, feeds the SAT through a direct buried cable. The buried cable originates at Georgia Power Company's Plant Wilson and can be powered by either the 230 kV grid system or from any combination of the Plant Wilson's six 60 MVA combustion turbine generators (CTGs). Two of these six CTGs have enhanced black-start capability, complete with a black-start diesel generator. These enhanced black-start CTGs are regularly tested to maintain a combined reliability of ≥ 95 %. In the safety evaluation report that accompanied Amendments 100 and 78, dated May 20, 1998, the NRC staff noted that, while VEGP is meeting the "SBO rule" by coping with DC power only, and the AC power source provided by Plant Wilson was not explicitly credited as an alternate AC (AAC) source as part of the VEGP SBO conformance, the NRC staff used the same guidance provided in NUMARC 87-00 and RG 1.155 to evaluate Plant Wilson as "equivalent" to an AAC source. The NRC staff concluded that the Plant Wilson facility meets the applicable requirements of NUMARC

87-00 as an "equivalent" AAC source. Therefore, there is reasonable assurance that, in the unlikely event of an SBO during the time that the system C battery is inoperable, the capability to provide auxiliary feedwater as part of the SBO coping strategy will be maintained.

The risk impact of the proposed change in Completion Time from 2 hours to 24 hours for an inoperable battery was evaluated using the three tiers of RG 1.177. The first tier, Tier 1, assesses the impact of the proposed change on core damage frequency (CDF), incremental conditional core damage probability (ICCDP), large early release frequency (LERF), and incremental conditional large early release probability (ICLERP). As part of their review supporting Amendments 100 and 78, the NRC staff focused on the capability of the VEGP probabilistic risk assessment (PRA) model to analyze the risk stemming from the changes to the Completion Time for the emergency DGs. The VEGP probabilistic risk assessment (PRA) model has since been revised periodically, and it has now been used to evaluate the proposed extended Completion Time for an inoperable battery. The original VEGP model was developed as part of the Individual Plant Examination (IPE) process. This model was reviewed by an Independent Review Group (IRG) and a consultant, PLG, Inc., who provided a critical review as part of the IPE process. This effort provided considerable confidence that the results and conclusions of the IPE were applicable and representative of the plant. The original PRA submitted as part of this process was then converted to linked-fault tree methodology based on the EPRI Computer Aided Fault Tree Analysis (CAFTA) suite of software. The current VEGP PRA is a Revision 2cy model which incorporates plant operating history as well as findings resulting from the Westinghouse Owners Group peer review. All calculations performed in support of the proposed extended Completion Time for an inoperable battery were performed in accordance with SNC approved procedures by qualified personnel. The VEGP PRA includes both a Level 1 and Level 2 analysis. The analysis models both generic and plant-specific initiators, including internal flooding, and dependencies that exist between initiating events and the associated mitigating systems. Generic data sources and plant-specific data were incorporated into the model using Bayesian techniques. Common cause failures are treated using the multiple Greek letter (MGL) method and generic data.

The analysis of the risk significance of the proposed change in Completion Time for an inoperable battery was performed in accordance with SNC procedures. In accordance with procedure, the risk analysis was originated and reviewed by fully qualified engineers. The originator ensures that the model utilized has been properly developed, controlled, documented in accordance with SNC procedure, and calculations are performed using a computer which has been verified to produce accurate results for the model selected. The reviewer in turn confirms that the risk analysis is error free, accurately addresses the issue under consideration, utilizes an appropriate approved model, is based on technically sound judgement, and is properly documented. The analysis is considered a Quality Assurance record and is maintained for the life of the plant.

The current estimated plant CDF for internal events at VEGP is 1.712 E-05 per year, and the SBO contribution is relatively small at approximately 4.60 %. For the purpose of this evaluation, the outage time for the batteries is based on an average time derived from historical data. Because the current Completion Time for an inoperable battery is so short, the batteries are not taken out of service during power operation unless some sort of corrective maintenance is required. The proposed extended Completion Time is not intended to provide for on-line preventive maintenance; it is only to provide for more orderly corrective maintenance. Therefore, in order to evaluate the risk impact of the proposed extended Completion Time, this average time was increased to an estimated value based on the ratio of the proposed Completion Time and the current Completion Time (24/2). With the increase in Completion Time from 2 hours to 24 hours for an inoperable battery, the CDF increased by a value of 1.700 E-07 and the LERF increased by a value less than 1 E-10, which is within the guidelines of RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis."

Basis for Proposed Changes

With the increase in Completion Time from 2 hours to 24 hours for an inoperable battery, ICCDP and ILERP were calculated as 1.548 E-07 and 5.899 E-11, respectively, which are within the guidelines of RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decision-making: Technical Specifications."

Finally, with the implementation of Amendments 100 and 78, VEGP has in place a Configuration Risk Management Program (CRMP) as required by TS 5.5.18. The CRMP provides a proceduralized risk-informed assessment to manage the risk associated with equipment inoperability. The program applies to TS structures, systems, or components for which a risk-informed Completion Time has been granted. The program includes the following elements:

- Provisions for the control and implementation of a Level 1 at power internal events PRA-informed methodology. The assessment shall be capable of evaluating the applicable plant configuration.
- Provisions for performing an assessment prior to entering the LCO Condition for preplanned activities.
- Provisions for performing an assessment after entering the LCO Condition for unplanned entry in to the LCO Condition.
- Provisions for assessing the need for additional actions after the discovery of additional equipment out of service conditions while in the LCO Condition.
- Provisions for considering other applicable risk significant contributors such as Level 2 issues and external events, qualitatively or quantitatively.

The procedure that is used to implement the CRMP is the same procedure that provides instructions to conduct risk-informed assessments required by 10 CFR 50.65 (a)(4) of safety impacts associated with scheduling maintenance and maintenance activities for VEGP in Modes 1, 2, 3, and 4.

The CRMP meets the Tier 2 and Tier 3 requirements of RG 1.177. The CRMP is a combination of a quantitative at-power internal events based Equipment Out of Service (EOOS) risk assessment tool and deterministic safety assessment process utilized by the plant. EOOS was used to meet the Tier 2 requirement that the licensee provide reasonable assurance that risk-significant plant equipment outage configurations will not occur when specific plant equipment is out of service consistent with the proposed change in Completion Time for an inoperable battery. Equipment outages involving the opposite train of NSCW concurrent with an inoperable battery will not be permitted.

Therefore, the proposed extended Completion Time for a single inoperable battery is acceptable based on the available redundancy, defense-in-depth provided by the Plant Wilson enhanced black-start combustion turbines and the SAT, and the fact that the acceptance criteria of RGs 1.174 and 1.177 are met due to the small impact on risk. In addition, the use of the CRMP will ensure that overall plant risk while in an extended TS Completion Time is managed to acceptable levels.

The changes made to the other conditions of LCO 3.8.4 are editorial/administrative to accommodate the addition of the new condition and to clarify that renamed Condition B (previously Condition A) is applicable for reasons other than new Condition A.

SR 3.8.4.1

The specific limiting value for battery terminal float voltage was removed from SR 3.8.4.1 and is now stated in the Bases. The revised SR will now require the battery charger to supply battery terminal voltage "greater than or equal to the minimum established float voltage." This voltage will maintain the battery plates in a condition that supports maintaining the battery grid life. The battery manufacturer establishes this voltage to provide the optimum charge on the battery. As such, the minimum established float voltage can be adequately controlled outside of the TS.

Enclosure 1

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Basis for Proposed Changes

SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5

Per SR 3.0.1, when any SR is not met, the LCO is not met. This is based on the premise that SRs represent the minimum acceptable requirements for operability of the required equipment. However, for SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5, failure to meet the SR does not necessarily mean that the equipment is not capable of performing its safety function, and the corrective action is generally a routine or preventive maintenance activity. For example, the Bases of SR 3.8.4.4 identify removal of visible corrosion and tightening of terminal connections as a preventive maintenance SR (both of which are generally quicker than verifying battery connection resistance). SR 3.8.4.3 (inspection for visual indication of physical damage or deterioration that could degrade battery performance) is not required for the battery to perform its safety function, but again reflects ongoing preventive maintenance activities. These activities are inappropriate for operability SRs and are generally better controlled under a maintenance program. With regard to the resistance verifications of SRs 3.8.4.2 and 3.8.4.5, the values of resistance specified in the TS are vendor recommended values; that is, values at which some action should be taken, not necessarily when battery operability is in question. The safety analyses do not assume a specific battery resistance value, but typically assume the batteries will provide adequate power. Therefore, the key issue is the overall battery resistance. Between surveillances, the resistance of each connection may vary independently from the others, with some being higher and some lower, and the battery remains capable of performing its function. Therefore, the battery should not be considered inoperable solely because one connection's resistance is high. Overall resistance will have a direct impact on battery operability; however, if the battery is able to meet the requirements of the battery service and discharge tests, the battery remains capable of performing its function. Therefore, the requirements of SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 are more appropriate for a maintenance program. In fact, the activities required by these SRs are recommended by IEEE-450, which makes control of these activities via new TS program 5.5.19 acceptable.

SR 3.8.4.6

SR 3.8.4.6 will become SR 3.8.4.2 to accommodate the removal of SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 as discussed above. This SR specifies battery charger current requirements for each DC source, and it verifies the design capacity of each charger. The SR is revised consistent with SR 3.8.4.1 to replace the specific voltage limit with "greater than or equal to the minimum established float voltage." The specific limit that is being replaced is 125 V. The minimum established float voltage for the VEGP batteries is 129.8 V. Therefore, the new limit will be conservative with respect to the existing limit. It is acceptable to control this limit in the Bases for the same reasons discussed under the changes to SR 3.8.4.1. Also, based on current loading requirements for DC systems C and D, the minimum time for which the chargers must deliver the required current has been reduced to 3 hours. Given present design requirements for systems C and D, if the associated chargers can deliver the specified current for at least 3 hours, they will be capable of fully recharging the batteries following a design basis discharge with margin.

In addition, revised SR 3.8.4.2 will include alternate acceptance criteria that would allow an actual in-service demonstration that the charger can recharge the battery to the fully charged state within 12 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state. This is a de facto demonstration of charger operability. This would occur following a service test as explained in the revised Bases for SR 3.8.4.2.

Finally, the Note restricting the performance of this SR during Modes 1, 2, 3, and 4 will be deleted. For VEGP, with two 100% capacity chargers for each battery, this SR can be performed at any time during power operation or shutdown for the charger that is not required for DC source operability. One of the chargers is simply taken out of service and a load is applied to demonstrate charger capacity. Therefore,

this SR can be performed at any time without potential for electrical perturbations to the 120 V AC or 125 V DC busses.

SR 3.8.4.7

SR 3.8.4.7 is renumbered to SR 3.8.4.3 to accommodate the removal of SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5, and Note 1 to this SR is revised to change the reference to SR 3.8.4.8 to SR 3.8.6.6 as discussed below.

SR 3.8.4.8

This SR will be moved to LCO 3.8.6 and renumbered as SR 3.8.6.6. In addition to these editorial changes, the Frequency for this SR is revised to be consistent with NUREG-1431. The Frequency specified in the VEGP TS for this SR refers to Table 3.8.4-1, and this table specifies test frequency based on battery life (≤ 85 % or > 85 %) and whether or not degradation is present. This is consistent with NUREG-1431 with an exception. When battery life reaches 85%, and if no degradation is present, VEGP Table 3.8.4-1 would leave the test interval at 24 months. According to Note 1 of VEGP Table 3.8.4-1, degradation is defined as a decrease in battery capacity of more than 10 % of capacity from its previous discharge test, or the battery capacity is less than 90 % of the manufacturer's rating. Therefore, battery capacity could be less than 100 % without degradation as defined by Note 1 to VEGP Table 3.8.4-1. However, as specified in NUREG-1431, when battery life has reached 85 %, battery capacity must be ≥ 100 % in order for the test frequency to remain at 24 months. Otherwise, the test frequency is reduced to 12 months. Therefore, the SR Frequency as specified in NUREG-1431 is more restrictive than VEGP Table 3.8.4-1, and the proposed change is conservative.

In addition, VEGP Table 3.8.4-1 is modified by three Notes. Note 1 defines degradation, which is defined in IEEE-450, and is therefore unnecessary for the VEGP TS. Note 2 describes how a battery could be restored to a 60-month test interval, and Note 3 restricts the use of replacement cells for a battery that has reached 85 % of its life and exhibits degradation. Both of these notes address maintenance issues that are not appropriate for the TS. Their deletion is more restrictive in that cell replacement cannot be used to effectively increase battery service life.

LCO 3.8.5

The only changes that are proposed for LCO 3.8.5 are associated with SR 3.8.5.1. Because of the changes to the surveillance requirements of LCO 3.8.4, the references to those surveillance requirements in SR 3.8.5.1 must be revised accordingly. In addition, the terminology "DC electrical power sources" is used for the sake of consistency with the LCO statement. These are administrative changes only.

LCO 3.8.6

The primary proposed change to LCO 3.8.6 is the removal of Table 3.8.6-1 and the associated Category A and B battery cell parameter limits. With the removal of the Category A and B limits, the associated Condition A, Required Actions and SRs 3.8.6.1 and 3.8.6.2 are also removed. The Category A and B limits reflect nominal fully charged battery parameter values with significant margin above that required for an operable battery. These Category A and B values represent appropriate monitoring and preventive maintenance levels for long term battery quality and extended battery life. As such, they do not reflect the 10 CFR 50.36 criteria for LCOs of "the lowest functional capability or performance levels of equipment required for safe operation of the facility." Therefore, these values (Table 3.8.6-1), the actions associated with restoration (existing Condition A and associated Required Actions), and SRs 3.8.6.1 and 3.8.6.2 associated with the Category A and B limits are more appropriate for a licensee controlled program subject to 10 CFR 50.59 and based on the recommendations of IEEE-450, 1995. The Category

A and B limits will continue to be controlled at their current levels, and actions will be implemented in accordance with the plant corrective action program. Furthermore, the battery and its preventive maintenance and monitoring are under the regulatory requirements of the Maintenance Rule. This relocation will continue to assure that the battery is maintained at current levels of performance, and it will allow the TS (and licensed operators) to focus on battery parameter degradation that approach (but continue to provide some margin to) levels that may impact battery operability.

Consistent with this approach, new Conditions and associated Required Actions are proposed to address degradation that could impact battery operability. Note that TSTF-360 allows for one or two batteries on a train to be affected at any one time, and a Note allows separate condition entry for each battery. However, in keeping with VEGP LCOs 3.8.4 and 3.8.5, only one battery will be allowed to be in any of the proposed new Conditions for LCO 3.8.6 at any given time. Therefore, train orientation is not important, and the Note allowing separate condition entry for each battery is not required.

New Condition A addresses what was formerly the Category C limit for float voltage. The associated Required Actions are to verify battery charger operability by monitoring battery terminal voltage (SR 3.8.4.1) and verify the overall battery state of charge by monitoring battery float current (SR 3.8.6.1). These actions, which are to be done within two hours, ensure that the battery maintains sufficient capacity to perform its intended function. As long as SRs 3.8.4.1 and 3.8.6.1 can be met, the affected battery does not have to be considered inoperable, and continued operation is permitted for a limited period of time. The affected battery cell voltage is to be restored within 24 hours. However, if for example, SR 3.8.4.1 is not met because battery terminal voltage is not within limit, then the chargers are not performing their function, and Condition B of LCO 3.8.4 would be applicable. If SR 3.8.6.1 is not met, this is indication that the battery state of charge is inadequate and new Condition B of LCO 3.8.6 is applicable.

New Condition B addresses the battery state of charge. State of charge is indicated by battery float current. When batteries A and B are fully charged, they will exhibit a float current of ≤ 2 amps. For battery C and D, the limit is ≤ 1 amp. If the float current for a battery exceeds its limit, this indicates that a partial discharge of the battery has occurred. This may be due to a temporary loss of charging capability or one or more battery cells in a low voltage condition reflecting some loss of capacity. Charging capability is verified by Required Action B.1, which verifies that battery terminal voltage is acceptable via SR 3.8.4.1. If terminal voltage is acceptable, and there are no cells that exhibit a low voltage condition (< 2.07 V), then there is adequate assurance that the battery can be recharged within 12 hours (Required Action B.2).

However, if terminal voltage is found to be less than the minimum established float voltage, then the battery charger(s) are inoperable or operating in the current limit mode. Operation in the current limit mode for two hours (Completion Time of Required Action B.1) is an indication that the battery is substantially discharged and may not be able to perform its required function. Failure to meet SR 3.8.4.1 would require entry into the appropriate Condition of LCO 3.8.4. If terminal voltage is low and charging current low, then the charger(s) are inoperable, and LCO 3.8.4, Condition B would be applicable and Required Action B.1 would require restoration within two hours. If terminal voltage is low, charging current is high, and this condition has persisted for two hours this is indicative of substantial battery discharge, and the battery would be inoperable. In this case, new Condition A of LCO 3.8.4 would be applicable.

If terminal voltage is satisfactory, but the out-of-limit float current condition is due to one or more cells with float voltage less than 2.07 V, the associated "<u>OR</u>" in revised LCO 3.8.6 Condition F would be applicable, and the battery must be declared inoperable immediately. At this point new Condition A of LCO 3.8.4 would be applicable. If the out-of-limit float current condition is due to one or more cells with low voltage, but cell voltage remains ≥ 2.07 V, and terminal voltage is satisfactory, then the battery is not

substantially discharged, and 12 hours to restore float current to within limit (recharge the battery) is reasonable prior to having to declare the battery inoperable.

New Condition C addresses electrolyte level. With one battery with one or more cells that exhibit electrolyte level above the top of the plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform its design function. Therefore, the battery does not have to be considered inoperable, and 31 days is allowed to re-establish electrolyte level to within the minimum established design limit. However, if the electrolyte level is below the top of the plates, there is a potential for dry-out and subsequent plate degradation. New Required Actions C.1 and C.2 address this condition (as well as provisions in Specification 5.5.19, Battery Monitoring and Maintenance Program). Required Action C.2 to verify that there is no evidence of leakage and the Specification 5.5.19.b requirement to equalize and test in accordance with the manufacturer's recommendation are taken from Annex D of IEEE Standard 450-1995.

New Condition D addresses pilot cell electrolyte temperature. A low electrolyte temperature limits the current and power available. While battery capacity may be degraded, the battery is sized with margin, and sufficient capacity exists to perform the intended function. Therefore, the battery does not have to be declared inoperable solely because the pilot cell temperature limit is not met. A Completion Time of 12 hours to restore the pilot cell temperature to within its limit is reasonable based on the above discussion.

New Condition E addresses two or more batteries with battery parameters not within limits. If this condition exists, there is not sufficient assurance that battery capacity has not been affected to the extent that the batteries remain capable of performing their intended function. Given that redundant batteries are involved, this condition has the potential for causing a loss of function. Therefore, it is important that at least three batteries be restored to within limits within two hours.

Revised Condition F provides a default Condition when the Required Actions and Completion Times for new Conditions A through E are not met. In addition, Condition F addresses the case where one battery has one or more cells with float voltage < 2.07 V and float current > the limit for the affected battery. The Required Action for Condition F is to immediately declare the affected battery inoperable.

The Bases for Condition 3.8.6.F is being slightly altered to account for a potential problem with respect to charging a battery for the purpose of raising a cell voltage back to the TS limit of 2.07 V. If an individual cell is found below its category C limit of 2.07 V, one of the ways the voltage can be raised is to place the battery in the equalize mode. This will eventually bring the battery back to the fully charged state. In this situation, the charger current may be above the float current limits. Condition 3.8.6.F requires declaring the battery inoperable if one or more cells are below 2.07 V and the float current is above limits, two degraded conditions. This is because the two conditions (low cell voltage and high float current) may be indicative of a reduced battery capacity which could mean that the battery may be unable to perform its safety functions. However, in the situation described, only one degraded condition exists, the low cell voltage. The current is high because the battery is being charged, therefore, the 3.8.6.F conditions do not exist, and it is not appropriate to declare the battery inoperable.

In support of the revisions to LCO 3.8.6 battery parameters, a completely new set of Surveillance Requirements is proposed for LCO 3.8.6. SR 3.8.6.1 addresses float current to ensure that a proper state of charge is maintained for the batteries. The appropriate float current, based on battery capacity, is specified for each battery to ensure a fully charged battery. The 7-day Frequency is consistent with IEEE-450, 1995. SRs 3.8.6.2 and 3.8.6.5 ensure that individual cell voltages are maintained and that degraded cells exhibiting low voltage are promptly identified. Individual pilot cells are checked on a 31-day Frequency (SR 3.8.6.2) and all of the cells are checked every 92 days (SR 3.8.6.5). These Frequencies are consistent with IEEE-450. In addition, Specification 5.5.19 addresses maintaining float voltage at an

Basis for Proposed Changes

adequate over-potential (2.20 V per cell) so as to limit the formation of lead sulfate and the potential for self discharge. SRs 3.8.6.3 and 3.8.6.4 address electrolyte level and pilot cell temperature. The SR on electrolyte level ensures that the plates remain covered and pilot cell temperature ensures that battery capacity is not impaired due to low temperature. The Frequency for these SRs is 31 days, and this is consistent with IEEE-450. Finally, as discussed above, existing SR 3.8.4.8 will be moved to LCO 3.8.6 as new SR 3.8.6.6. This SR verifies that battery capacity is ≥ 80 % of the manufacturer's rating when subjected to a performance discharge test or a modified performance test. The Frequency is modified to be consistent with NUREG-1431, and it is consistent with IEEE-450.

Finally, a new program will be added to Section 5.0 of the VEGP TS, Specification 5.5.19, Battery Monitoring and Maintenance Program. This program will provide for restoration and maintenance of battery cells with float voltage < 2.13 V and for cells that have been discovered with electrolyte level below the top of the plates. This program will be based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of vented Lead-Acid Batteries for Stationary Applications." Note that the language in TSTF-360 would require equalization and testing when electrolyte level is found to be below minimum established design limits. Consistent with IEEE 450 and the battery manufacturer's recommendations, equalization and testing should only be required when electrolyte level is found to be below the top of the plates. Performing equalization and testing when electrolyte level is below design limits (i.e., the marks on the battery casing) is unnecessary and excessive.

Enclosure 2

Vogtle Electric Generating Plant
Request to Revise Technical Specifications
DC Sources and TSTF-360, Revision 1

Significant Hazard Consideration Evaluation

Proposed Changes

Southern Nuclear Operating Company (SNC) proposes to revise the Vogtle Electric Generating Plant (VEGP) Unit 1 and Unit 2 Technical Specifications (TS). The proposed changes would revise TS Limiting Conditions for Operation (LCO) 3.8.4, "DC Sources – Operating," LCO 3.8.5, "DC Sources – Shutdown," and LCO 3.8.6, "Battery Cell Parameters." The proposed changes are based on Industry/TSTF Standard Technical Specification Change Traveler TSTF-360, Revision 1. The following is a detailed description of the proposed changes.

LCO 3.8.4 – The following changes are proposed for LCO 3.8.4.

- A new Condition A for an inoperable DC source due to an inoperable battery, with associated Required Actions and Completion Times, is proposed.
- Existing Condition A is renamed Condition B and revised to address one DC electrical power subsystem inoperable for reasons other than Condition A. The terminology "DC electrical power source" is used throughout for the sake of consistency with the LCO statement.
- Existing Condition B is renamed Condition C.
- Existing Surveillance Requirement (SR) 3.8.4.1 would be revised to "Verify battery terminal voltage is greater than or equal to the minimum established float voltage."
- Existing SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 would be removed from the TS, and their requirements would become part of the Battery Monitoring and Maintenance Program that will be required by new TS 5.5.19.
- Existing SR 3.8.4.6 would be renumbered to SR 3.8.4.2. The Note associated with this SR would be deleted and the SR would be revised to replace the 125 V criteria with "greater than or equal to the minimum established float voltage." The charging time requirement for systems C and D is revised from ≥ 8 hours to ≥ 3 hours. An alternative criteria would be added to the SR that allows the charger operability to be verified by recharging its associated battery to the fully charged state within 12 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.
- Existing SR 3.8.4.7 would be renumbered to SR 3.8.4.3, and the reference to SR 3.8.4.6 in the Note associated with existing SR 3.8.4.7 would be renumbered to SR 3.8.6.6.
- Existing SR 3.8.4.8 would be moved to LCO 3.8.6 and renumbered to SR 3.8.6.6. In addition, existing Table 3.8.4-1 would be deleted and replaced with the Frequency from the associated SR in NUREG-1431, i.e., "60 months <u>AND</u> 12 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating <u>AND</u> 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating."

LCO 3.8.5 – The following changes are proposed for LCO 3.8.5.

- SR 3.8.5.1 would be revised to delete reference to the SRs relocated from LCO 3.8.4 and renumber the remaining referenced SRs.

LCO 3.8.6 – The following changes are proposed for LCO 3.8.6.

- The word "cell" is deleted, and the LCO statement is revised to delete reference to the specific limits of Table 3.8.6-1. With regard to the specific limits of Table 3.8.6-1, the following limits are relocated to the Battery Monitoring and Maintenance Program specified in new TS 5.5.19:
    - Category A and B limits for cell voltage and electrolyte level; and
    - Category C specific value limit for electrolyte level.

Significant Hazard Consideration Evaluation

The requirements for specific gravity will be replaced with float current monitoring.

- Existing Condition A, associated Required Actions and Completion Times will be deleted and replaced with the following new Conditions:
  - A new Condition A, associated Required Actions and Completion Times for one battery with one or more battery cells float voltage < 2.07 V.
  - A new Condition B , associated Required Actions and Completion Times for one battery with float current > 2 amps.
  - A new Condition C, associated Required Actions and Completion Times for one battery with one or more cells electrolyte level less than minimum established design limits.
  - A new Condition D, associated Required Actions and Completion Times for one battery with pilot cell electrolyte temperature less than minimum established design limits.
  - A new Condition E, associated Required Actions and Completion Times for two or more batteries with battery parameters not within limits.
- Existing Condition B would be renamed Condition F and revised by referencing the new Conditions B, C, D, and E. In addition, the existing portions of the Condition that address electrolyte temperature and battery cell parameters not within Category C limits would be deleted and replaced with a Condition that addresses battery cell voltage and float current.
- The existing SRs and Table 3.8.6-1 would be deleted and replaced with an SR for float current, pilot cell voltage, electrolyte level, pilot cell temperature, and connected cell voltage.

A new program, the Battery Monitoring and Maintenance Program, to be specified in new TS 5.5.19, will be created. The requirements of this program will be based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications."

Evaluation

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

   No. The proposed changes increase the Completion Time for an inoperable battery, relocate preventive maintenance requirements to licensee controlled programs, and generally restructure the TS requirements for DC sources. The revised requirements will allow licensed operators to focus their attention on battery parameters that are indicative of battery operability as opposed to preventive maintenance issues. The increased Completion Time for an inoperable battery will allow corrective maintenance to be accomplished via a more orderly and effective work process. It will also minimize the potential for an additional shutdown/restart transient to comply with the TS in order to accomplish the required maintenance. The DC sources are not initiators to any analyzed accident sequence. Operation in accordance with the proposed TS will continue to ensure that the DC sources remain capable of performing their safety function and that all analyzed accidents will continue to be mitigated as previously analyzed. Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

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

   No. The proposed changes do not introduce any new equipment, create new failure modes for existing equipment, or create any new limiting single failures. Plant operation will not be altered, and all safety functions previously addressed in accident analyses will continue to be performed.

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

3. Do the proposed changes involve a significant reduction in a margin of safety?

   No. The proposed changes will not adversely affect operation of plant equipment – principally the four Class 1E DC sources and the equipment supported by them. The changes aimed at restructuring the TS requirements for DC sources will have the effect of reducing the burden on licensed operators by focusing the TS requirements on conditions that impair DC source operability. Requirements related to preventive maintenance will be addressed via new Specification 5.5.19 and the plant maintenance program. Margin to the battery operability requirements will continue to be maintained at current levels in accordance with IEEE-450. The extended Completion Time for an inoperable battery has been shown to have a negligible impact on plant risk using the criteria of Regulatory Guides 1.174 and 1.177. Therefore, the proposed changes do no involve a significant reduction in any margin to safety.

Enclosure 3

Vogtle Electric Generating Plant
Request to Revise Technical Specifications
DC Sources and TSTF-360, Revision 1

Marked-up Technical Specification and Bases Pages

(continued)

LIST OF TABLES

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources – Operating

LCO 3.8.4 Four class 1E 125 V DC electrical power sources shall be OPERABLE.

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

INSERT 3.8.4 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B ~~A~~. One DC electrical power source inoperable for reasons other than Condition A.	B ~~A~~.1 Restore DC source electrical power ~~subsystem~~ to OPERABLE status.	2 hours
C ~~B~~. Required Action and Associated Completion Time not met.	C ~~B~~.1 Be in MODE 3. AND C ~~B~~.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ~~≥ 126 V on float charge~~ greater than or equal to the minimum established float voltage.	7 days

(continued)

INSERT: 3.8.4 ACTIONS

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One [or two] battery charger[s] on one [PWR: train BWR: division]] 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[s] to OPERABLE status.	7 days
B. A. One [or two] batter[y][ies] on one [PWR: train BWR: division]] inoperable. One DC electrical power source inoperable due to an inoperable battery	B.1 A Restore batter[y][ies] DC electrical power source to OPERABLE status.	[2] 24 hours

INSERT: Charger SR

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.2	... OR Verify each battery charger can recharge the battery to the fully charged state within [24] 12 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.	...

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance is ≤ 50 μohms for inter-cell connections, inter-rack connections, inter-tier connections, and terminal connections.	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration.	18 months
SR 3.8.4.4	Remove visible battery terminal corrosion and verify cell to cell and terminal connections are coated with anti-corrosion material.	18 months
SR 3.8.4.5	Verify battery connection resistance is ≤ 50 μohms for inter-cell connections, inter-rack connections, inter-tier connections, and terminal connections.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.6 2 greater than or equal to the minimum established float voltage INSERT CHARGER SR	---NOTE--- This Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. --- Verify the battery charger supplies: ≥ 400 amps for System A and B ≥ 300 amps for System C, and ≥ 200 amps for System D at [illegible] for ≥ 8 hours for Systems A & B and ≥ 3 hours for Systems C & D.	18 months
SR 3.8.4.7 3	---NOTES--- (6.6) 1. The modified performance discharge test in SR 3.8.4.8 may be performed in lieu of the service test in SR 3.8.4.7. 3 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	18 months
SR 3.8.4.8 6.6 MOVE to LCO 3.8.6 as SR 3.8.6.6	---NOTES--- 1 This Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	INSERT FREQUENCY FOR NEW SR 3.8.6.6 In accordance with Table 3.8.4-1

INSERT: FREQUENCY FOR NEW SR 3.8.6.6

60 months

AND

12 months when battery shows degradation or has reached 85% of expected life with capacity $<$ 100 % of manufacturer's rating

AND

24 months when battery has reached 85% of the expected life with capacity $\geq$ 100% of manufacturer's rating

Delete

Table 3.8.4-1

Discharge Test Surveillance Requirements

Battery Life	Battery Condition	Test Frequency		
		At Least Once Per 60 Months	At Least Once Per 24 Months	At Least Once Per 12 Months
Battery Life ≤ 85% of Expected Service Life	No Degradation(1)	X		
	Degradation(1)			X(2)
Battery Life >85% of Expected Service Life(3)	No Degradation(1)		X	

1. Degradation is defined as a decrease in battery capacity of more than 10% of capacity from its previous discharge test, or the battery capacity is less than 90% of the manufacturer's rating.

2. The battery can be restored to a 60-month test interval by cell replacement if discharge test results indicate that cell replacement will restore the battery to a minimum of 90% of rated capacity with no degradation. Replacement cells must be tested to demonstrate a minimum capacity of 100% of the manufacturer's rating prior to installation.

3. When battery life is greater than 85% of the expected life of the battery and degradation is indicated, cell replacement shall not be used to restore the capability of the battery for more than one year, and the battery shall be replaced within one year of the date of the discovery of the cell degradation.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	-----NOTE----- The following SRs are applicable but not required to be performed: SR 3.8.4.6 2 SR 3.8.4.7 3 ~~SR 3.8.4.8~~ ----- the electrical power For DC sources required to be OPERABLE, the following SRs of Specification 3.8.4 are applicable: SR 3.8.4.1 SR 3.8.4.2 (see Note) SR 3.8.4.3 (see Note) SR 3.8.4.4 SR 3.8.4.5 SR 3.8.4.6 (see Note) SR 3.8.4.7 (see Note) SR 3.8.4.8 (see Note)	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 required Class 1E 125 V batteries shall be within the limits of Table 3.8.6-1.

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

ACTIONS

NOTE
Separate Condition entry is allowed for each battery.

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

(continued)

INSERT 3.8.6 ACTIONS

INSERT: 3.8.6 ACTIONS

ACTIONS

NOTE

Separate Condition entry is allowed for each battery.

CONDITION		REQUIRED ACTION		COMPLETION TIME
A.	One ~~[or two]~~ battery ~~[ies on one [PWR: train BWR: division]]~~ with one or more battery cells 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] batter[y][ies] on one [PWR: train BWR: division]] with float current > [2] amps.~~ Battery A or B with float current > 2 amps. OR Battery C or D with float current > 1 amp.	B.1	Perform SR 3.8.4.1.	2 hours
		AND		
		B.2	Restore battery float current to ~~≤ [2] amps~~ within limit.	[12] hours
	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]~~ battery ~~[ies on one [PWR: train BWR: division]]~~ 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]~~ battery ~~[ies on one [PWR: train BWR: division]]~~ 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~~ Two or more batteries ~~in redundant [PWR: trains BWR: divisions]~~ with battery parameters not within limits.	E.1	Restore battery parameters for at least three batteries ~~in one [PWR: train BWR: division]~~ to within limits.	2 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. F Required Action and associated Completion Time of Condition A , B, C, D, or E not met. OR One or more batteries with average electrolyte temperature of the representative cells < 70°F. OR One or more batteries with one or more battery cell parameters not within Category C limits. INSERT 3.8.6F	B.1 F.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	Verify battery cell parameters meet Table 3.8.6-1 Category A limits for designated pilot cells.	7 days

(continued)

INSERT 3.8.6 SRs

《MOVE SR 3.8.6.6 (from SR 3.8.4.8)》

INSERT 3.8.6 F (2[nd] Condition)

OR

One ~~[of the]~~ battery ~~[ies on one {PWR: train BWR: division}]~~ with one or more battery cells float voltage < [2.07] V and float current > [2] amps for systems A or B batteries or > 1 amp for systems C or D.

INSERT: 3.8.6 SRs

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.6.1	------NOTE------ Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. --- Verify each system A and B battery float current is ≤ [2] amps. Verify each system C and D battery float current is ≤ 1 amp.	7 days
SR 3.8.6.2	Verify each battery pilot cell voltage is ≥ [2.07] V.	31 days
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ [2.07] V.	92 days

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.2	Verify battery cell parameters meet Table 3.8.6-1 Category B limits.	92 days AND Once within 24 hours after a battery discharge < 109.7 V for batteries A and B, < 108.3 V for battery C, and < 106.2 V for battery D AND Once within 24 hours after a battery overcharge > 140 V
SR 3.8.6.3	Verify average electrolyte temperature of representative cells is ≥ 70°F.	92 days

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

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

(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) Or battery charging current is < 2 amps when on float charge.

5.5 Programs and Manuals

5.5.17 Containment Leakage Rate Testing Program (continued)

b. Air lock testing acceptance criteria are:

1) Overall air lock leakage rate is ≤ 0.05 L_a when tested at ≥ P_a,

2) For each door, the leakage rate is ≤ 0.01 L_a when pressurized to ≥ P_a.

The provisions of SR 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program.

The provisions of SR 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.18 Configuration Risk Management Program

The Configuration Risk Management Program (CRMP) provides a proceduralized risk-informed assessment to manage the risk associated with equipment inoperability. The program applies to technical specification structures, systems, or components for which a risk-informed allowed outage time has been granted. The program shall include the following elements:

a. Provisions for the control and implementation of a Level 1 at power internal events PRA-informed methodology. The assessment shall be capable of evaluating the applicable plant configuration.

b. Provisions for performing an assessment prior to entering the LCO Condition for preplanned activities.

c. Provisions for performing an assessment after entering the LCO Condition for unplanned entry into the LCO Condition.

d. Provisions for assessing the need for additional actions after the discovery of additional equipment out of service conditions while in the LCO Condition.

e. Provisions for considering other applicable risk significant contributors such as Level 2 issues and external events, qualitatively or quantitatively.

INSERT 5.5.19

INSERT 5.5.19 PROGRAM

5.5.19 **Battery Monitoring and Maintenance Program**

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries For Stationary Applications," ~~or of the battery manufacturer~~ of the following:

a. Actions to restore battery cells with float voltage < [2.13] V, [and]

b. Actions to equalize and test battery cells that had been discovered with electrolyte level below the ~~minimum established design limit.~~ top of the plates.

(continued)

BASES

BACKGROUND (continued)

Batteries are sized in accordance with IEEE 485 (Ref. 3) to have sufficient capacity to supply the required loads for a loss of coolant/ loss of offsite power (LOCA/LOSP) duration of 2 3/4 hours and a station blackout (SBO) duration of 4 hours. For LOSP/LOCA, they are sized at a minimum temperature of 70°F; their initial capacity was increased by 10% for load growth and 25% for aging. The required final (end of duty cycle and end of life) battery cell voltages for each load group have been analyzed to demonstrate that adequate voltage is provided to the loads. The battery voltage specifications are discussed in detail for each load group in FSAR, Chapter 8 (Ref. 4).

INSERT: V_{DC} Bases

Each 125 VDC battery is provided with two battery chargers, each of which is sized to supply the continuous (long term) demand on its associated DC system while providing sufficient power to replace 110% of the equivalent ampere-hours removed from the battery during a design basis battery discharge cycle within a 12 hour period after charger input power is restored. Normally, both battery chargers are on line with load sharing circuitry to ensure that the DC load is properly shared between the two chargers. Only one charger is required OPERABLE to support the associated DC power system. The sizing of each battery charger meets the requirements of IEEE 308 (Ref. 1) and Regulatory Guide 1.32 (Ref. 5).

INSERT: Charger

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

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 6), and in the FSAR, Chapter 15 (Ref. 7), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation.

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

(continued)

INSERT: Battery Capacity

... meet the duty cycle(s) discussed in the FSAR, Chapter [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.

INSERT: Vpc Bases

~~... The minimum design voltage limit is 105/210 V.~~

The battery cells are of flooded lead acid construction with a nominal specific gravity of [1.215]. This specific gravity corresponds to an open circuit battery voltage of approximately 120 V for a [58] cell battery (i.e., cell voltage of [2.065] volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ [2.065] Vpc, the battery cell will maintain its capacity for [30] days *without further charging per manufacturer's instructions*. Optimal long term performance however, is obtained by maintaining a float voltage [2.20 to 2.25] Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of [2.22] Vpc corresponds to a total float voltage output of [128.8] V for a [58] cell battery as discussed in the FSAR, Chapter [8] (Ref. 4).

INSERT: Charger

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

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

BASES (continued)

ACTIONS

INSERT 3.8.4 ACTION Bases

B A.1

Condition A [B] represents one train with a loss of ability to completely respond to an event, and/or a potential loss of ability to remain energized during normal operation. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution system train.

If one of the required DC electrical power sources is inoperable (for reasons other than Condition A) (e.g., ~~inoperable battery,~~ inoperable battery charger, or inoperable battery charger and associated inoperable battery), the remaining DC electrical power source(s) has [ve] the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure ~~would~~ [could], however, result in the ~~complete~~ loss of the ~~remaining 125 VDC electrical power source with attendant loss of ESF functions,~~ [minimum necessary DC electrical sources to mitigate a worst case accident] continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 8) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power source and, if the DC electrical power source is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

C B.1 and C B.2

If the inoperable DC electrical power source cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 8).

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the

(continued)

INSERT: 3.8.4 ACTION Bases ~~(continued)~~

A.1 (~~B.1~~)

~~REVIEWERS NOTE~~
~~The 2 hour Completion Times of Required Actions B.1 and C.1 are in brackets. Any licensee wishing to request a longer Completion Time will need to demonstrate that the longer Completion Time is appropriate for the plant in accordance with the guidance in Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decision Making: Technical Specifications."~~

Condition A (~~B~~) represents one DC source inoperable due to an inoperable battery ~~[PWR: train][BWR: division] with one [or two] batter[y][ies] inoperable.~~ With one ~~[or two]~~ battery ~~[ies]~~ inoperable, the DC bus is being supplied by the OPERABLE battery charger ~~[s]~~. Any event that results in a loss of the AC bus supporting the battery charger ~~[s]~~ will also result in loss of DC to the associated 120 V vital AC bus. ~~that [train]~~. Recovery of the AC bus supporting the charger, especially if it is due to a loss of offsite power, will be hampered by the fact that many of the components necessary for the recovery (e.g. diesel generator control and field flash, AC load shed and diesel generator output circuit breakers, etc.) likely rely upon the battery ~~[ies]~~. In addition the energization transients of any DC loads that are beyond the capability of the battery charger ~~[s]~~ and normally require the assistance of the battery ~~[ies]~~ will not be able to be brought online. The ~~[2]~~ 24 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.

INSERT: SR 3.8.4.1 Bases

..., while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum float voltage established by the battery manufacturer ([2.20] Vpc times the number of connected cells for the battery terminal voltage ~~or [127.6] V at the battery terminals~~). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years).

INSERT: SR 3.8.4.2 Bases

This SR provides two options. One option requires that each battery charger be capable of supplying the necessary current for each system ~~[400] amps~~ at the minimum established float voltage for [8] hours for systems A & B and 3 hours for systems C & D. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least [2] hours.

The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest combined ~~coincident~~ demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The systems A & B batteries are ~~battery is~~ recharged when the measured charging current is ≤ [2] amps. The systems C and D batteries are recharged when the measured charging current is ≤ 1 amp.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1 (continued)

charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery ~~(or battery cell)~~ and maintain the battery ~~(or a battery cell)~~ in a fully charged state. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the initial voltages assumed in the battery sizing calculations. The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 9).

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

INSERT B SR 3.8.4.1

SR 3.8.4.2

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

The resistance limit specified for interrack and intertier connections is corrected for cable resistance. The limits established for this SR must not be above the ceiling value established by the manufacturer.

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

SR 3.8.4.3

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

The Surveillance Frequency of 18 months is adequate to verify the status of cell, cell plate, and rack integrity.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.3 (continued)

This Frequency is acceptable based on operational experience related to battery integrity and physical deterioration.

SR 3.8.4.4 and SR 3.8.4.5

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

The resistance limit specified for the interrack and intertier connections is corrected for cable resistance. The connection resistance limits for SR 3.8.4.5 shall not be above the ceiling value established by the manufacturer.

The Surveillance Frequency of 18 months is adequate to inspect for and remove corrosion from cell to cell and terminal connections and to verify connection resistance. This Frequency is adequate based on operational experience related to corrosion and connection resistance trends.

SR 3.8.4.6 2 Verifies the design capacity of the battery chargers

This SR requires that each battery charger be capable of supplying 400 amps for systems A and B, 300 amps for system C, and 200 amps for system D at 125 V for ≥ 8 hours. These requirements are based on the design capacity of the chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 5), the battery charger supply is ~~required~~ recommended 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,

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.6 2 (continued)

irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

INSERT B SR3.8.4.2

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

For a battery charger with charger output aligned to the associated 1E 125 VDC bus, this Surveillance is required to be performed during MODES 5 and 6 since it would require the DC electrical power subsystem to be inoperable during performance of the test.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance on a battery charger with charger output aligned to the associated 1E 125 VDC bus would perturb the electrical distribution system and challenge safety systems. This note is not intended to restrict performance of the SR on a redundant battery charger that is not in service supplying the associated 125 VDC bus. Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1. Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2. Post Corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.13

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

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 5) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests, not to exceed 18 months.

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

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 confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. The modified discharge test will be performed in accordance with the guidance provided in IEEE-450 (Ref. 11) with the exception that the battery electrolyte temperature may be corrected after the test using a methodology approved by the battery manufacturer.

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

1. Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2. Post Corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

MOVE TO SR 3.8.6.6 BASES

SR 3.8.4.8 (6.6)

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

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

INSERT FOR SR 3.8.6.6 BASES

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 9) and IEEE-485 (Ref. 3). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed cycle loads when the battery design capacity reaches this 80% limit.

The Surveillance Frequency for this test ~~as specified in Table 3.8.4-1~~ is normally 60 months~~, when the battery is less than or equal to 85% of its expected life with no degradation and 12 months if the battery shows degradation and is less than or equal to 85% of its expected life. When the battery has exceeded 85% of its expected life with no degradation, the Frequency becomes 24 months~~. Degradation is indicated, according to IEEE-450 (Ref. 9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is ≥ 10% below the manufacturer rating. These Frequencies are similar to those recommended by IEEE-450 (Ref. 9) and require that testing be performed in a conservative manner relative to the battery life and degradation which in turn will ensure that battery capacity is adequately monitored and that the battery remains capable of performing its intended function.

If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's ratings, 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 reduced to only 24 months for batteries that retain capacity ≥ 100% of the manufacturer's ratings.

This SR is modified by a Note. The reason for Note 1 is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems.

(continued)

INSERT FOR SR 3.8.6.6 BASES

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

The modified discharge test may consist of just two rates; for instance, the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Since the ampere-hours removed by a 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.

BASES

SURVEILLANCE REQUIREMENTS

MOVE TO SR 3.8.6.6 BASES

SR 3.8.~~4.8~~ 6.6 (continued)

Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1. Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2. Post Corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

REFERENCES

1. IEEE-308-1978.
2. 10 CFR 50, Appendix A, GDC 17.
3. IEEE-485-1983, June 1983.
4. FSAR, Chapter 8.
5. Regulatory Guide 1.32, February 1977.
6. FSAR, Chapter 6.
7. FSAR, Chapter 15.
8. Regulatory Guide 1.93, December 1974.
9. IEEE-450-1975 and 1987.
10. Regulatory Guide 1.129, December 1974.
11. ~~IEEE-450-1995.~~

BASES

ACTIONS

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

maintain or increase reactor vessel inventory, provided the required SDM is maintained.

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

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.3. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

REFERENCES

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

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

battery float current as well as

BASES

BACKGROUND

and

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

INSERT 3.8.6 BACKGROUND BASES

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 1) (3) and Chapter 15 (Ref. 2) (4), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

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

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

b. A worst case single failure.

Battery cell parameters satisfy Criterion 3 of 10 CFR 50.36 (c)(2)(ii).

LCO

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

Battery parameter

INSERT 3.8.6 LCO BASES

(continued)

INSERT: 3.8.6 Background Bases

Battery Monitoring and Maintenance Program

... In addition to the limitations of this Specification, the [licensee controlled program] also implements a program specified in Specification 5.5.[X] for monitoring various battery parameters that is based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications" (Ref.1).

The battery cells are of flooded lead acid construction with a nominal specific gravity of [1.215]. This specific gravity corresponds to an open circuit battery voltage of approximately 120 V for a [58] cell battery (i.e., cell voltage of [2.065] volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ [2.065] Vpc, the battery cell will maintain its capacity for [30] days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage [2.20 to 2.25] Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of [2.22] Vpc corresponds to a total float voltage output of [128.8] V for a [58] cell battery as discussed in the FSAR, Chapter [8] (Ref. 2).

INSERT: 3.8.6 LCO Bases

... Additional preventative maintenance, testing, and monitoring performed in accordance with the [licensee controlled program] is conducted as specified in Specification 5.5.[X].

Battery Monitoring and Maintenance Program

BASES (continued) e

APPLICABILITY

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

parameter limits are

ACTIONS

INSERT 3.8.6 ACTION BASES

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

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

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

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

(continued)

INSERT: 3.8.6 ACTION Bases

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

(battery capacity may be reduced) (4)

With one or more cells in one ~~or more~~ batteries ~~in one {PWR: train}{BWR: division}~~ < [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.

B.1 and B.2

Condition B addresses the case where battery A or B has float current > 2 amps; or battery C or D has float current > 1 amp. ~~One or more batteries in one {PWR: train}{BWR: division} with float current > [2] amps~~ This 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 addressed 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. ~~{Reviewer's Note: A plant that cannot meet the 12 hour Completion Time due to an inherent battery charging characteristic, can propose an alternate time equal to 2 hours plus the time experienced to accomplish the exponential charging current portion of the battery charge profile following the service test (SR 3.8.4.6).}~~ 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~~ batter~~ies~~ ~~in one [redacted] train [redacted]~~ 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.[redacted], 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.[redacted].b item to initiate action to equalize and test in accordance with manufacturer's recommendation are taken from Annex D of IEEE Standard 450-1995. They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery ~~[ies]~~ may have to be declared inoperable and the affected cell[s] replaced.

D.1

With one ~~or more~~ batter~~ies~~ ~~in one [redacted] train [redacted]~~ 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~~ two of more batteries ~~in redundant trains~~ 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 ~~there~~ their required function, given that ~~redundant batteries are~~ more than one battery is involved. With ~~redundant batteries~~ more than one battery 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~~ a single battery not within limits are therefore not appropriate, and the parameters must be restored to within limits on at least ~~one train~~ three batteries within 2 hours.

BASES

ACTIONS

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

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

F
B.1

any

With one or more batteries with one or more battery cell parameters outside the Category C limits for any connected cell, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 70°F, are also cause for immediately declaring the associated DC electrical power source inoperable.

battery

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

INSERT 3.8.6 F.1 BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

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

INSERT 3.8.6 SR BASES

SR 3.8.6.2

The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 3). In addition, within 24 hours of a battery discharge < 109 V for batteries A and B, < 108.3 V for battery C, and < 106.2 V for battery D, or a battery overcharge > 140V, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause

MOVE SR 3.8.6.6 BASES FROM SR 3.8.4.8 BASES

(continued)

See INSERT 3.8.6.F.1 Bases next page

INSERT: 3.8.6 F.1 Bases

... discovering one or more batteries in one train 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.

INSERT: 3.8.6 SR Bases

SR 3.8.6.1

Verifying battery float current while on float charge is used to determine the state of charge of the battery. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a charged state. The float current requirements are based on the float current indicative of a charged battery. Use of float current to determine the state of charge of the battery is consistent with IEEE-450 (Ref. 1). The 7 day Frequency is consistent with IEEE-450 (Ref. 1).

This SR is modified by a Note that states the float current requirement is not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. When this float voltage is not maintained 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 [130.5] V at the battery terminals, or [2.25] Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltage in this range or less, but greater than [2.07] Vpc, are addressed in Specification 5.5.[X]. 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 Frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE-450 (Ref. 1).

SR 3.8.6.3

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

SR 3.8.6.4

This Surveillance 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 Frequency is consistent with IEEE-450 (Ref. 1).

INSERT: 3.8.6.F.1 Bases

.....discovering a battery with one or more battery cells float voltage less than 2.07 V and float current greater than 2 amps for batteries A and B, or 1 amp for batteries C and D indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately. This condition is intended to apply when the battery is in the float mode. For example, if an individual cell is discovered below the 2.07 V limit, a possible corrective action would be to place the battery in the equalize mode. In this condition, the charger amperage is elevated and a measurement of 'float' current, may be above the stated limits with an individual cell below the 2.07 V criteria. This an expected condition; therefore, in this case, it is not appropriate to enter Condition F.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.2 (continued)

battery voltage to drop to ≤ the values specified above for each battery do not constitute a battery discharge provided the battery terminal voltage and float current return to pretransient values. This inspection is also consistent with IEEE-450 (Ref. 3), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.

SR 3.8.6.3

This Surveillance verification that the average temperature of representative cells is > 70°F, is consistent with a recommendation of IEEE-450 (Ref. 3), that states that the temperature of electrolytes in representative cells should be determined on a quarterly basis. For the response to loss of offsite power and loss of coolant accidents, the batteries are sized at a minimum temperature of 70°F.

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

Table 3.8.6-1

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

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

The Category A limits specified for electrolyte level are based on manufacturer recommendations and are consistent with the guidance in IEEE-450 (Ref. 3), with the extra

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

¼ inch allowance above the high water level indication for operating margin to account for temperatures and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 3) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

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

The Category A limit specified for specific gravity for each pilot cell is ≥ 1.195 (0.015 below the manufacturer fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 3), the specific gravity readings are based on a temperature of 77°F (25°C).

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

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

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell will not mask overall degradation of the battery.

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 allowable limits, the assurance of sufficient capacity described above no longer exists, and the battery must be declared inoperable.

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

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

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

Because of specific gravity gradients that are produced during the recharging process, delays of several days may

(continued)

BASES

SURVEILLANCE REQUIREMENTS

~~Table 3.8.6-1 (continued)~~

~~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.~~

REFERENCES

3 ~~3 1~~. FSAR, Chapter 6.

4 ~~3 2~~. FSAR, Chapter 15.

~~5 3 [illegible] and 1987.~~

1. IEEE-450-1995
2. FSAR, Chapter 8.

Enclosure 4

Vogtle Electric Generating Plant
Request to Revise Technical Specifications
DC Sources and TSTF-360, Revision 1

Clean-typed Technical Specification and Bases Pages

(continued)

LIST OF TABLES

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources – Operating

LCO 3.8.4 Four class 1E 125 V DC electrical power sources shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One DC electrical power source inoperable due to an inoperable battery.	A.1	Restore DC electrical power source to OPERABLE status.	24 hours
B. One DC electrical power source inoperable for reasons other than Condition A.	B.1	Restore DC electrical power source to OPERABLE status.	2 hours
C. Required Action and Associated Completion Time not met.	C.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	C.2	Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is greater than or equal to the minimum established float voltage.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.2	Verify the battery charger supplies: ≥ 400 amps for System A and B ≥ 300 amps for System C, and ≥ 200 amps for System D at greater than or equal to the minimum established float voltage for ≥ 8 hours for Systems A and B and ≥ 3 hours for Systems C and D. <u>OR</u> Verify each battery charger can recharge the battery to the fully charged state within 12 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	18 months
SR 3.8.4.3	-------------------------NOTES------------------------- 1. The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of the service test in SR 3.8.4.3. 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. -- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	18 months

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources – Shutdown

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

APPLICABILITY: MODES 5 and 6

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required DC electrical power sources inoperable.	A.1.1 Declare affected required feature(s) inoperable.	Immediately
	<u>OR</u>	
	A.2.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	A.2.2 Suspend movement of irradiated fuel assemblies.	Immediately
	<u>AND</u>	
	A.2.3 Initiate action to suspend operations involving positive reactivity additions.	Immediately
	<u>AND</u>	
	A.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.5.1	------------------------------NOTE------------------------------ The following SRs are applicable but not required to be performed: SR 3.8.4.2 SR 3.8.4.3 -- For the DC electrical power sources required to be OPERABLE, the following SRs of Specification 3.8.4 are applicable: SR 3.8.4.1 SR 3.8.4.2 (see Note) SR 3.8.4.3 (see Note)	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Parameters

LCO 3.8.6 Battery parameters for the required Class 1E 125 V batteries shall be within limits.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One battery with one or more battery cells float voltage < 2.07 V.	A.1 Perform SR 3.8.4.1. AND A.2 Perform SR 3.8.6.1. AND A.3 Restore affected cell voltage ≥ 2.07 V.	2 hours 2 hours 24 hours
B. Battery A or B with float current > 2 amps. OR Battery C or D with float current > 1 amp.	B.1 Perform SR 3.8.4.1. AND B.2 Restore battery float current to within limit.	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 battery 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 battery 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. Two or more batteries with battery parameters not within limits.	E.1 Restore battery parameters for at least three batteries to within limits.	2 hours
F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR	F.1 Declare associated battery inoperable.	Immediately

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. (continued) One battery with one or more battery cells float voltage < 2.07 V and float current > 2 amps for systems A or B batteries, or > 1 amp for system C or D.		

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 system A and B battery float current is ≤ 2 amps. Verify each system C and D battery float current is ≤ 1 amp.	7 days
SR 3.8.6.2	Verify each battery pilot cell voltage is ≥ 2.07 V.	31 days
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	31 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ 2.07 V.	92 days
SR 3.8.6.6	-------------------------NOTE------------------------- This Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months <u>AND</u> 12 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating <u>AND</u> 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating

5.5 Programs and Manuals

5.5.17 Containment Leakage Rate Testing Program (continued)

b. Air lock testing acceptance criteria are:

1) Overall air lock leakage rate is ≤ 0.05 L_a when tested at ≥ P_a,

2) For each door, the leakage rate is ≤ 0.01 L_a when pressurized to ≥ P_a.

The provisions of SR 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program.

The provisions of SR 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.18 Configuration Risk Management Program

The Configuration Risk Management Program (CRMP) provides a proceduralized risk-informed assessment to manage the risk associated with equipment inoperability. The program applies to technical specification structures, systems, or components for which a risk-informed allowed outage time has been granted. The program shall include the following elements:

a. Provisions for the control and implementation of a Level 1 at power internal events PRA-informed methodology. The assessment shall be capable of evaluating the applicable plant configuration.

b. Provisions for performing an assessment prior to entering the LCO Condition for preplanned activities.

c. Provisions for performing an assessment after entering the LCO Condition for unplanned entry into the LCO Condition.

d. Provisions for assessing the need for additional actions after the discovery of additional equipment out of service conditions while in the LCO Condition.

e. Provisions for considering other applicable risk significant contributors such as Level 2 issues and external events, qualitatively or quantitatively.

5.5.19 Battery Monitoring and Maintenance Program

This Program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice

(continued)

5.5 Programs and Manuals

5.5.19 Battery Monitoring and Maintenance Program (continued)

for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," of the following:

a. Actions to restore battery cells with float voltage < 2.13 V, and

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

5.5 Programs and Manuals

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(continued)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources — Operating

BASES

BACKGROUND

There are four safety features 125 VDC systems (identified A, B, C, and D) per unit. Each system has a 59-cell lead calcium battery, switchgear (electrically operated drawout circuit breakers), two redundant battery chargers, and 125 VDC distribution panels (molded case circuit breakers). Systems A, B, and C each have a 125 VDC motor control center for motor operated valves. There is no capability to connect the DC systems between themselves, between Unit 1 and Unit 2 systems, or between the safety features systems and the nonsafety features systems. Table B 3.8.4-1 shows the DC sources and train associations. The 125 VDC systems A and C form the train A safety features DC system and their associated battery chargers receive power from two Class 1E train A motor control centers. The 125 VDC systems B and D form the train B safety features DC system and their battery chargers receive power from two Class 1E train B motor control centers.

The 125 VDC systems A, B, C, and D supply DC power to channels 1, 2, 3, and 4, respectively, and are designated as Class 1E equipment in accordance with the applicable sections of Institute of Electrical and Electronic Engineers (IEEE) Standard 308 (Ref. 1). As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 2), the DC electrical power system is designed so that no single failure in any 125 VDC system will result in conditions that will prevent the safe shutdown of the reactor plant. The plant design and circuit layout from these DC systems provide physical separation of equipment, cabling, and instrumentation essential to plant safety. Each 125 VDC battery is separately housed in a ventilated room apart from its chargers and distribution equipment. All the components of the 125 VDC Class 1E systems are housed in Category 1 structures.

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

(continued)

BASES

BACKGROUND (continued)

Batteries are sized in accordance with IEEE 485 (Ref. 3) to have sufficient capacity to supply the required loads for a loss of coolant/ loss of offsite power (LOCA/LOSP) duration of 2 3/4 hours and a station blackout (SBO) duration of 4 hours. For LOSP/LOCA, they are sized at a minimum temperature of 70°F; their initial capacity was increased by 10% for load growth and 25% for aging. The required final (end of duty cycle and end of life) battery cell voltages for each load group have been analyzed to demonstrate that adequate voltage is provided to the loads. The battery voltage specifications are discussed in detail for each load group in FSAR, Chapter 8 (Ref. 4).

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 121.8 V for a 59 cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.23 Vpc corresponds to a total float voltage output of 131.6 V for a 59 cell battery as discussed in the FSAR, Chapter 8 (Ref. 4).

Each 125 VDC battery is provided with two battery chargers, each of which is sized to supply the continuous (long term) demand on its associated DC system while providing sufficient power to replace 110% of the equivalent ampere-hours removed from the battery during a design basis battery discharge cycle within a 12 hour period after charger input power is restored. Normally, both battery chargers are on line with load sharing circuitry to ensure that the DC load is properly shared between the two chargers. Only one charger is required OPERABLE to support the associated DC power system. The sizing of each battery charger meets the requirements of IEEE 308 (Ref. 1) and Regulatory Guide 1.32 (Ref. 5).

The battery chargers are 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.

(continued)

BASES

BACKGROUND (continued)

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

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

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 6), and in the FSAR, Chapter 15 (Ref. 7), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation.

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

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

b. A worst case single failure.

The DC sources satisfy Criterion 3 of 10 CFR 50.36 (c)(2)(ii).

(continued)

BASES (continued)

LCO

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

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

APPLICABILITY

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

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

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

The DC electrical power requirements for MODES 5 and 6 are addressed in the Bases for LCO 3.8.5, "DC Sources — Shutdown."

ACTIONS

A.1

Condition A represents one DC source inoperable due to an inoperable battery. With one battery inoperable, the DC bus is being supplied by the OPERABLE battery charger. Any event that results in a loss of the AC bus supporting the battery charger will also result in loss of DC to the associated 120 V vital AC bus. Recovery of the AC bus supporting the charger, 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

(continued)

BASES (continued)

ACTIONS

A.1 (continued)

flash, AC load shed and diesel generator output circuit breakers, etc.) likely rely upon the battery. In addition the energization transients of any DC loads that are beyond the capability of the battery charger and normally require the assistance of the battery will not be able to be brought online. The 24 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 specified completion times.

B.1

Condition B represents one train with a loss of ability to completely respond to an event, and/or a potential loss of ability to remain energized during normal operation. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution system train.

If one of the required DC electrical power sources is inoperable for reasons other than Condition A (e.g., inoperable battery charger or inoperable battery charger and associated inoperable battery), the remaining DC electrical power sources 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 the minimum necessary DC electrical sources to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 8) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power source and, if the DC electrical power source is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

C.1 and C.2

If the inoperable DC electrical power source cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are

(continued)

BASES (continued)

ACTIONS

C.1 and C.2 (continued)

reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 8).

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the battery chargers, which support the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state while supplying the continuous steady state loads of the associated DC subsystem. 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 cells for the battery terminal voltage). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 9).

SR 3.8.4.2

This SR verifies the design capacity of the battery chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 5), the battery charger supply is recommended to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying the necessary current for each system at the minimum established float voltage for 8 hours for

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.2 (continued)

systems A and B and 3 hours for systems C and D. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest combined demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The systems A and B batteries are recharged when the measured charging current is ≤ 2 amps. The system C and D batteries are recharged when the measured charging current is ≤ 1 amp.

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

For a battery charger with charger output aligned to the associated 1E 125 VDC bus, this Surveillance is required to be performed during MODES 5 and 6 since it would require the DC electrical power subsystem to be inoperable during performance of the test.

SR 3.8.4.3

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.3 (continued)

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 5) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests, not to exceed 18 months.

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

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

1. Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2. Post Corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

REFERENCES

1. IEEE-308-1978.
2. 10 CFR 50, Appendix A, GDC 17.
3. IEEE-485-1983, June 1983.
4. FSAR, Chapter 8.
5. Regulatory Guide 1.32, February 1977.
6. FSAR, Chapter 6.
7. FSAR, Chapter 15.
8. Regulatory Guide 1.93, December 1974.
9. IEEE-450-1975 and 1987.
10. Regulatory Guide 1.129, December 1974

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources — Shutdown

BASES

BACKGROUND

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

APPLICABLE SAFETY ANALYSES

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

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

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

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

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

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

The DC sources satisfy Criterion 3 of 10 CFR 50.36 (c)(2)(ii).

LCO

The DC electrical power sources required to support the necessary portions of AC, DC, and AC vital bus electrical

(continued)

BASES

LCO (continued)

power distribution subsystems required by LCO 3.8.10, "Distribution Systems — Shutdown," shall be OPERABLE. At a minimum, at least one train of DC electrical power sources with each DC source within the train (Systems A and C OR Systems B and D) consisting of one battery, and one required battery charger per battery, and the corresponding control equipment and interconnecting cabling within the train, are required to be OPERABLE. The equipment associated with each train of DC Sources is shown in Table B 3.8.4-1.

In the case where the requirements of LCO 3.8.10 call for portions of a second train of the distribution subsystems to be OPERABLE (e.g., to support two trains of RHR, two trains of CREFS, or instrumentation such as source range indication, containment ventilation isolation actuation, and/or CREFS actuation), the associated required DC bus(es) are OPERABLE if energized to the proper voltage from either:

- an OPERABLE DC Source, in accordance with LCO 3.8.5, or
- the associated charger(s) using the corresponding control equipment and interconnecting cabling within the train, in accordance with LCO 3.8.10.

(continued)

BASES

LCO (continued)

The above requirements ensure the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

APPLICABILITY

The DC electrical power sources required to be OPERABLE in MODES 5 and 6 provide assurance that:

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

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

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

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

ACTIONS

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

If two subsystems are required by LCO 3.8.10, the remaining subsystem with DC power available may be capable of supporting sufficient systems to allow continuation of CORE ALTERATIONS and fuel movement. By allowing the option to declare required features inoperable with the associated DC power source(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCO ACTIONS. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and operations involving positive reactivity additions). The Required Action to suspend positive reactivity additions does not preclude actions to

(continued)

BASES

ACTIONS

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

maintain or increase reactor vessel inventory, provided the required SDM is maintained.

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

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

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.3. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

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

REFERENCES

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

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage 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 5.5.19 for monitoring various battery parameters that is based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice For Maintenance, Testing, And Replacement of Vented Lead-Acid Batteries For Stationary Applications" (Ref. 1).

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 121.8 V for a 59 cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.20 to 2.25 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.23 Vpc corresponds to a total float voltage output of 131.6 V for a 59 cell battery as discussed in the FSAR, Chapter 8 (Ref. 2).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 3) and Chapter 15 (Ref. 4), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

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

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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

b. A worst case single failure.

Battery parameters satisfy Criterion 3 of 10 CFR 50.36 (c)(2)(ii).

LCO

Battery parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Battery parameter limits are conservatively established, allowing continued 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 are conducted as specified in Specification 5.5.19.

APPLICABILITY

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

ACTIONS

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

With one or more cells in one battery < 2.07 V, battery capacity may be reduced. 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 < 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.

(continued)

BASES

ACTIONS (continued)

B.1 and B.2

Condition B addresses the case where battery A or B has float current > 2 amps; or battery C or D has float current > 1 amp. This 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 addressed 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.

(continued)

BASES

ACTIONS

B.1 and B.2 *(continued)*

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 battery 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 5.5.19, 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 5.5.19.b item to initiate action to equalize and test in accordance with manufacturer's recommendation are taken from Annex D of IEEE Standard 450-1995. They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cell(s) replaced.

D.1

With one battery 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.

(continued)

BASES

ACTIONS (continued)

E.1

With two or more batteries 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 more than one battery is involved. With more than one battery 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 a single battery not within limits are therefore not appropriate, and the parameters must be restored to within limits on at least three batteries within 2 hours.

F.1

With one or more batteries with any battery parameter outside the allowances of the Required Actions for Condition A, B, C, D, or E, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery must be declared inoperable. Additionally, discovering a battery with one or more battery cells float voltage less than 2.07 V and float current greater than 2 amps for batteries A and B, or 1 amp for batteries C and D indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately. This condition is intended to apply when the battery is in the float mode. For example, if an individual cell is discovered below the 2.07 V limit, a possible corrective action would be to place the battery in the equalize mode. In this condition, the charger amperage is elevated and a measurement of 'float' current may be above the stated limits with an individual cell below the 2.07 V criteria. This is an expected condition; therefore, in this case, it is not appropriate to enter Condition F.

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 float current requirements are based on the float current indicative of a charged battery. Use of float current to determine the state of charge of the battery is consistent with IEEE-450 (Ref. 1). The 7 day Frequency is consistent with IEEE 450 (Ref. 1).

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1 (continued)

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.1 are being taken, which provide the necessary and appropriate verifications of the battery condition. Furthermore, the float current limits of 2 amps for batteries A and B, and 1 amp for batteries C and D are established based on the nominal float voltage value and are 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 129.8 V at the battery terminals, or 2.20 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltage in this range or less, but greater than 2.07 Vpc, is addressed in Specification 5.5.19. 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 frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE-450 (Ref. 1).

SR 3.8.6.3

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

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established desigh limit (i.e., 60 °F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The Frequency is consistent with IEEE-450 (Ref. 1).

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

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. 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.

The modified discharge test may consist of just two rates; for instance, the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelop 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. 9) and IEEE-485 (Ref. 3). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed cycle loads when the battery design capacity reaches this 80% limit.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's ratings, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

life, the Surveillance Frequency is reduced to only 24 months for batteries that retain capacity ≥ 100% of the manufacturer's ratings.

Degradation is indicated, according to IEEE-450 (Ref. 9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is ≥ 10% below the manufacturer rating. These Frequencies are similar to those recommended by IEEE-450 (Ref. 9) and require that testing be performed in a conservative manner relative to the battery life and degradation which in turn will ensure that battery capacity is adequately monitored and that the battery remains capable of performing its intended function.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems.

Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

1. Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation of the required performance is available; and

2. Post Corrective maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

REFERENCES

1. IEEE-450-1995.

2. FSAR, Chapter 8.

3. FSAR, Chapter 6.

4. FSAR, Chapter 15.